



White Paper
**TRADE, ENERGY AND
CLIMATE CHANGE**

HARMONIZING NIGERIAN AND GLOBAL CONCERNS ON CLIMATE

PUTRU

Collaborators



FEDERAL MINISTRY OF
INDUSTRY, TRADE &
INVESTMENT



Technical Partner

PUTTRU

How to cite this work: PUTTRU (2022). Trade, Energy and Climate Change: Harmonizing Nigerian and Global Concerns on Climate. Abuja: PUTTRU

© 2022 PUTTRU Technologies Limited. All rights are reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of PUTTRU Technologies Limited. Comments or suggestions should be forwarded to us at: info@puttru.com

About PUTTRU: Our vision is to be the bridge to an African energy market able to meet its current and future energy demands in a manner that ensures sustainable development. By leveraging advances in technology, we enable African energy businesses and financiers, within and outside Africa, to connect, interact and close investment deals.

Photo Credit: © Shutterstock

White Paper

TRADE, ENERGY AND CLIMATE CHANGE

Harmonizing Nigerian and Global Concerns on Climate

Contents

FOREWORD	2
ACKNOWLEDGMENTS	6
ABBREVIATIONS AND ACRONYMS	7
TABLES AND FIGURES	7
EXECUTIVE SUMMARY	8
INTRODUCTION	15
RATIONALE	17
CHAPTER 1 – CLIMATE CHANGE	18
1. Introducing Climate Change	19
1.1. Nigeria’s emissions profile	20
1.2. Sources of Nigeria’s greenhouse gas emissions	21
CHAPTER TWO: ENERGY	26
2. An introduction to Nigeria’s energy sector	27
2.1 Sources of emissions from Nigeria’s energy sector for modern fuels	28
2.2.1 Decarbonising Energy Industries in Nigeria	27
2.2.2 Decarbonising the Transport Sector	30
2.2.3 Decarbonising Industries	32
2.3 Bringing it all Together	32
CHAPTER THREE: TRADE	33
3. Introducing the economics of attracting investment	34
3.1 Why Productivity Matters	38
3.2 The place of trade in increasing investment for Nigeria’s sustainable future	39
CHAPTER FOUR: TRADE, ENERGY AND CLIMATE BALANCE	44
4. Introducing the Trade, Energy and Climate Change (TEC) Nexus	45
4.1 TEC Balance and lessons for Nigeria	47
CONCLUSION	52
REFERENCES	53

FOREWORD



**BY THE HONOURABLE
MINISTER OF ENVIRONMENT**

The 2017 Climate Change Vulnerability Index classifies Nigeria as one of the ten most vulnerable countries to the impacts of climate change in the world, as evidently seen around us, and jeopardizes present and future livelihoods in our country today. The science is clear on the gravity of this issue, and we need to actively engage in multilateral processes that aim to address this global challenge.

Nigeria is a signatory to the UNFCCC and Paris Agreement and is committed to its obligations. President Muhammadu Buhari announced Nigeria's commitment to achieving a net zero target by 2060 and assented to the Climate Change Bill in November 2021, less than a week after

the conclusion of COP 26. The Act is a legal framework for achieving low GHG emissions while ensuring green and sustainable economic growth. The Act ensures that Nigeria formulates programmes and policies for achieving its long-term goals on climate action, consistent with national development plans.

This white paper explores the different nexus between trade and climate change while focusing on how future trade opportunities will be affected by climate change.

In achieving the global goals for curbing the menace of climate change, a major transformation of energy production and consumption is required to bring about a rapid reduction in emissions of greenhouse gases (GHG) consistent with the Paris Agreement. In meeting the Nation's energy needs, we launched the Energy Transition Plan (ETP) which covers about 65% of Nigeria's emissions that sets out a timeline and framework for the attainment of emissions reduction across 5 key sectors: Power, Cooking, Oil and Gas, Transport, and Industry. To kickstart the implementation of the ETP, Nigeria seeks to raise an initial \$ 10 billion in support ahead of COP 27.

This white paper explores the different nexus between trade and climate change while focusing on how future trade opportunities will be affected by climate change and policy response. This will guide stakeholders in discussions on how trade provides the goods and services that can drive mitigation and adaptation, and the new opportunities for promoting trade diversification in the transition to a low-carbon world.

Mohammed H. Abdullahi
Honourable Minister of Environment
Federal Ministry of Environment

FOREWORD

**BY THE HONOURABLE
MINISTER OF POWER**



The Federal Government of Nigeria has demonstrated its commitment to sustainable development by its endorsement of Climate Change goals. Under the Nationally Determined Contribution (NDC) of the Paris Accord, Nigeria is committed to reducing its greenhouse gases by 47% conditionally and 20% unconditionally. At the COP26, His Excellency, Muhammadu Buhari made a commitment to net-zero emissions by 2060 which could be achieved majorly through the implementation of the Energy Transition Plan (ETP). As the government body established with the sole aim of formulating policies for scaling the delivery of power, the Ministry in accordance with Nigeria's Electricity Vision EV 30:30:30 is focused at meeting the nation's power demands through sustainable means. The EV specifically aims at achieving 30GW power capacity by Y2030 by harnessing renewable energy sources up to 30% to complement fossil fuel sources for energy security.

The white paper's objective if met could contribute in a great way to supporting Nigeria realise both energy targets and climate change goals.

Sustainable development calls for wide stakeholders' participation through synergies, dialogue, and objective analysis capable of providing guidance to the actualisation of the nation's economic, energy and climate change aspirations. PUTTRU Technologies Limited has invested its resources in developing this white paper on trade, energy, and climate change for COP27. The white paper was prepared in collaboration with a Technical Working Group (TWG) comprising of Agencies of Government and Private Stakeholder interests. The white paper's objective if met could contribute in a great way to supporting Nigeria realise both energy targets and climate change goals. On the strength of the need to meet up with the country's commitment to net zero emissions by 2060 and carbon neutrality, the Ministry strongly calls on all stakeholders, private and public partners, investors and global climate change and energy experts to study the white paper for better understanding of the conditions necessary to achieve transformational economic development for our country and meet her climate obligations.

H.E Engr. Abubakar D. Aliyu FNSE, FNICE
Honourable Minister of Power

FOREWORD



**BY THE HONOURABLE
MINISTER OF INDUSTRY, TRADE AND INVESTMENT**

The links between trade and investment on the one hand and power and climate change on the other are complex; but for a country like Nigeria to achieve sustainable growth and development getting this mix right is crucial. The Federal Ministry of Industry, Trade and Investment has been working diligently to move Nigeria’s economy forward and fast-track the implementation of the Nigeria Industrial Revolution Plan (NIRP). The NIRP aims to reposition Nigeria as a key global supply chain player, with a specific focus on the export of value-added products. To achieve this, power supply bottlenecks and high energy costs need to be addressed. In order to drive Nigeria’s industrialisation agenda, we need a strategy that combines dramatic growth in trade and export levels with improved levels of affordable energy across the country.

I commend the production of this white paper, which combines three of the most pressing concerns for not just our country or continent but for the entire world. The technical working group, made up of public and private sector representatives and the academia, have provided sound recommendations that harmonise both Nigerian and global perspectives on these topical issues.

The future is in our hands, and I hope this white paper inspires action that helps create a positive one.

Nigeria is open for business, investment and trade but not to the detriment of future generations. Sustainability must be a key focus of all planned investments to avoid the development of new projects that go against our plans for a carbon-neutral Nigeria. The future is in our hands, and I hope this White Paper inspires action that helps create a positive one.

H.E Otunba Richard Adeniyi Adebayo, CON
Honourable Minister of Industry, Trade and Investment

ACKNOWLEDGMENTS

Lead Author: Monica Maduekwe (Ms.), Founder, PUTTRU Technologies

Contributors and Reviewers: Members of Technical Working Group (TWG)

No.	Organisation	Department	Full name
1	Energy Commission of Nigeria (ECN)	Energy Policy, Planning and Analysis (Director)	Dr. Abdulwaheed AHMED
2	Energy Commission of Nigeria (ECN)	Energy Policy, Planning & Analysis (EPPA)	Usman Ibrahim NDACEKO
3	Federal Ministry of Environment (FMENV)	Department of Climate Change (Head, Mitigation)	Asmau JIBRIL
4	Federal Ministry of Environment (FMENV)	Department of Climate Change (DCC)	Lawan E. PWANA
5	Federal Ministry of Environment (FMENV)	Department of Climate Change (DCC)	Adesola Olatunde EFFIWAT
6	Federal Ministry of Power (FMP)	Department of Renewable and Rural Power (Ag. Director)	Engr. Abubakar Ali DAPSHIMA
7	Federal Ministry of Power (FMP)	Department of Renewable and Rural Power	Engr. Philip ABEL
8	Federal Ministry of Trade, Industry and Investment (FMITI)	Industrial Development Department (IDD)	Engr. Uche KENE-OKOYE
9	National Assembly	Office of the Deputy President of the Senate	Hon. Abdulmumin ABDULSALAM
10	Nigerian National Petroleum Corporation (NNPC)	Renewable Energy Division (RED)	Elvis O. AGBONGHAE
11	Nigerian National Petroleum Corporation (NNPC)	Renewable Energy Division (RED)	Auwala BALA
12	Nigerian National Petroleum Corporation (NNPC)	Corporate Planning and Strategy (CP&S)	Fatimah DALHATU

Other Contributors and Reviewers:

Professor **Adeola Adenikinju** (Mr.), PhD, Director, Centre for Petroleum, Energy Economics and Law (CPEEL), University of Ibadan, Nigeria

Ayodeji Babajide (Mr.), Centre for Petroleum, Energy Economics and Law (CPEEL), University of Ibadan, Nigeria

Ifey Ikeonu (Ms.), Energy Policy & Regulation Consultant, Nigeria

Norbert Edomah (Mr.), PhD, Associate Professor (Reader) in Energy Policy & Electricity Planning, Head, Department of Electrical/Electronic Engineering, School of Science & Technology, Pan-Atlantic University, Nigeria

Opeyemi Akinyemi (Ms.), PhD, Centre for Petroleum, Energy Economics and Law (CPEEL), University of Ibadan, Nigeria

Timothy Ononiwu (Mr.), Chief Financial Officer, Axxela, Nigeria

Uduak Akpan (Mr.), Director of Research, SPIDER Solutions Nigeria Ltd.

ABBREVIATIONS AND ACRONYMS

AD	Aggregate Demand	GDP	Gross Domestic Product
AFC	African Finance Corporation	GGW	Great Green Wall
AfCFTA	African Continental Free Trade Area	GHG	Greenhouse gases
AFOLU	Agriculture, Forestry and other Land Use	HDI	Human Development Index
AS	Aggregate Supply	ICE	Internal Combustion Engines
BAU	Business as Usual	IPCC	Intergovernmental Panel on Climate Change
BOI	Bank of Industry	IPPU	Industrial Processes and Product Use
BUR	Biennial Update Report	NDC	Nationally Determined Contribution
CAGR	Compound Annual Growth Rate	NERC	Nigerian Electricity Regulatory Commission
CBA	Carbon Border Adjustment	NESI	Nigerian Electricity Supply Industry
CBN	Central Bank of Nigeria	NIRP	Nigeria Industrial Revolution Plan
CCUS	Carbon Capture Utilization and Storage	NIIMP	National Integrated Infrastructure Master Plan
CNG	Compressed Natural Gas	NNPC	Nigerian National Petroleum Corporation
ECN	Energy Commission of Nigeria	PAIF	Power and Aviation Intervention Fund
EITE	Energy Intensive, Trade Exposed	PMS	Premium Motor Spirit
EKC	Environmental Kuznets Curve	PPP	Public Private Partnership
ETP	Energy Transition Plan	TEC	Trade, Energy and Climate
ETS	Emissions Trading Scheme	UNCTAD	United Nations Conference on Trade and Development
EU	European Union	UNDP	United Nations Development Programme
EV	Electric Vehicle	UNEP	United Nations Environment Programme
FAO	Food and Agricultural Organization	UNFCCC	United Nations Framework Convention on Climate Change
FGN	Federal Government of Nigeria	US	United States
FMENV	Federal Ministry of Environment		
FMITI	Federal Ministry of Trade, Industry and Investment		
FMP	Federal Ministry of Power		

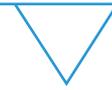
TABLES AND FIGURES

Table 1: Development indicators for top African economies	21
Table 2: Selected GHG emissions from Agriculture, Forestry and Other Land Use in Nigeria (2017), Gg	23
Table 3: Selected GHG emissions from Energy (Gg)	28
Table 4: Electricity consumption and CO₂ emissions per capita	28
Table 5: Actions for TEC Balance in Nigeria	35
Table 6: Pathways Nigeria may follow.	50
Figure 1: CO₂ emissions for European Union (Convention), 2020 inventory	22
Figure 2: Sources of CO₂ Emissions in Nigeria	22
Figure 3: Population growth vs population with access to electricity in Nigeria, 2007- 2020	29
Figure 4: GDP by expenditure in Nigeria, 2012 to 2020	37
Figure 5: The contribution of international trade to GDP of top economies in Africa	39
Figure 6: GDP growth (annual %) in Nigeria, 2012 to 2020	41
Figure 7: Infrastructure investment needs in Nigeria in five years, US\$ billion	49

EXECUTIVE SUMMARY



Nigeria will need about \$2.3 trillion of investment to meet the country's hard and soft infrastructure needs in the years leading up to 2050.



Financing transformational economic development to meet Nigeria's climate obligations presents a significant challenge. According to the Nigerian National Integrated Infrastructure Master Plan (NIIMP), Nigeria will need about \$2.3 trillion of investment to meet the country's hard and soft infrastructure needs in the years leading up to 2050. In addition, the country will need about \$400 billion to finance her Energy Transition Plan (ETP). Addressing these needs presents a challenge of resource mobilisation for the country.

However, these two – economic development and climate actions – are two sides of the same coin, as carbon neutrality would need a viable economic structure to stand. Such an economic structure will be characterised by a macroeconomic environment that creates a feedback loop to investors, informing them of the positive prospects of the economy and, hence, helping to consistently attract the necessary investment.

This White Paper uses the macroeconomic theory of aggregate demand and aggregate supply to analyse what conditions must exist for Nigeria to create the right conditions to attract investors for a net zero future. The analysis stresses the need to address Nigeria's persistent large negative net export figures, diversify Nigeria's export structure and support industries that have backward and forward production linkages with her extractive industries, among other critical interventions. However, this would require the mitigation of sources of adverse supply shocks. In this paper, inadequate supply, as well as consumption of modern energy sources in Nigeria, is seen as a critical source of adverse supply shocks in the country.

The Paper acknowledges that increasing consumption of modern energy sources for the entire population will alleviate energy poverty and support the macroeconomic environment needed to attract investment. However, in turn, this will increase greenhouse gas emissions from modern energy consumption compared to a scenario where the status quo of low modern energy consumption is maintained. Consequently, drawing from the Environmental Kuznets Curve (EKC) hypothesis proffered per the United States-Mexico Free Trade Agreement, the Paper argues that this increase in emissions is necessary for weaning the country from overreliance on crude oil exports as the chief source of government revenue and for enabling Nigeria to achieve carbon neutrality in the long term. However, the White Paper warns that a Do-Nothing scenario will be worse for global climate goals, as Nigeria's rising population, widening energy and income poverty will increase unsustainable dependence on the world's carbon sinks, particularly forests.

There is need for more widespread attention on — as well as action against — the global income inequality gap.

Consequently, the White Paper calls for stakeholders, including Nigeria's international trade partners, to act now. Specifically, the Paper calls for planned and targeted investments to go into strategic projects in the next 5 - 7 years to avoid investing in infrastructures that are energy-intensive in the near term, since doing so will result in path dependencies that will delay the emergence of a carbon-neutral Nigeria.

In conclusion, there is need for more widespread attention on — as well as action against — the global income inequality gap, which has widened since the turn of the new century, otherwise a poorly managed energy transition will worsen the conditions of the world's poorer countries. No doubt, climate change has always worn a human face, hence the need for more effective collaborations between developed and developing countries in order to avert global catastrophe.

CHAPTER 1 – CLIMATE CHANGE

development ambitions that do not factor in sustainability are short-sighted and defeat the goal of improving citizens' welfare

The chapter introduces the issue of climate change, providing a background on what the concerns are for the world and why every country must contribute to reducing global greenhouse gas emissions. This is founded on the premise that development ambitions that do not factor in sustainability are short-sighted and defeat the goal of improving citizens' welfare. The chapter also demonstrates that, owing to peculiar national circumstances, strategies for reducing greenhouse gas emissions will inevitably differ among countries. As echoed in the Paris Agreement Article 2 (2): "This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances."

The chapter further reports that Nigeria's emissions are chiefly driven by activities in agriculture, forestry and other forms of land use (AFOLU), with this sector accounting for 68% of the country's CO₂ emissions (BUR, 2021). At present, this sector holds the largest potential for Nigeria to substantially contribute to reducing global greenhouse gas emissions. However, current development indicators actually threaten Nigeria's capacity to fully curb emissions from these sectors, especially where deforestation and inefficient combustion of wood fuel are inevitable for energy consumption.

CHAPTER 2 – ENERGY

if Nigeria is to achieve net zero emissions in the power sector especially, providing the infrastructure to support the use of renewables for baseload energy will be fundamental

Data presented in this chapter shows that traditional biomass is the largest source of energy used by final energy consumers, with about 175 million Nigerians depending on traditional biomass for cooking (World Bank, 2022). Traditional biomass comes from wood resources as well as waste from agriculture and animals. Black carbon and carbon dioxide emissions not captured due to deforestation threaten global climate goals. In general, the current state of Nigeria's energy sector limits opportunities for carbon neutrality. For example, in the power sector, there would be need for a considerable level of infrastructure development and high-performing electricity market operations. Moreover, beyond generation capacity, as well as the energy mix, there must be evidence of adequate transmission capacity and, on the electricity retail side, distribution companies that are able to sell electricity and receive commensurate revenues from their operations. Having such a structure in the electricity market ensures the growth and viability of the market by creating a self-sustaining feedback loop system that is able to attract investment to continually achieve the objectives of the market, including decarbonisation.

However, it is important to stress that opportunities exist in addressing emissions from consumption of modern energy sources. In this regard, areas needing immediate action include- the road transport sector, which is a major consumer of oil products, and the power sector itself, which requires vast improvements in terms of efficiency.

Nonetheless, if Nigeria is to achieve net zero emissions in the power sector especially, providing the infrastructure to support the use of renewables for baseload energy will be fundamental (e.g., replacing traditional fossil baseload technologies with battery storage or solutions from cross-border grid interconnections), thus underscoring the imperative of accelerated investments in the country.

CHAPTER 3 - TRADE

The phenomena of aggregate demand and aggregate supply, as well as the impact of inflation, are components of macroeconomic theory that enable economies to manage the relevant indicators as best as possible with a view to increasing investment and growing the economies. The chapter covers the current state of Nigeria's macroeconomic environment to demonstrate why trade levels must improve in the country in order to create an economy that can sustainably attract the level of investment needed to achieve carbon neutrality.

The chapter further demonstrates that, given the importance of government spending and, hence, the government's ability to generate revenue to increase spending, steady inflows of receipts from natural resources cannot be weakened for countries that rely on this for income without commensurate increases in other sources of income generation, if the broad outcome of carbon neutrality is to be achieved. However, the chapter also warns that if Nigeria continues to depend largely on exports of her raw commodities—mainly crude oil in this instance—the country will eventually witness declined receipts from her natural resource wealth. Thus, owing to the need to act urgently, the chapter stresses that Nigeria must pursue a broad-based economic growth strategy that, among others, utilises petroleum products from her crude oil wealth in increasing local manufacturing capacity. For instance, petroleum coke, asphalt and road oil, petrochemical feedstocks and other outputs of refined crude oil are used in manufacturing aluminium, steel, glass, paint, fertilizer, synthetic rubber, plastics, etc.—inputs for hard infrastructure development.

the issues of double-digit inflation levels, excessive interest rates, high unemployment rates and a depreciated naira, as well as a negative trade balance, point to the production capacity constraints affecting aggregate supply (AS) in Nigeria's macroeconomy

Underscoring the importance of increasing productivity in Nigeria, the paper demonstrates how the issues of double-digit inflation levels, excessive interest rates, high unemployment rates and a depreciated naira, as well as a negative trade balance, point to the production capacity constraints affecting aggregate supply (AS) in Nigeria's macroeconomy. At a very low level of production capacity, it will not require having a large volume of money in circulation for Nigeria's economy to reach full capacity and crisis levels. The chapter argues that the multiplier effect from increased local consumption and investment will place Nigeria on the desired path to finance her carbon neutrality goals in the long term.

CHAPTER 4 - TRADE, ENERGY AND CLIMATE BALANCE

The chapter draws examples from the European Union (EU)—specifically how EU regulations on emission allocations and allowances are implemented with certain safeguards that minimize undue hardship on member states with smaller GDP per capita, as well as how the said regulations protect certain EU sectors and industries while achieving the Union's global emissions reduction goal. Specific examples include the preferential treatment given to the energy sector and industries that the EU classifies as energy-intensive, trade-exposed (EITE) sectors.

The example from the EU market is to stress the importance of balancing trade, energy and climate objectives. If well managed, this could create the right macroeconomic environment where each reinforces the other: increased energy supply supports increased trade and trade supports the economy to meet the huge investment needed to achieve carbon-neutrality goals.

The chapter suggests possible outcomes of likely pathways, viz: (i) choosing to do nothing and allowing the status quo to unfold as it pleases, i.e. the business-as-usual approach (ii) allowing economic growth to happen haphazardly, without any targeted, coordinated inflow of investment, i.e. accelerated growth and (iii) achieving Trade, Energy and Climate (TEC) Balance through infrastructure investments aligned with the NIIMP and ETP.

Finally, the White Paper outlines a three-point strategy for harmonising Nigerian and global concerns:

- I. **Sustainably** increasing material consumption in a manner that creates the necessary local economic conditions for attracting investments to achieve carbon neutrality.
- II. **Substituting** waste removal mechanisms from material consumption with those that meet sustainability conditions, such as increasing biomass stock to remove added CO₂ emissions from the atmosphere and increasing recycling to reduce wasteful material consumption, etc.
- III. **Shifting** consumption from geographies/economies with very high CO₂ per capita/GDP per capita into geographies with levels too low to attain carbon neutrality by meeting sustainability conditions for industrial activities of comparative advantages to be relocated to these economies, e.g. Nigeria.

The three conditions under this strategy are line with achieving Article 4 (1) of the Paris Agreement: "In order to achieve the long-term temperature goal set in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of the century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty."

Actionable items under these three-point strategy include:

Sustainably increasing material consumption in a manner that creates the necessary local economic conditions to attract investment to achieve carbon neutrality.

Diversification of Nigeria’s energy mix should be done with energy security as a priority. Energy security investments that allow the country’s power sector to increasingly integrate variable renewables into the grid will be pivotal in achieving a low carbon power sector (grid stability, transmissions lines, cross border electricity networks, etc.).

Increasing capital for government spending through prudent and sustainable use of her natural resources and other forms of domestic resource mobilisation.

Prioritising energy efficiency and investments towards energy security in the power sector.

Improving energy efficiency would include reducing the GHG emissions under Fugitive Emissions from the oil and gas sector, increasing efficiency at the power generation, transmission, distribution segments of the market, through the use of best available technologies and, at the end-user level, through standards that limit import of inefficient appliances and facilitate households and businesses’ purchase of efficient appliances and equipment.

In the road transport sector prioritise the Avoid, Shift and Improve sustainable transport policy measures that lead to a significant reduction of very old vehicles on the road, increase public transport options and usage, using cleaner fuels including biofuels, address urban sprawling and reduce distance travelled.

Increase international climate finance inflows towards investments in Nigeria to complement public funds with the objective of stimulating businesses to invest in the economy.

Substituting waste removal mechanisms from material consumption to those that meet sustainability conditions, such as increasing biomass stock to remove added CO₂ emissions from the atmosphere, increasing recycling to reduce wasteful material consumption, etc.

Balancing natural capital depreciation. For instance, the use of fossil fuels should be offset by increasing the country’s natural carbon stock as well as increasing carbon sequestration through technology where feasible.

Combating deforestation through a wide-scale afforestation and reforestation programmes, implemented alongside economic development programmes that increase the capacity of households to afford modern cooking fuels.

For industries, the use of energy-efficient technologies as well as cleaner production practices (including recycling/resource efficiency) can substantially reduce emissions from this sector.

Shifting consumption from geographies/economies with very high CO₂ per capita/GDP per capita into geographies with levels too low to attain carbon neutrality, by meeting sustainability conditions for industrial activities of comparative advantages to be relocated to these economies, e.g., Nigeria.

Increase production capacity of firms and industries by increasing energy supply and consumption through her renewable and non-renewable energy resources as well as energy efficiency.

Nigeria’s trade partners must have interest beyond the country’s raw commodities to support diversification of the country’s export structure. New trade agreements should (1) aim to increase Nigeria’s export volumes and (2) a larger part of these new trade agreements must be on higher value-added products.

Realisation of Nigeria’s industrialisation goals must be considered a priority and implemented alongside a green industry plan where carbon capture utilisation and storage technologies and green and blue hydrogen feature strongly.

Increasing employment opportunities by increasing manufacturing, trade and export activities. Preferably, new investments in manufacturing and agricultural (e.g., production of fertilizer) industries that have forward and backward linkages with Nigeria’s extractive industries (mining and steel, petroleum).

In terms of impact, point 3 on Shifting Consumption will have the strongest effect on increasing Nigeria’s productivity and, hence, setting the economy on the path to financing her carbon-neutrality goals. This is where the larger part of new investments must go into in the next 5 to 7 years.



INTRODUCTION

In November 2021, the President of the Federal Republic of Nigeria, Muhammadu Buhari, signed the Nigeria Climate Change Bill into an Act. This coincided with the 26th United Nations Climate Change Conference (COP26). The Climate Change Act was, thus, sending a clear and strong message to the international community: Nigeria is serious about climate change.

Furthermore, in preparation for the COP26, Nigeria produced an Energy Transition Plan (ETP). The plan charts a pathway for Nigeria to attain a carbon-neutrality status by 2060, a decade before the deadline specified in the Act, i.e. 2070. Together, the Act and the ETP demonstrates Nigeria's ambitions as well as provides evidence of the political will to achieve these climate goals. Having established these fundamentals, the country now needs to proceed to the next stage, which is mobilising adequate capital for this transformation to occur. As we will show in this White Paper, without investment in tangible economic transformation activities in Nigeria, the objectives of the Act and ETP will remain theoretical.

Without investment in tangible economic transformation activities in Nigeria, the objectives of the Act and ETP will remain theoretical.

Nigeria recognises that, while vital, dependence on transnational climate finance¹ alone will not enable the country to achieve her climate goals. Climate finance will play an enabling role. However, economic activities in Nigeria, based on increasing industrial activities, trade and infrastructure development, will be the main determinants of the country's capacity to finance her climate goals.

Nigeria also recognises that increasing industrial and trade activities as well as infrastructure development will lead to increasing material consumption compared to the current levels in the country. The socioeconomic situation is currently marked by a huge infrastructure deficit, low employment levels (33.3%² unemployed according to the 2020 Q4 data by the National Bureau of Statistics) and high poverty rates in Nigeria.

However, this increase in material consumption, although unavoidable, could be strategically managed to create opportunities for Nigeria to decouple economic growth from dire environmental impacts and, thus, set the country on a course to carbon neutrality³ in the long run.

Considering the trade, energy and climate change nexus, the White Paper poses the question: Can Nigeria attain carbon neutrality while increasing material consumption? If so, how?

The Paper reports that Nigeria's main final energy consumption comes from traditional biomass, particularly for cooking. Moreover, the most substantial contribution Nigeria can make to reducing global GHG emissions today is through reforestation and afforestation as well as modernisation of her agriculture sector, which accounts for the largest share of CO₂ emissions today (68%) (BUR, 2021). The energy sector in Nigeria is the second largest contributor to total national emissions, accounting for 28% (BUR, 2021). Energy Industries and Transport are the two primary drivers of emissions in this sector. The decarbonisation of these subsectors must be taken seriously if Nigeria is to stay the desired course of carbon neutrality. However, there are structural issues in the energy sector and the wider economy that must be addressed to attain this goal. For example, issues of grid instability in the power sector and issues of productivity in the wider economy will influence the extent to which Nigeria can truly meet net zero emissions goals in the power sector.

¹ Climate finance is an instrument of the United Nations Framework Convention on Climate Change (UNFCCC) in line with the Convention's principle of "common but differentiated responsibility and respective capabilities." The instrument aims to mobilise financing for climate change mitigation and adaptation in developing countries from developed countries. The financial mechanisms, by which funding from developed countries is channelled to developing countries, include the Global Environment Facility (GEF), the Green Climate Fund (GCF), the Special Climate Change Fund (SCCF), the Least Developed Countries Fund (LDCF) and the Adaptation Fund. Source – UNFCCC: Introduction to Climate Finance. Available at: <https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance>

² In Q2 of 2020 the unemployment rate in Nigeria was 27.1%. However, by Q4 of 2020, owing to the pandemic, the number had risen to 33.3% (NBS, 2020). The latest numbers are yet to be published.

³ According to the Intergovernmental Panel on Climate Change, "Net zero carbon dioxide emissions are achieved when anthropogenic carbon dioxide emissions are balanced globally by anthropogenic carbon dioxide removals over a specified period". This is the same as carbon neutrality.

For the analytical framework on the chapter on trade, the White Paper deploys the theory of aggregate demand and aggregate supply, while also incorporating the impact of inflation. This is a macroeconomic theory that enables economies to manage the relevant indicators as best as possible with a view to increasing investments and growing the economies. Basing the analysis on the theory of aggregate demand and aggregate supply, the White Paper notes that to attract investment for the infrastructure development needed for transitioning, the country must mitigate

issues of grid instability in the power sector and issues of productivity in the wider economy will influence the extent to which Nigeria can truly meet net zero emissions goals in the power sector.

sources of adverse supply shocks, including inadequate energy supply. The urgency of not being left behind requires Nigeria to take the most advantage of her oil and gas resources to build up her hard infrastructure assets, as this would be necessary for the modernisation of her power/energy sector to meet carbon-neutrality goals. The White Paper stresses the importance of investments going into strategic sectors of the economy in the next 5 to 7

years. This is to avoid an alternative scenario where the larger part of infrastructure investments occurs sporadically, leading to inefficient capital projects (energy- and carbon-intensive) being embarked upon in the near future. The Paper warns that, owing to path dependencies and the lock-in effect, these structures derail and delay the country's net zero timeline. The White Paper concludes with a call to Nigeria's trade partners to immediately design investment agreements for achieving the global objectives of carbon neutrality in the long term.

The White Paper argues that Nigeria can attain carbon neutrality while increasing material consumption through the trade, energy and climate balance. In fact, increasing material consumption would be fundamental to attaining carbon neutrality in the long run, as demonstrated in the White Paper.

Aligning with Article 4 (1) of the Paris Agreement, the White Paper outlines a 3-point strategy for harmonising Nigerian and global concerns as follows:

- I. Sustainably increasing material consumption in a manner that creates the necessary local economic conditions to attract investment to achieve carbon neutrality.
- II. Substituting waste removal mechanisms from material consumption to those that meet sustainability conditions, such as increasing biomass stock to remove added CO₂ emissions from the atmosphere, increasing recycling to reduce wasteful material consumption, etc.
- III. Shifting consumption from geographies/economies with very high CO₂ per capita/GDP per capita into geographies with levels too low to attain carbon neutrality, by meeting sustainability conditions for industrial activities of comparative advantages to be relocated to these economies, e.g. Nigeria.

The Objective of the White Paper is to inform the international community and Nigeria's trade partners on how the country's national concerns on trade, energy and climate change can be harmonised with global concerns in a manner that ensures that Nigeria's interests are seen as global interests. Given Nigeria's large and growing population, achieving this balance between trade, energy and climate change is a matter of national, continental and global concern. Ultimately,

Nigeria can attain carbon neutrality while increasing material consumption through the trade, energy and climate balance.

the Goal is to strengthen Nigeria's position as a global trade partner in the global supply chain as the world moves towards a net-zero future.

In addition to the Introduction and Conclusion sections, the paper is divided into Four Chapters. Chapter One is on Climate Change, Chapter Two on Energy and Chapter Three on Trade. Chapter Four synthesises the previous three, i.e. Trade, Energy and Climate Balance. This is followed by the Conclusion, which offers recommendations for accelerating Nigeria's transition to a net-zero future through TEC Balance actions.

RATIONALE

Developing countries, e.g. Nigeria, have an advantageous position compared to mature economies when it comes to transitioning to a carbon-neutral future. This is mainly because the hard infrastructure, as well as the industries needed by a larger and growing fraction of its population, is yet to be built. Considering that infrastructure built today will last for decades, there is much more scope for countries like Nigeria to prepare for a net-zero future. However, there is also the possibility that the infrastructure built in the next years will rather be the type that locks in the country into an energy- and carbon-intensive future.

Factors that will determine if the next infrastructure projects to come online in the next decade will set Nigeria on a net-zero course or a carbon-intensive trajectory will depend on the state of the structure of Nigeria's economy today.

Nigeria already has impressive levels of experience and a repository of sustainable policies and regulatory instruments, among others, in the climate and energy sector. The focus must now increasingly be on implementation. The White Paper posits that a successful sustainability plan for climate and energy must be married with achieving wider macroeconomic outcomes (e.g., macroeconomic stabilisation, increasing productivity, etc.). The association between these two is the contribution this White Paper will be making to the existing body of work.

Developing countries, e.g. Nigeria, have an advantageous position compared to mature economies when it comes to transitioning to a carbon-neutral future

Analysis in the White Paper is anchored on the following:

- **Where we are** – this considers the level of electricity per capita consumption, characteristics of the country's electricity market, level of traditional biomass in total final consumption, income per capita, etc.
- **Why we are here** – this looks into issues of adverse supply shocks, production capacity constraints and effect on productivity in the economy, export structure, inflation, a depreciated naira and high levels of imports as well as the impact of these on investment.
- **Where we want to go** – a strong and resilient economy able to transition to a net-zero future.
- **What Nigeria must become to get to where we want to go** – an economy able to attain high productivity levels and attain conditions that attract investments needed to meet economic, social and environmental goals.

Rather than discussing the most advanced technologies and impressive instruments for regulating carbon emissions, this White Paper adopts a pragmatic, *back-to-the-drawing-board* approach. Starting with what Nigeria can start doing today to contribute to reduction of global greenhouse gas emissions, the Paper discusses why a wealthier Nigeria (at a per capita level) is best for global climate goals. For instance, the choice of cleaner cooking fuels, more energy-efficient vehicles, the use of best available technologies in industries, etc., are markedly influenced by costs and affordability issues.

The White Paper posits that a successful sustainability plan for climate and energy must be married with achieving wider macroeconomic outcomes

Generally, we are at a very important point in our history where the urgency of addressing climate change is ever more pressing—an impressive talk will not be enough.



CHAPTER ONE CLIMATE CHANGE

Greenhouse gases (GHG), although naturally occurring, have increased in the earth's atmosphere as a result of anthropogenic activities; these include burning of fossil fuels and deforestation.

1. INTRODUCING CLIMATE CHANGE

Greenhouse gases (GHG), although naturally occurring, have increased in the earth's atmosphere as a result of anthropogenic activities; these include burning of fossil fuels and deforestation. GHG, in nature, as well as its effects, are critical to human survival on earth, as they are responsible for temporarily trapping the radiation from the sun⁴ and keeping the earth's temperature warm enough to support life. Without this greenhouse effect, the earth's temperature would be below the freezing point of water (IPCC, 2007).

Increased concentration of GHG emissions such as carbon dioxide (CO₂), Nitrous oxide (N₂O) and Methane (CH₄) may occur naturally or as a result of human activities. However, Hydrofluorocarbons (HFC), Perfluorocarbons (PFC), Sulfur hexafluoride (SF₆) and Nitrogen trifluoride (NF₃) occur only from anthropogenic activities. Owing to these anthropogenic activities, more of these gases are being released into the earth's atmosphere, thereby increasing the greenhouse effect and global warming.

It is important to note that climate change as a result of anthropogenic increase of GHG concentrations is an unintended effect of the human pursuit of improved living conditions. For instance, food production through agriculture, land-use changes due to construction of roads and other infrastructure and burning fossil fuel for electricity as well as its positive impact on productivity have also had the effect of increasing GHG concentrations. According to IPCC (2007), agriculture, land-use change and use of fossils have resulted in CO₂, N₂O and CH₄ increasing substantially. At higher levels of global warming, human life would be endangered.

The challenge of climate change is therefore to balance factors for survival. A policy scenario where economic growth is pursued without consideration for sustainability is not only short-sighted but also detrimental and counterproductive to the goal of improved living conditions for a people, even if this may not be obvious at the present time. This clearly explains why African countries, including Nigeria, are signatories to the Paris Agreement. Over the years, the power of such a globally unified position has been proven. For instance, the effect of the Montreal Protocol in phasing out ozone layer-depleting substances demonstrates the potency of collective action to address threats to environmental sustainability⁵.

Climate change as a result of anthropogenic increase of GHG concentrations is an unintended effect of the human pursuit of improved living conditions.

Along the same lines, on the matter of regulating GHG emissions, this would require countries' collective action, using individualised strategies, with the objective of meeting global goals. For

4 Two-thirds of the radiations from the sun reaches the earth's surface and is radiated back. However, some of this is captured by the atmosphere and is reradiated back to the earth. This helps keeps the earth's temperature warm enough.

5 "To date, the Parties to the Protocol have phased out 98% of Ozone Depleting Substances (ODS) globally compared to 1990 levels". Source - UNEP: The Montreal Protocol. Available at: <https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol>

African countries most especially, what this means is that countries would need tailored positions on What, Where and How. That is: 'What' are the key GHG emissions being emitted by the country? 'Where' are emissions coming from? 'How' can the country most effectively contribute to the global goal of reducing GHG emissions? This same requirement is well articulated in the Paris Agreement, specifically Article 2 (2): "This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances" (UN, 2015, p. 3).

The subsequent sections will further assess this What, Where and How as it concerns Nigeria.

1.1. NIGERIA'S EMISSIONS PROFILE

The Climate Change Act of Nigeria "seeks to provide a framework for achieving low greenhouse gas emissions (GHG), inclusive green growth and sustainable economic development." Setting GHG targets per sector and their regulation, as well as instruments such as the creation of a carbon budget and mechanisms for a carbon tax regime, are articulated in the Act (FGN, 2021).

It is, thus, important to identify the key sources of emissions to assess where tightening of emissions may be applied as well as where a pilot carbon budget⁶ may be most effectively implemented to enable the country to set and regulate a realistic benchmark that is able to achieve the tripartite objective of the Act. Moreover, given the direct relationship between energy consumption, the economy and emissions, an analysis of Nigeria's emissions, as well as the capacity to tighten emissions, will be considered using socioeconomic indicators.

Regarding volume (i.e. how much) of emissions, Africa accounts for a minimal share of the global CO₂ emissions at 3.8%. Nigeria, Africa's largest economy and population, accounts for 0.36% of global CO₂ emissions. As of 2020, other top African economies accounted for global CO₂ emissions as follows: Algeria, Egypt, Morocco and South Africa with 0.61%, 0.45%, 0.19% and 1.3% respectively.⁷

The Climate Change Act of Nigeria "seeks to provide a framework for achieving low greenhouse gas emissions (GHG), inclusive green growth and sustainable economic development.

Other things being equal, population and GDP per capita have a positive relationship with emissions.

To give some background, on a population basis, Algeria, Egypt, Morocco and South Africa are significantly smaller, with their populations representing 21%, 50%, 18% and 29% respectively of Nigeria's population. Furthermore, on GDP per capita, while Nigeria may be the largest economy in Africa, the country performs the least

among the top five economies in Africa on a per capita basis. The same is true when comparing Nigeria and the other top African economies on the basis of human development and population with access to electricity, as presented in Table 1.

6 Carbon Budget means the approved quantity of Greenhouse Gases emission that is acceptable over a specified time. Source: Climate Change Act of Nigeria.

7 The source of the data is Our World in Data (OWD) and compared with British Petroleum (BP) Statistical Review of World Energy 2021. Both sources differ slightly in data reported. For instance, for BP Africa contribute 3.9% as of 2020. Also, for BP Algeria is 0.5% compared to OWD's 0.61%, Egypt is 0.6% compared to OWD's 0.45% and Morocco is 0.2% compared to OWD's 0.19% for the same year. For South Africa, BP and OWD report the same, 1.3%. BP, unfortunately, does not provide data for Nigeria. For the intent of comparison, the White Paper uses OWD's data. However, this discrepancy underscores the importance of national data.

Table 1 Development indicators for top African economies

Africa's top five economies	Population	GDP per capita, PPP (current international \$) ⁸	Population with access to electricity	Human development Index (HDI), global ranking (out of 189 countries)
Nigeria	206 million	\$ 5,186.41	55.4%	161
Algeria	43 million	\$ 11,324.24	99.8%	91
Egypt	102 million	\$ 12,607.00	100%	116
Morocco	37 million	\$ 7,369.49	100%	121
South Africa	59 million	\$ 13,360.57	84.39%	114

Source: World Bank (2022), World Development Indicators; UNDP (2022), Human Development Report

Compared to the other top African economies, Nigeria has the most daunting task of connecting over 100 million people to electricity today, without even accounting for population growth in the next few decades. Moreover, increasing energy access to these millions of people will require increasing energy production and consumption.

Nigeria's lower emissions profile, i.e. contribution to global CO₂ emissions, is not necessarily because the country is the most carbon-efficient economy compared to the other top African economies (excluding Morocco). In fact, it is because of Nigeria's suppressed energy demand and consumption, brought about by lower-than-desired economic activities and output as well as higher rates of income poverty, among others. If Nigeria were to achieve her development objectives and pull millions of people out of poverty as planned, emissions would certainly be more substantial than current levels. As such, there is need for the country to develop a forward-looking approach to safeguard a sustainable future while addressing energy and income poverty.

If Nigeria were to achieve her development objectives and pull millions of people out of poverty as planned, emissions would certainly be more substantial than current levels

1.2. SOURCES OF NIGERIA'S GREENHOUSE GAS EMISSIONS

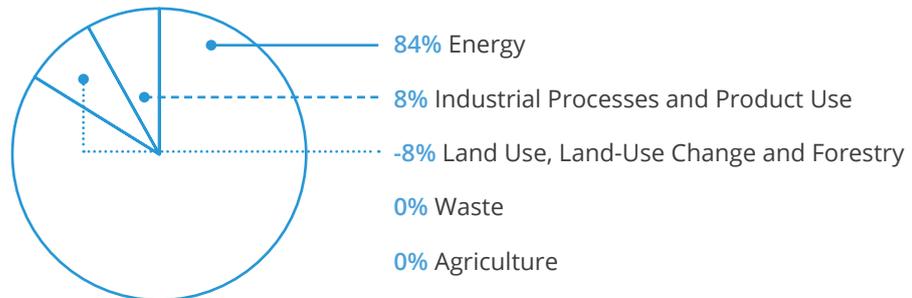
Globally, the power sector accounts for one-quarter of all GHG emissions (COP26, 2021), hence, the amount of attention the sector has received concerning the achievement of carbon neutrality at the international level. There tends to be a direct relationship between GHG emissions and energy consumption, as explained. There is also a direct relationship between those two variables and economic growth, marked by higher levels of industrialisation in such countries.

For instance, in the European Union, the energy sector is the single largest source of CO₂ emissions, accounting for 84% of total CO₂ emissions (Figure 1).

⁸ We are using GDP in Power Purchasing Parity (PPP) to take into account the costs of living in the respective countries, i.e. to measure how far a dollar can go, spending wise, in each of these countries. The value for GDP per capita at constant 2015 US\$ is much different. For instance, the GDP per capita (constant 2015 US\$) in Nigeria is US\$ 2,396.04 and in South Africa this is US\$ 5,659, the highest figure out of all the economies in the Table 1.

Agriculture is the largest contributor to CO₂ emissions in Nigeria, accounting for 68%

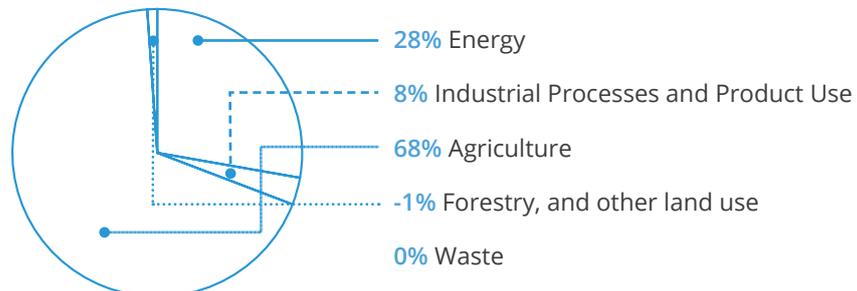
Figure 1: CO₂ emissions for European Union (Convention), 2020 inventory



Source: UNFCCC (2020)

While the energy sector is a key contributor to CO₂ emissions worldwide, agriculture is the largest contributor to CO₂ emissions in Nigeria, accounting for 68%, as shown in Figure 2 below.

Figure 2: Sources of CO₂ Emissions in Nigeria



Source: Second Biennial Update Report (BUR2) to the United Nations Framework Convention on Climate Change, 2021

The significance of this is that while Nigeria may have an ambitious Energy Transition Plan (ETP), the country's most meaningful contribution to reducing global CO₂ emissions in the short term will be in the agriculture sector. Obviously, the scenario will be different for Europe, where the most substantial contribution the region can make to CO₂ emissions reduction is in its energy sector.

Furthermore, for Nigeria, the most significant area by which the country can contribute to global CO₂ emissions reduction lies in sustainable forestry practices. According to the country's emissions inventory to the UNFCCC, while Agriculture, Forestry and other land use (AFOLU) may account for the bulk share of national emissions, emissions from Forest lands (i.e. deforestation) is the main culprit.

Nigeria, the most significant area by which the country can contribute to global CO₂ emissions reduction lies in sustainable forestry practices

Table 2: Selected GHG emissions from Agriculture, Forestry and Other Land Use in Nigeria (2017), Gg

	Net CO ₂	CH ₄	N ₂ O
Agriculture, Forestry, and other land use (AFOLU)	315,427.96	1,669.82	87.04
Livestock		1,327.77	5.278
Enteric Fermentation		1,266.91	
Manure Management		60.86	
Land	319,970.58		
Forest Land	319,970.58		
Aggregate sources and non-CO₂ emissions sources on land		342.05	81.76
Emissions from biomass burning		0.19	0.01
Direct N ₂ O Emissions from managed soils			60.714
Indirect N ₂ O Emissions from managed soils			19.831
Indirect N ₂ O Emissions from manure management			1.208
Rice cultivation		341.86	
Other			
Harvested wood products	- 4,542.63		

Source: Second Biennial Update Report (BUR2) to the United Nations Framework Convention on Climate Change, 2021

For a GHG like CH₄, livestock/crop production is the main source, as observed by the United Nations Food and Agricultural Organization (FAO). According to the FAO, CH₄ emissions from agriculture come from crop and livestock production, with the largest source of CH₄ emissions coming from the digestive systems of ruminant livestock (FAO, 2018). Other contributors include livestock manure, synthetic fertilizer, rice cultivation, manure management, crop residue, etc. (FAO, 2018). Owing to the sources of CH₄ emissions in agriculture, the scope for technology to address CH₄ emissions in this sector is limited (UNEP, 2021). However, improved agricultural practices can ameliorate some of these issues. Thus, modernising agricultural activities in Nigeria holds significant potential. Nevertheless, at the national scale, the energy sector is the largest source of CH₄ emissions in Nigeria, accounting for 61% (BUR, 2021). Compared to the agriculture sector, technologies can make a significant difference in curbing CH₄ emissions in the energy sector—a point that will be discussed in the next chapter, which focuses on energy.

Generally, concerning emissions from AFOLU, while land clearing for food production and rearing of livestock is unavoidable, afforestation and reforestation programmes can offset this, but West and Central Africa is not taking full advantage of the environmental benefits of tree planting. The Global Forest Resources Assessment 2020 reported a decrease of carbon stocks in forest biomass in West and Central Africa as well as South America, from 1990 – 2020, but not in other regions. In fact, for East Asia the number of carbon stocks increased significantly (FAO, 2020). For East Asia, the report notes that the reforestation programme implemented in recent decades by China, Japan and the Republic of Korea have made the region the leader in number of planted forests (FAO, 2020).

While land clearing for food production and rearing of livestock is unavoidable, afforestation and reforestation programmes can offset this.

As Nigeria develops, construction of roads, buildings and even food production will require land-use change. Thus, for immediate action, Nigeria's What, Where and How should have a primary fo-

cus on combating deforestation through wide-scale afforestation and reforestation programmes. Examples from East Asia and Europe show how sustainable forest management can offset carbon stock depletion arising from unavoidable land-use changes.



Box 1: Examples of sustainable forest initiatives in Nigeria

Great Green Wall (GGW) Programme, Reforestation Programme

The GGW is an initiative of the African Union, established in 2007. The GGW aims to restore 100 million hectares of currently degraded land; sequester 250 million tons of carbon and create 10 million green jobs by 2030. The initiative conceived to address land degradation and desertification, boost food security and support communities to adapt to climate change in the Sahel-Sahara region of Africa.

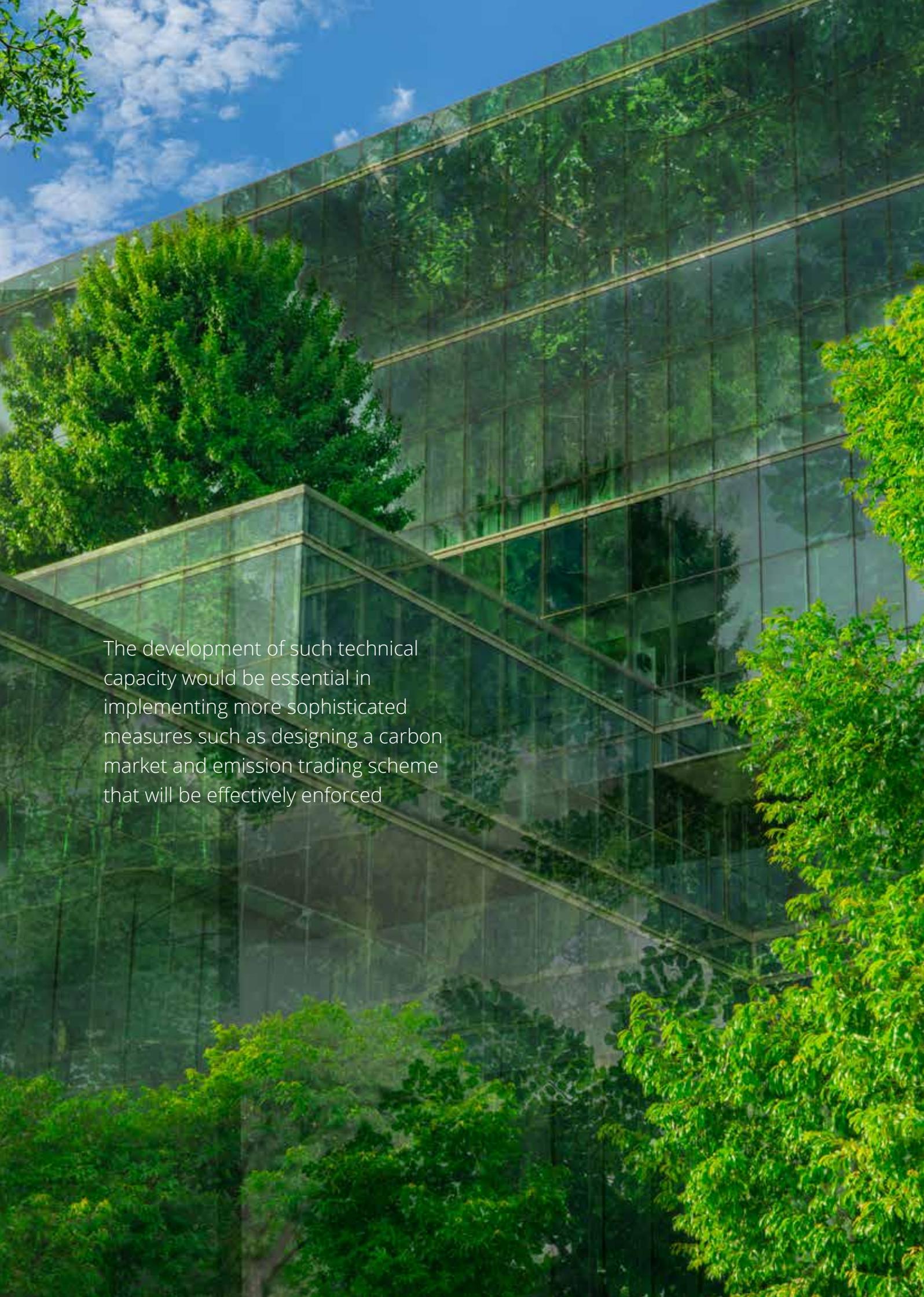
Source: Ministry of Environment, Nigeria; UNFCCC (2022).

In conclusion, curbing the burning of fossil fuels is the global priority for achieving climate goals, given that this is the key source of GHG emissions in the world's largest economies. By virtue of the magnitude of fossil fuel used and the GHGs emitted by these economies, this is clearly where immediate action should focus.

For Nigeria, however, the priority lies elsewhere: land-use changes from agriculture, where implementation of a carbon budget would be significant. The overall objective would be to increase Nigeria's carbon stock. In terms of administration, a national tree planting programme could be effectively implemented, measured, reported and monitored at reasonable transaction and compliance costs to the government. The development of such technical capacity would be essential in implementing more sophisticated measures such as designing a carbon market and emission trading scheme that will be effectively enforced. Not only is this option more practical, based on national circumstances, but it is the more effective option.

Moreover, as we will show in the next chapter on Energy, when it comes to energy consumption in Nigeria, we see unsustainable land-use change practices also being an issue, with biomass occupying a key position in final energy consumption. Thus, reforestation and afforestation would be essential instruments in offsetting natural capital depreciation for sustainable economic development in Nigeria.

As Nigeria develops, construction of roads, buildings and even food production will require land-use change

A low-angle photograph of a modern glass skyscraper. The building's facade is composed of large glass panels that reflect the surrounding environment, including lush green trees and a bright blue sky with scattered white clouds. The perspective is looking up at the building, which dominates the frame. The text is overlaid on the lower-left portion of the image.

The development of such technical capacity would be essential in implementing more sophisticated measures such as designing a carbon market and emission trading scheme that will be effectively enforced



CHAPTER TWO ENERGY

One of the key differences between energy-poor countries and others is the dominance of traditional biomass in the former's energy mix

2. AN INTRODUCTION TO NIGERIA'S ENERGY SECTOR

One of the key differences between energy-poor countries and others is the dominance of traditional biomass in the former's energy mix. Traditional biomass refers to wood resources (firewood and charcoal), agricultural by-products and waste as well as animal waste as used for cooking and heating purposes. Such usage is different from using biomass for generating electricity and heat as well as for transportation, as can be observed in advanced economies.

In Nigeria, traditional biomass occupies a significant position in total final consumption of energy. According to World Bank (2022) data, only 15% of Nigeria's population has access to clean fuels and technologies for cooking as of 2020. This means that about 175 million Nigerians rely only on traditional biomass for cooking. This is a concern for the natural environment, as unsustainable felling of trees for charcoal production is a threat to global climate goals, especially as Nigeria's population grows. Besides the carbon emissions from cutting down trees, the inefficient burning of traditional biomass releases black carbon into the atmosphere and contributes to climate change.

About 175 million Nigerians rely only on traditional biomass for cooking.

Reducing emissions here can hardly be achieved by implementing carbon budgets and carbon taxes, since the underlying driver here is income poverty. For the reasons of energy justice and climate goals, the immediate actions here would be targeted at increasing household consumption of cleaner and modern energy options by increasing the capacity to afford this option. Increasing capacity for household consumption and the economy's total spending to meet households' demand for clean energy services will be covered in Chapter Three, which focuses on trade.

2.1. SOURCES OF EMISSIONS FROM NIGERIA'S ENERGY SECTOR FOR MODERN FUELS

While it is important to consider Nigeria's most significant contribution to GHG emissions as of today, i.e. AFOLU, and to devise means to limit them, it is also necessary to pay attention to sectors that might not be significant contributors to GHG emissions at present but have the potential of occupying this position in the coming decades. One such potentially crucial sector is the energy sector.

According to the country's latest emissions inventory, the energy sector is the second largest contributor after AFOLU, accounting for 28% of CO₂ emissions. As presented in Table 3, energy industries and transport are key sectors of concern, representing 43% and 29% of CO₂ emissions from the energy sector.

Table 3: *Selected GHG emissions from Energy (Gg)*

	CO ₂	CH ₄	N ₂ O
Total National Emissions for Energy	131,196.32	3,976.36	12.768
Energy industries	57,052.16	12.15	1.59
Manufacturing industries and construction	14,758.46	4.61	0.60
Transport	37,646.98	14.35	1.62
Other sectors	16,996.54	676.70	8.90
Fugitive emissions from Solid fuels		0.76	
Fugitive emissions from oil and natural gas	4,742.179	3,267.793	0.07

Source: Second Biennial Update Report (BUR2) to the United Nations Framework Convention on Climate Change, 2021

2.2.1. DECARBONISING ENERGY INDUSTRIES IN NIGERIA

According to the UNFCCC reporting format, energy industries include public electricity and heat production, petroleum refining and manufacture of solid fuels and other energy industries. In Nigeria, 85.5% of installed power generation capacity is from gas, whereas hydro sources account for 14.5% (NIIMP, 2020, p.65). This also influences the CO₂ emissions profile of buildings, industries and other energy-using sectors. In the near future, Nigeria must diversify her energy power mix, with priorities being appropriately aligned. Diversification of Nigeria's energy mix should be done with energy security as a priority, followed by decarbonisation. Energy security investments that allow the country's power sector to increasingly integrate variable renewables into the grid will be pivotal to achieving a low-carbon power sector (transmissions lines, cross-border electricity networks, etc.).

At the global level, the concentration of attention on the power sector as a key sector to fight climate change is well justified. Not only is the sector a key source of CO₂ emissions, but there is more scope for technology to cut down emissions from this sector compared to other sectors. The global trend of the energy/power sector being the major contributor to emissions can also be observed at individual levels for certain countries, but not Nigeria, as shown above in Figure 2. This situation is due to Nigeria's extremely low electricity consumption per capita, even when compared to other high population regions, as presented in Table 4 below. The significance of this is that, even with her large population, Nigeria's electricity usage is not enough to influence the global system with regard to CO₂ emissions from the power sector.

Table 4: *Electricity consumption and CO2 emissions per capita*

Economies	Population	Electricity consumption per capita (MWh/capita)	CO2 emissions per capita (tCO2/capita)	GDP per capita (constant 2015 US\$)
Nigeria	206 million	0.13	0.46	\$2,396
Brazil	212 million	2.54	1.81	\$8,229
United States	331 million	12.28	12.98	\$58,203
European Union	447 million	5.68	5.23	\$31,041
China	1.4 billion	5.12	7.07	\$10,370

Source: International Energy Agency (IEA); World Bank (2022), World Development Indicators.

Nevertheless, it is worth noting the observation below from FMP (2022):

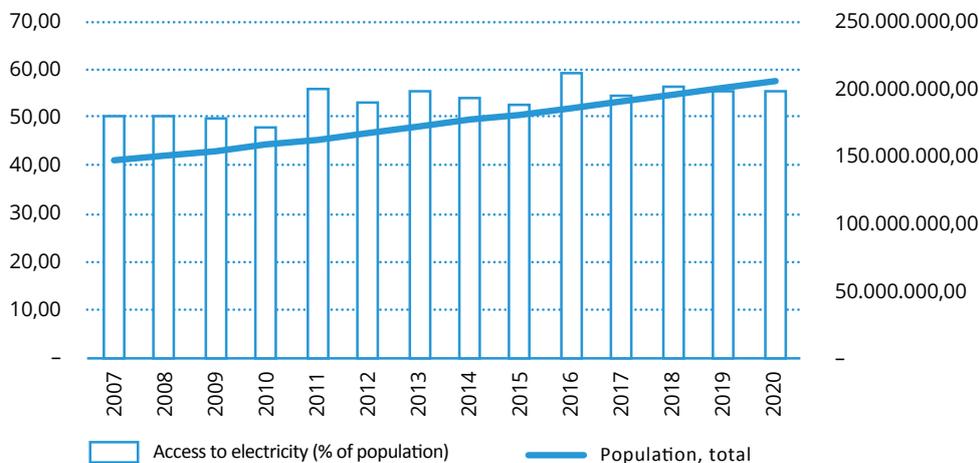
The Federal Government of Nigeria (FGN) has put up a number of mechanisms to increase electricity access in Nigeria in a sustainable manner in tandem with its commitments in the Paris Climate Accord. One of such mechanisms is the Electricity Vision 30:30:30, which aims to increase Nigeria’s electricity generation capacity to 30GW in year 2030, with 30% of this coming from Renewable Energy sources. With this vision, several actions have been taken to deploy 12GW additional large hydro, 3.5GW small hydro, 6.5GW Solar PV and 3.2GW Wind Generating Plants on the grid-side, as well as a robust plan to reduce transmission and distribution losses to 8% by 2030. On the off-grid side, plans are underway to deploy 13GW Off-grid resources (i.e., Mini-grids 5.3GW and Solar Home Systems and Street Light 2.7GW and Self Generation 5GW to 13GW) to light up Nigeria. (FMP, 2022).

FMP (2022) further notes that the “FGN has reiterated its commitments to the net-zero carbon emissions by 2060, and efforts are being made to create a handshake with the climate change actions of 2030.”

It is important to stress that higher levels of electricity consumption require a considerable level of infrastructure development in the power sector and high-performing electricity market operations. Furthermore, beyond generation capacity, alongside the energy mix, there must be evidence of adequate transmission capacity and, on the electricity retail side, distribution companies that are able to sell electricity and receive commensurate revenues from their operations. Having such a structure in the electricity market ensures the growth and viability of the market by creating a self-sustaining feedback loop system that is able to attract investment to continually achieve the objectives of the market, including decarbonisation.

It is, thus, important to emphasise that what this means is that decarbonising the power sector in Nigeria goes beyond merely switching from fossil fuel-based generation plants to wind and solar sources of power generation. In fact, in order to move from theories of projections and target setting, building a functional electricity market that is able to attract investment across the value chain of the power sector should be the foundation for energy transition in the power sector. Without infrastructure, Nigeria’s low emissions profile in the power sector will remain the result of energy poverty, which is a hindrance to inclusive growth and sustainable development. As seen in Figure 3, population growth has maintained a strong, steady upward trend. Consequently, electricity access in Nigeria has continued to falter.

Figure 3: Population growth vs population with access to electricity in Nigeria, 2007-2020



Source: World Bank (2022), World Development Indicators

Nigeria's priorities in decarbonising the power sector for now should be attaining energy efficiency and investing in energy security.

Nigeria's low electricity consumption per capita, considering her population size and economy, reflects the inadequate level of investment spending in the power sector and realisation of projects. In turn, this reflects a wider set of economic constraints in Nigeria (with elements of institutional quality)—as discussed in Chapter Three.

Thus, considering the grid instability issues and the infrastructure deficit in the power sector, population growth and the increasing numbers of segments of the population without access to electricity, as well as the low level of investment in the power sector, Nigeria's priorities in decarbonising the power sector for now should be attaining energy efficiency and investing in energy security. Improving energy efficiency will include reducing the GHG emissions under Fugitive Emissions from the oil and gas sector, increasing efficiency at the power generation, transmission, distribution segments of the market, through the use of best available technologies and, at the end-user level, through standards that limit import of inefficient appliances and facilitate purchase of efficient appliances and equipment by households and businesses. According to Ikeonu (2022),

Furthermore, improving energy efficiency through the introduction of demand side management programmes will be fundamental in encouraging commercial and industrial customers as well as public sector infrastructure service providers to optimize efficient energy use. This will not only save cost and reduce GHG emissions but will also maximise the use of limited electricity supply in the country.

Attention must also be paid to creating a feedback loop that continuously attracts investment into Nigeria's power sector. This will be pivotal to realising the infrastructure needed for a more sophisticated electricity market, as envisioned in the Market Rules for Nigerian Electricity Supply Industry (NESI) (2014). Such a market will be needed for a carbon-neutral future in Nigeria.

As shown in Table 3, Fugitive Emissions from the oil and gas sector as a contributor to Nigeria's emissions profile is rather significant. Fugitive Emissions for the oil and gas industry include GHG emissions outside fuel combustion and could also result from gas transportation through pipelines to the point of fuel use (IPCC, 2006). Other examples include gas flaring, which, luckily, has been declining steadily in Nigeria in recent years but can be further improved.

Thus, in line with Article 2 (2) of the Paris Agreement, the What, Where and How of decarbonising Nigeria's power sector and energy industries is to reduce GHG emissions from the power sector through efficiency, starting with activities even outside the traditional power sector value chain (e.g. gas pipeline transportation), as well as to create a market that attracts investment.

2.2.2. DECARBONISING THE TRANSPORT SECTOR

Globally, the majority of vehicles in the world run on internal combustion engines (ICE) and rely predominantly on fossil fuels. This situation may start changing in the near future. McKinsey predicts that owning an Electric Vehicle (EV) will eventually become cheaper than owning an ICE vehicle by 2025 in most regions⁹, i.e. based on "purchase price, maintenance, fuel cost, and resale value" (McKinsey, 2022, p.24). Even if this were to be the case in major economies, considering Nigeria's unique circumstances, EVs should not be relied on as the best strategy for the country to contribute to reducing global GHG emissions in the short term, in line with Article 2 (2) of the Paris Agreement. The transport sector in Nigeria is wholly a fossil fuel-based sector, with no trams or metro stations powered by electricity, as is the case in more advanced economies. With the cur-

⁹ Nigeria's contribution to total global vehicle stock is rather insignificant, even with her population. Considering the state of Nigeria's manufacturing sector and capacity, it is important to think critically about the phase-out of ICE vehicles and the takeover of EVs as a result of wealthier countries (who are also the major manufacturers of vehicles) being able to cut down the costs of EV, making them more affordable than ICE. Concerning this likelihood of ICE phase-out, a comment from Dr. Ahmed, a Director at the Energy Commission of Nigeria (ECN), was that "if care is not taken, Nigerians will use diesel generators to charge their electric vehicles." Maybe an exaggeration. Nevertheless, it is important to acknowledge that the social cost of the energy transition will differ between economies and some economies, especially those heavily dependent on others, will be more vulnerable. Thus, even with lower economic development, developing countries do not have the luxury of "doing things at their own pace." Moreover, reducing the vulnerability of countries like Nigeria to adverse shocks from the energy transition, as a result of positions taken by wealthier economies, should be seen as a matter of national security.

rent priority of bringing electricity to homes, options for decarbonising the transport sector might seem limited, but this is not quite the case.

Using the case study of Lagos, Nigeria's largest state by population and economy, Maduekwe et al. (2020) present options for Nigeria's road transport sector to meet emissions reduction targets. By modelling road transport energy consumption to 2032, the authors find that the biggest contributors to emissions in Nigeria's road transport sector are the very old vehicles that still dominate the sector. According to them, if Nigeria is to meet her emissions targets in the road transport sector, there will need to emerge a mix of policy actions such as reducing the number of old vehicles on the road and ensuring that the age limit of vehicles reduces from 40 years to 22 years (with such vehicles being the minority), creating incentives for people to choose public transport over owning personal vehicles and, thus, reducing the growth rate of personal vehicle ownership, and reducing mileage or distance travelled through smarter urban planning and development. In the case of Lagos, Maduekwe et al. (2020) note that Nigeria's most populous state will be able to reduce vehicular emissions by 50% by 2032, with 2011 as the baseline. The Avoid, Shift and Improve policy measures are outlined in the country's Nationally Determined Contribution (2021).

Biggest contributors to emissions in Nigeria's road transport sector are the very old vehicles that still dominate the sector.



Box 2: 2030+ NDC targets for Nigeria's transport sector

Identified mitigation measures for Nigeria's transport sector

- ▷ 100, 000 extra buses by 2030
- ▷ Bus Rapid Transport (BR) will account for 22.1% of passenger-km by 2035
- ▷ 25% of trucks and buses using CNG by 2030
- ▷ All vehicles meet EURO 3 emission limits by 2023 and EURO 4 by 2030

Source: NDC (2021).

Such sustainable transport measures do not reflect only Nigeria's national circumstances but also her capacity, as articulated in Article 2 (2) of the Paris Agreement.

Furthermore, Agbonghae (2022) notes that "the transport sector can be decarbonized to some extent if Nigeria implements the National Biofuel Program and sets mandates for biofuels blending with Premium Motor Spirit (PMS) and Diesel. The good thing about the biofuel program is that it links the agricultural sector (the highest GDP contributor) to the oil and gas sector (the highest FOREX earner), and it has enormous potential for job creation and economic diversification."

Thus, with regard to the transport sector, Nigeria's most substantial contribution to global GHG emissions reduction will be to reduce CO₂ emissions, i.e. the What, Where and How, in the road transport sector through Avoid, Shift and Improve sustainable transport policy measures that lead to a significant reduction of very old vehicles on the road, increase of public transport options and usage, use of cleaner fuels including biofuels, addressing urban sprawling and reducing distance travelled. Generally, it is important to stress that the prevalence of old vehicles on Nigerian roads is directly linked to low-income levels and issues of affordability. In addition to the

Innovative payment solutions will also play a role in supporting private car owners to choose the cleanest vehicles possible

benefits of Nigerians becoming wealthier and being able to afford more energy-efficient vehicles, innovative payment solutions will also play a role in supporting private car owners to choose the cleanest vehicles possible.

2.2.3. DECARBONISING INDUSTRIES

CO₂ emissions from energy used by manufacturing industries and construction account for 11% of total CO₂ emissions from the energy sector. In addition, non-energy emissions from Industrial Processes and Product Use (IPPU) occupy a minor position in total national CO₂ emissions, representing just 3% as shown in Figure 2 above. If Nigeria is to attain the envisaged development ambitions, industrialisation (manufacturing and construction) would certainly see significant growth. Thus, it is imperative that the technologies and processes used are aligned with attaining a net-zero ambition starting now.

The main sources of CO₂ emissions in the IPPU sectors are Cement, Iron and Steel Production as well as Ammonia Production, which account for 45%, 55% and 0% respectively of CO₂ emission

from IPPU in Nigeria (BUR, 2021). While these sectors are energy-intensive and would need to rely on fossil fuels (natural gas) for many operations, today the use of energy-efficient technologies as well as cleaner production practices (including recycling/resource efficiency) can substantially reduce emissions from this sector. The Cement and Iron and Steel industries, as well as other industries set to grow to meet Nigeria's industrialisation goals, will benefit from

Technologies like hydrogen (green and blue) have a role to play in meeting the cleaner energy needs for Nigeria's industrialisation.

the uptake of carbon capture utilisation and storage (CCUS). Considering that these tend to be large energy-consuming units and have opportunities to scale in size (especially as local manufacturing capacity expands), technologies like hydrogen (green and blue) have a role to play in meeting the cleaner energy needs for Nigeria's industrialisation. However, since these technologies become more cost-effective with large-scale units, realisation of Nigeria's industrialisation plan must be considered a priority and implemented alongside a green industry future where CCUS and hydrogen feature strongly.

2.3. BRINGING IT ALL TOGETHER

With her 206 million people, Nigeria is responsible for just 0.36% of global GHG emissions, owing to low GDP/capita, low electricity consumption per capita and low ranking on the Human Development Index (HDI). If the momentum for economic growth were to rise to the desired levels, without consideration for the environment, the country's GHG footprint would be significant. Hence, the need for Nigeria to begin setting up structures today that will guarantee a sustainable future in the long term.

Thus, in line with this, Nigeria has taken positions to tighten emissions from the country's economy, the most recent being the Climate Change Act and the Energy Transition Plan (ETP). Among other things, Nigeria will aim to try out instruments such as a carbon budget and mechanisms for a carbon tax.

In accordance with Article 2 (2) of the Paris Agreement, specifically relating to the need for climate actions to reflect national circumstances and capacities, the chapter has analysed where Nigeria can make the most substantial contribution to the global GHG emissions reduction in the short term. The most substantial contribution Nigeria can make to global GHG emissions reduction is in the Agriculture and Forestry sectors of her economy, based on the country's current emissions profile. Thus, sustainable agricultural practices and modernisation of the sector, as well as combating deforestation through a wide-scale afforestation and reforestation programme, hold the most potential for Nigeria's contribution under the Paris Agreement.

The chapter also identified the transport sector as the next most critical sector for immediate actions to curtail emissions. In Nigeria, the sector is entirely dependent on fossil fuels. However, based on published research, reducing the age of vehicles on Nigeria's roads could substantially increase energy efficiency and reduce energy consumption by the transport sector. After this, other Avoid, Shift and Improve actions could deepen the results.

Furthermore, the power sector, being cross-cutting, would need to be on a path to decarbonisation starting from now, starting with energy security. Moreover, priority actions based on Nigeria's circumstances and capacities include improving efficiency in equipment, operations and demand-side management. Agbonghae (2022) suggests that "investing in utility-scale solar projects and decentralizing our grid¹⁰ will go a long way in ensuring low-carbon power generation and transmission/distribution effectiveness as we ramp up our electricity generation capacity."

Finally, decarbonising Nigeria's power sector hinges heavily on the capacity of the country to attract investment to her economy and, of course, the power sector, as this will be critical for the infrastructure development needed for a sophisticated electricity market that is able to produce a carbon-neutral economy.

It will also be necessary to create an economywide feedback loop that assures private investors that Nigeria's electricity market is investable. We will see why and how trade is the missing piece.

¹⁰ This refers to the current Bill to allow states to generate, transmit and distribute electricity in areas covered by the national grid. Currently the function of planning and dispatching electricity from power generators and feeding electricity into the national grid is centralised and done by a single system operator, i.e. the Transmission Company of Nigeria (TCN), who is also the Transmission Service Provider (TSP). The Bill will allow states to have their own electricity markets.



It will also be necessary to create an economywide feedback loop that assures private investors that Nigeria's electricity market is investable.

CHAPTER THREE TRADE

Adverse supply shocks and lack of energy supply reduce the capacity of an economy to produce.



3. INTRODUCING THE ECONOMICS OF ATTRACTING INVESTMENT

Individual economies have varying quantities of resources that determine their capacity to produce at any given time. Capital, labour, energy and other deployed resources will determine the difference between one economy's output and another's. The capacity of economies to mobilise and employ these resources effectively could be affected by a number of factors, including supply shocks. Adverse supply shocks and lack of energy supply reduce the capacity of an economy to produce. In turn, by limiting economic output, this leads to inflation.

Inflation has the capacity to erode the value of money and introduce uncertainties, causing investors to lack confidence in an economy. To address inflation, the monetary policy response is to increase interest rate. On their part, higher interest rates reflect the scarcity of the goods and services in high demand, with the objective being to reduce demand. By reducing demand, consumption reduces and so does output. Thus, inflation provides a feedback loop informing businesses to restrict investment in that economy. Through these actions, there is a fall in the total level of spending in an economy to produce goods and services demanded by households, businesses, governments and for export (i.e. aggregate demand), owing to the indirect relationship between aggregate demand and inflation.

It is for this reason that keeping inflation low is a priority for countries, as this plays a key role in encouraging spending and investment.

Inflation in Nigeria has been within the double-digit bracket even before the Russia-Ukraine crises that has led to inflationary pressures across the globe. Prior to the recession, inflation in Q1 of 2020 averaged at 12.20% (CBN, 2022). However, as the recession kicked in and real output began to decline, inflation went up, averaged at 13.55% from Q2 to Q4 of 2020. During the recovery, in 2021, inflation remained strong at an average of 16.98% (CBN, 2022). As at June 2022, inflation in Nigeria was at 18.6%, topping that of peer countries (see Table 5).

Table 5: Inflation rates in top African economies, 2022 (retrieved on 29 July 2022)

Top African economies	Inflation
Nigeria	18.6%
Algeria	7.22% ¹¹
Egypt	13.155%
Morocco	7.2%
South Africa	7.4%

Source: World Bank (2022), *World Development Indicators* – for Algeria; Central Bank of Egypt (CBE); Bank Al-Maghrib (Morocco); Central Bank of Nigeria (CBN); South Africa Reserve Bank

11 Data for Algeria is for 2020.

The main determining factor is not the interest rate but investors' confidence in the future prospects of the economy.

The effect of Nigeria's high inflation rate can be observed in the interest rate charged by commercial banks. The average prime rates for lending

to power and energy companies is 15.58% and that for the maximum rate, which reflects the credit spread in the country, is 23.9%. For prime rates, the range is 5% to 25% and for the maximum the range is 11% to 30% (CBN, 2022).¹²

The high interest rate in Nigeria is a deterrent to investment, as explained above. However, some schools of economics argue that, although an important factor, the main determining factor is not the interest rate but investors' confidence in the future prospects of the economy, that is, if investments are made towards increasing productive capacity today, there is likely to be payoff in the future and the rate of return will likely exceed the high interest rate. Thus, in situations where the present state of the economy does not provide comfort to investors, government spending, especially with regard to capital projects and other expansionary policy positions, would be needed to increase the economy's aggregate demand and, thus, stimulate businesses to invest in the economy. Herein lies the importance of increased climate finance inflows towards investments in Nigeria and for complementing public funds.

Herein lies the importance of increased climate finance inflows towards investments in Nigeria and for complementing public funds.

The Nigerian government has implemented several initiatives to increase aggregate demand in the economy by leading investment in capital projects. Box 4 provides a few examples of such capital investments.



Box 4: Examples of government capital investment initiatives in Nigeria

- ▶ **The N300 billion Power and Aviation Intervention Fund (PAIF):** The CBN provided a N300 billion facility for investment in debentures to be issued by the Bank of Industry, (BOI) in accordance with Section 31 of the CBN Act 2007, for investment in power and aviation projects. The funds are to be channelled through the BOI for on-lending to the Deposit Money Banks at a maximum interest rate of 1.0% for disbursement at a concessionary interest rate of not more than 7.0% and a tenor of 10 to 15 years. The African Finance Corporation (AFC) will serve as technical adviser to the fund.
- ▶ **The Presidential Infrastructure Development Fund (PIDF)** is an initiative of President Muhammadu Buhari managed by the Nigeria Sovereign Investment Authority (NSIA). PIDF was conceived in 2018 as the President's initiative to accelerate the execution of certain critical, strategic infrastructure projects essential to the rapid growth and modernisation of Nigeria's economy. There are three projects under PIDF, namely (i) Lagos-Ibadan Expressway (LIE), (ii) Second Niger Bridge Project (2NB) and (iii) Abuja-Kano Road (AKR).

However, we cannot undermine the present reality - owing to economic conditions in the country, the current high debt-to-revenue ratio in Nigeria, as well as its effect on the government's capacity to invest - that spending from government is not, by itself, significant enough to create this sort of reaction from private investors.

¹² CBN (2022). Deposit and Lending Rates in the Banking Industry for the week ended April 22, 2022. Available at: <https://www.cbn.gov.ng/Documents/depositandlending.asp>

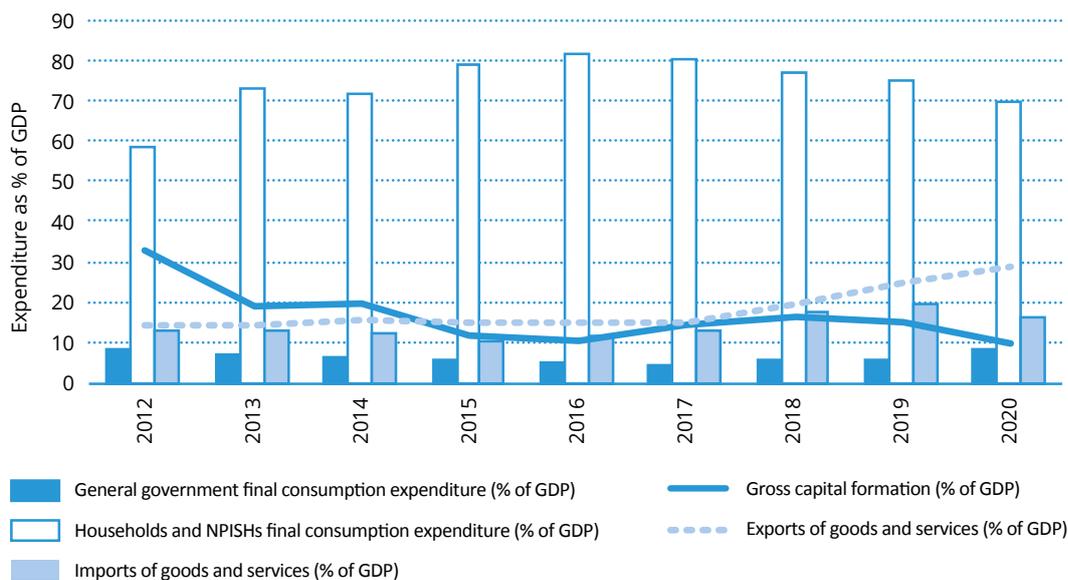
An economy's aggregate demand is the summation of the level of government spending, autonomous consumption and autonomous investment as well as net exports. The ultimate goal is to balance each of these factors in such a way that aggregate demand increases.

Figure 4 shows Nigeria's GDP by expenditure. For the years covering 2012 to 2020, government spending in Nigeria grew marginally at a Compound Annual Growth Rate (CAGR)¹³ of 1% for the eight years covered. The largest expenditure to Nigeria's GDP is Gross Capital Formation at a CAGR of 9% p.a. However, this growth is recent, picking up in 2018. From 2012 to 2017, Gross Capital Formation grew at a CAGR of 1%. The next largest contributors are Import and Household consumption, which grew at 3% and 2% per year over the eight-year period of 2012 to 2020. For exports, this was -15% from 2012 to 2020. Thus, the last input of the equation, i.e. net exports, made a negative contribution to Nigeria's aggregate demand.

Increasing productivity and net exports/trade is considered in this White Paper as a critical component of growing Nigeria's economy to a stage where the country becomes increasingly attractive to investors

Increasing productivity and net exports/trade is considered in this White Paper as a critical component of growing Nigeria's economy to a stage where the country becomes increasingly attractive to investors and gets into a stronger position to mobilise the necessary capital for infrastructure development to support a carbon-neutral economy.

Figure 4: GDP by expenditure¹⁴ in Nigeria, 2012 to 2020



Source: World Bank (2022), World Development Indicators

13 The Compound Annual Growth Rate (CAGR) calculates the mean value for each year over the duration covered, in this case 2012 to 2020. This helps to level out the volatility from the different periods to give information on performance of the indicator of interest over the duration inspected.

14 Culled from World Bank Glossary: "General Government Final Consumption Expenditure reports include all government current expenditures for purchases of goods and services (including compensation of employees), national defence and security; Households and NPISHs expenditure is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. Exports of Goods & Services value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. Gross capital formation consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, etc."

3.1. WHY PRODUCTIVITY MATTERS

According to Adenikinju (2022), "Inflation primarily impacts imports and exports by affecting the exchange rate. High inflation results in higher interest rates, which results in weaker currencies and makes imports relatively cheaper than domestic output."

High inflation results in higher interest rates, which results in weaker currencies and makes imports relatively cheaper than domestic output.

To expand on the statement made by Adenikinju (2022), the Nigerian situation may be explained thus: (1) As a result of high inflation in Nigeria, compared to the situation in countries with whom the country trades, these countries may

demand less of Nigerian goods; (2) as a result of Nigeria's economy growing, Nigerians spend more on importing from other countries compared to what the trading partner countries demand for Nigerian goods¹⁵. Thus, scenarios 1 and 2 will lead to a depreciation of the naira. In theory, the more naira Nigeria's trading partners can get for a unit of their own currency the more they would want to buy from Nigeria, if Nigerian goods were in demand. However, if there is a production capacity constraint, points 1 and 2 will be maintained.

Thus, in Nigeria we see that exports are affected by inflation as it becomes cheaper to import goods and services than to produce them in the country. During the pandemic-triggered recession, from Q2 of 2020 to 2021, the naira weakened to the dollar, pound sterling, euro, yuan and other major currencies (CBN, 2022). This should have had an effect of increasing exports from Nigeria, which should increase aggregate supply (AS). Imports of goods and services (as a % of GDP) fell from 19.8% to 16.57% (i.e. a percentage change of -16.3%) from 2019 to 2020. However, exports as a percentage of GDP fell more, from 14.22% to 8.83% (a percentage change of -37.9%) for 2019 and 2022 respectively (World Bank, 2022).

Double-digit inflation levels, excessive interest rates, high unemployment and a depreciated naira alongside a negative trade balance all point to issues of production capacity constraints affecting aggregate supply (AS)¹⁶ in Nigeria's macroeconomy. Furthermore, at a very low level of production capacity, it will not require having a large volume of money in circulation for Nigeria's economy to reach full capacity and enter crisis levels.

At a very low level of production capacity, it will not require having a large volume of money in circulation for Nigeria's economy to reach full capacity and enter crisis levels.

Energy being an input for productivity, the country's energy crisis is one source of adverse supply shocks in Nigeria's macroeconomy. Nigeria is

currently far from her true production capacity, and the existence of persistent adverse supply shocks in Nigeria's economy means that demand for goods and services for its 206 million people results in AS quickly approaching full capacity, further driving inflation up and keeping unemployment high. Moreover, this is evident in the fact that there is still a very high demand for imports despite the naira's weakness.

At this level, the economy is at an equilibrium point where the poverty level is high. According to the World Bank, 92% of the Nigerian population lived on less than \$5.50 a day as at 2011 PPP international dollars as of 2020 (World Bank, 2022). In order to move from this current point of low productivity to optimal productivity levels, i.e. Nigeria's ideal national output, it is imperative to design policies to drive and mobilise investments. As discussed above, productivity and increased trade volumes will be essential for creating the sort of economy that attracts investments.

¹⁵ This relationship is explained by Goodwin et al., (2019), pages 507 – 510.

¹⁶ Aggregate Supply explains the impact of inflation on amount of goods and services a country's producing section is willing to supply to the market and the effects of capacity constraints.

3.2. THE PLACE OF TRADE IN INCREASING INVESTMENT FOR NIGERIA'S SUSTAINABLE FUTURE

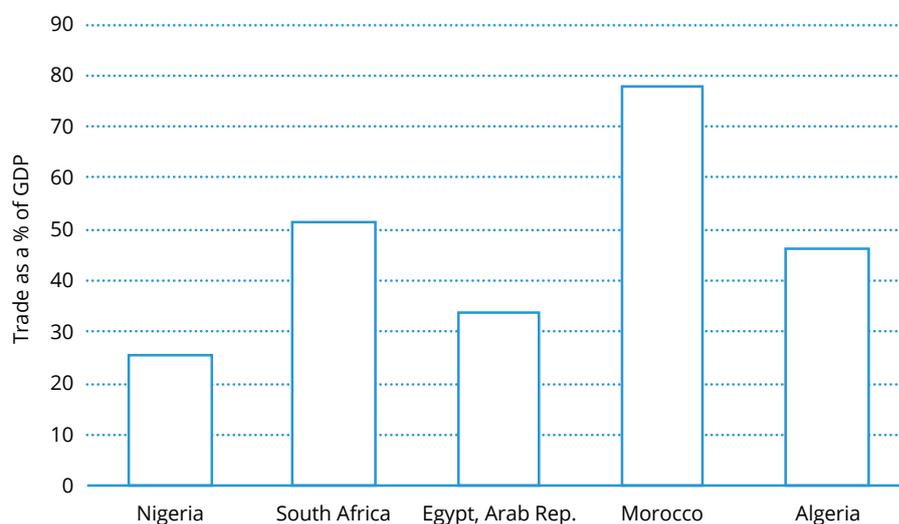
As we have also shown, adverse supply shocks—a clear example of which is the low level of energy supply and consumption in Nigeria, among other issues faced by Nigerian firms—reduces the capacity of producers in the country to supply goods and services as well as invest towards increasing production capacity in the country. According to Ikeonu (2022), reliance on alternative power generation by the commercial and industrial (C&I) sector substantially increases cost of production and renders goods manufactured in Nigeria uncompetitive. Research by the Nigerian Electricity Regulatory Commission (NERC) found that industries were spending as much as 40% of their cost on running and maintaining diesel generators (Ikeonu, 2022).

Reliance on alternative power generation by the commercial and industrial (C&I) sector substantially increases cost of production and renders goods manufactured in Nigeria uncompetitive.

The issue with Nigeria's negative net exports on average is that it is large and has persisted for years. As discussed above, exports from Nigeria have been contracting at a CAGR of -15% from 2012 to 2020, negatively impacting on the GDP of the country, employment levels and investment.

Generally, when compared to the largest economies in Africa, trade's contribution to Nigeria's GDP is the lowest at 25% (see Figure 5).

Figure 5: *The contribution of international trade to GDP of top economies in Africa*



Source: World Bank (2022), World Development Indicators

Further to that, in terms of the impact of trade on development, owing to concentration on exporting raw commodities, exports are not optimised for economic development in the country. Nigeria's export structure is driven by export of her petroleum resources (raw commodities). In 2020, this accounted for 90% of all exports. Food items and manufactured goods stood at both 4% each and others at 2% (UNCTAD, 2022).

It is well known that natural resource wealth must be managed such that the extractive industry has linkages with other sectors of the economy, e.g. forward production linkages (increasing lo-

Owing to concentration on exporting raw commodities, exports are not optimised for economic development in the country.

her exports and increase her manufacturing capacity. Nevertheless, the urgency of transitioning to a carbon-neutral economy provides a strong impetus for a broad-based development path and for building back better, especially following the aftermath of the COVID-19 and severe economic shocks brought about by the Russia-Ukraine war on the Nigerian economy, leading to widening poverty, income inequality and unsustainable dependence on the environment for fuel.

Goodwin et al., (2019, p.461) note that while the usual response to rising inflation is to hike interest rates, a more effective response from government would be to tackle unemployment through expansionary monetary policies that drive down interest rates.

For Nigeria, this would require expansionary policies that target increasing spending as follows:

- Firstly, there would have to be more investment in energy and power infrastructure to increase the supply capacity of goods and services in Nigeria. This would be followed by investment in manufacturing and agricultural (e.g. production of fertilizer) industries that have forward and backward linkages with Nigeria's extractive industries (mining and steel, petroleum). As discussed above, adverse supply shocks have an inflationary effect on the economy and contractionary effects on exports from a country.
- Secondly, tied to the first point, there is need for a targeted effort to turn around Nigeria's long trend of negative net export to positive by diversifying the country's export structure. As discussed above, this would have a positive effect on the employment rate in Nigeria,

A diversification of the export structure would require Nigeria's trade partners to have interest beyond her raw commodities.

cal industrial capacity) and spatial linkages (investing in infrastructure – electricity grids, construction, etc.), among others. It can be argued that Nigeria has had many decades to diversify

followed by a multiplier effect on consumption as well as investment. Such a diversification of the export structure would require Nigeria's trade partners to have interest beyond her raw commodities. If such an investment strategy is implemented in pari-passu with investment in power and energy infrastructure, the results will be optimised. It is important to stress that

without adequate investment in power infrastructure, production in Nigeria will remain globally uncompetitive and, given the current poverty levels, cheap imports will remain attractive to the populace (Ikeonu, 2022).

- "Expenditures to boost productivity like expanding energy infrastructure should not necessarily come from the government, which is already saddled with high public debt" (Adenikinju, 2022), hence the need for increased participation of the private sector. It is important to note that while the investment strategy may be front-loaded with public finance, private finance would need to bring in a larger share of the investment needed. Public finance would include spending from the Nigerian government as well as other sources, including transnational climate finance. As shown above, government spending in Nigeria has maintained a meagre average growth rate of 1% per year. There is, therefore, need to deepen public-private-partnerships (PPP) in Nigeria in a way that gives comfort and builds investors' confidence in the future prospects of Nigeria's economy.

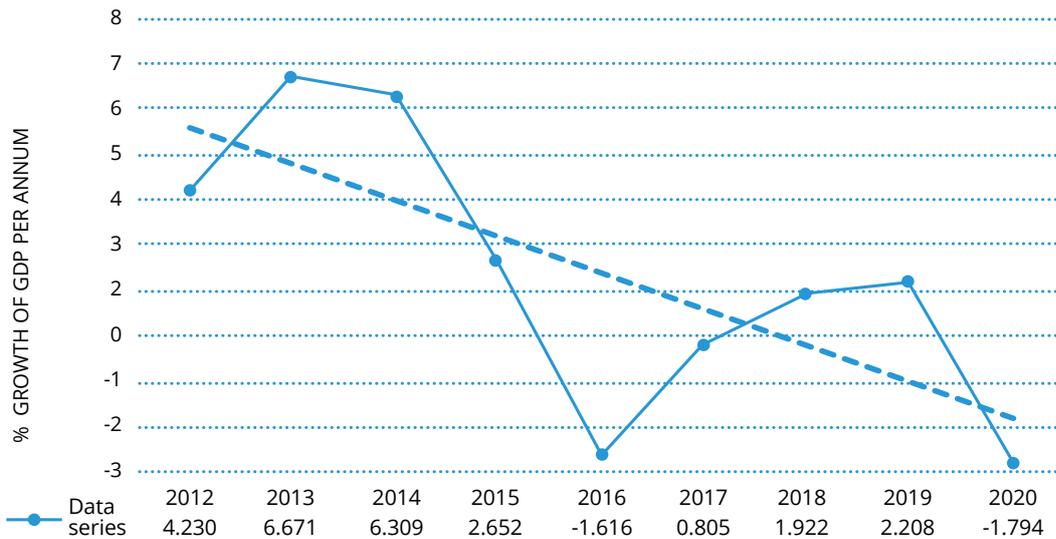
The phenomena of aggregate demand and aggregate supply, alongside the impact of inflation, are components of macroeconomic theory that enable economies to manage the relevant indicators as best as possible with a view to increasing investment and growing the economies. Because of the importance of government spending and, hence, government's ability to generate revenue to increase spending, steady inflows of receipts from natural resources cannot be weakened for countries that rely on such for income, without commensurate increases in other sources of income generation, if the broad outcome of carbon neutrality is to be achieved.

The purpose of this chapter is to explain why the pathway and timeline to attaining carbon neutrality can hardly be the same for each economy. By comparing the top five economies in Afri-

ca, the Paper has shown that even among “peers”, socioeconomic indicators such as GDP per capita (PPP), electricity consumption per capita, population growth, export structure and trade create different realities for each of these countries, especially with regard to their capacity to attract investment. For Nigeria, total spending in the economy (aggregate demand) did not reach full potential over the 8-year period covered (2012- 2020), as net exports contracted at a CAGR of -15% per year. Moreover, declining total spending means declining consumption and investment in an economy, whose effect is shown in Figure 6. In the next decade, it is imperative that the trend line follows a strong upward trend, as against what occurred from 2012 to 2020.

In the next decade, it is imperative that the trend line follows a strong upward trend.

Figure 6: **GDP growth (annual %) in Nigeria, 2012 to 2020**



Source: World Bank (2022), World Development Indicators

Thus, in line with Article 2 (2) of the Paris Agreement, specifically on the matter of equity, for Nigeria to be on the path to carbon neutrality in the long term, she would need to:

- Increase her capacity to supply goods and services to her population by increasing energy supply and consumption through her renewable and non-renewable energy resources as well as energy efficiency.
- Increase employment opportunities by increasing manufacturing, trade and export activities.
- Increase capital for government spending through prudent and sustainable use of her natural resources and other forms of domestic resource mobilisation (but being conscious of the contractionary effect that certain instruments could have and, thus, defeat the purpose of increasing consumption and investment).

Increase capital for government spending through prudent and sustainable use of her natural resources and other forms of domestic resource mobilisation

These are short- to medium-term carbon neutrality actions that will be implemented at the same time as the immediate actions for GHG emissions reduction covered in chapters one and two. In the long term, Nigeria’s dependence on her oil and gas resources (receipts and consumption) should be markedly reduced in line with carbon neutrality conditions.

Nonetheless, in the short and medium term, priority must be given to balancing natural capital depreciation. For instance, the use of fossil fuels should be offset by increasing the country's natural carbon stock as well as increasing carbon sequestration through technology where feasible.

Thus, it is important that the international community take a critical look at the extent to which the taxonomy of sustainable financing is actually inclusive and embodies the principles of Article 2(2) of the Paris Agreement.



Box 5: Opportunities for increasing productivity through exports in Nigeria

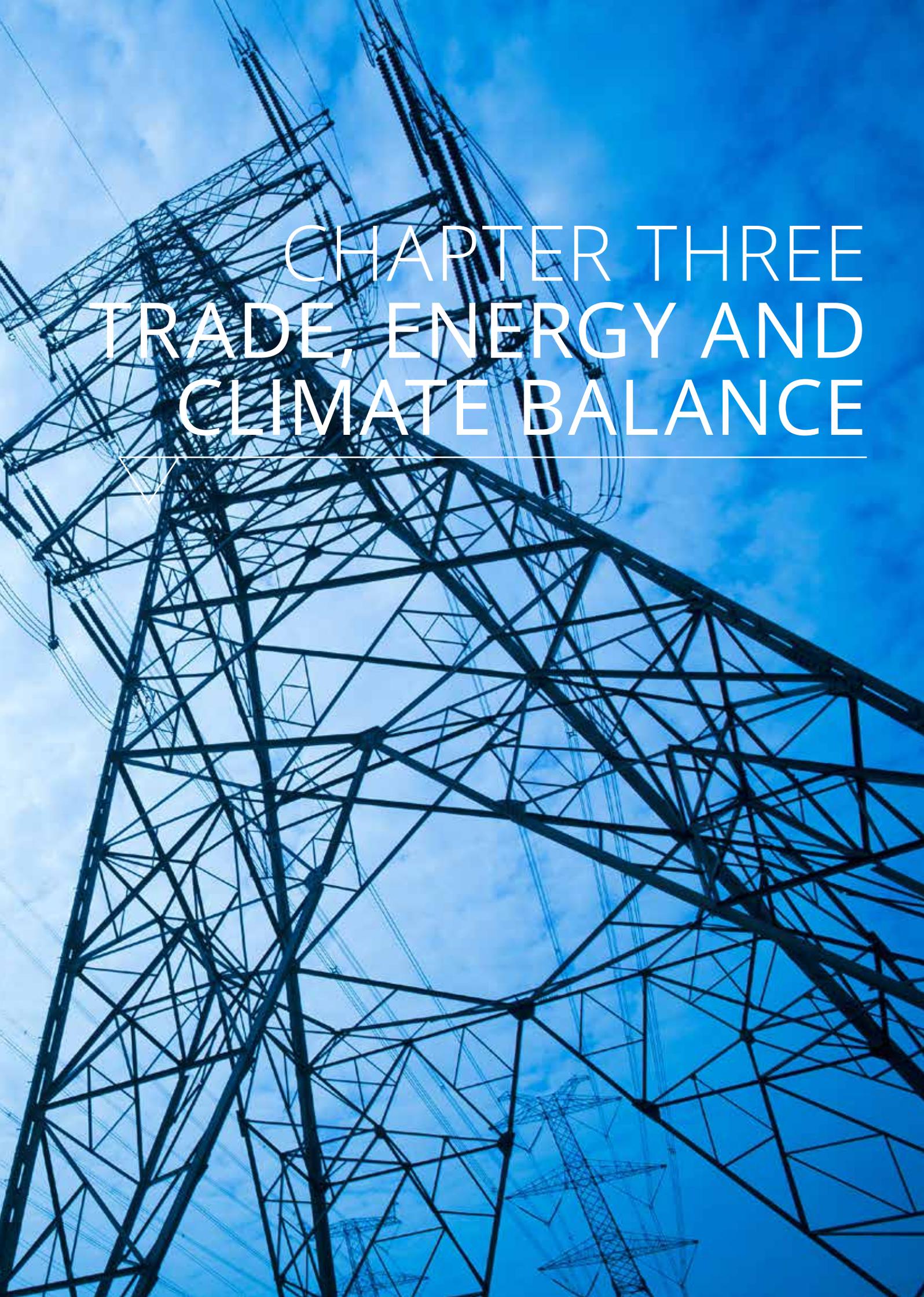
African Continental Free Trade Area (AfCFTA)

African Continental Free Trade Area (AfCFTA) is a flagship project of Agenda 2063 of the African Union — Africa's own development vision. The AfCFTA aims at accelerating intra-African trade and boosting Africa's trading position in the global market by strengthening Africa's common voice and policy space in global trade negotiations.

One of the objectives of the AfCFTA is to promote industrial development through diversification and regional value chain development, agricultural development and food security.

Source: AU: About the African Continental Free Trade Area (AfCFTA).





CHAPTER THREE TRADE, ENERGY AND CLIMATE BALANCE

4. INTRODUCING THE TRADE, ENERGY AND CLIMATE CHANGE (TEC) NEXUS

Trade, energy and climate change are linked, given that energy is necessary for increasing industrial activities and affordable energy supplies could contribute to improving the global competitiveness of an economy's industries. Affordable energy sources have largely been conventional energy sources including fossil fuels, specifically in the absence of carbon tax. Thus, increased levels of energy consumption and trade tend to increase emissions as well and, thus, contribute to climate change.

Reviewing Nigeria's long-term plans for energy, it is clear that the country has high ambitions for this sector. Energy infrastructure development is central to Nigeria's long-term development plans. The 2020-2043 National Integrated Infrastructure Master Plan (NIIMP) aims to prioritise investment in energy and transport as a strategy for meeting the goals and objectives of the country's infrastructure aspirations. The Plan envisages that investment in energy will grow at 50% per annum over the next 23 years (NIIMP, 2020, p.81). Power generation is expected to grow from 3.5 GW in 2019 to 350 GW in 2043, corresponding to an increase in access to electricity from 40% in 2019 to 100% in 2043. Nigeria would need a total investment of US\$ 759 billion in the energy sector by 2043 and US\$ 49.5 billion in the Plan's first five years to meet this objective¹⁷.

Affordable energy supplies could contribute to improving the global competitiveness of an economy's industries.

Gas to power is recognised in the NIIMP as a pivotal element in achieving the universal energy access ambitions of the country as well as being a national priority for investment. In the first five years of the NIIMP, out of the US\$ 49.5 billion earmarked for the energy sector in general, Nigeria plans to spend US\$ 37 billion in the petroleum sector alone (NIIMP, 2020, p.82). This investment will go into developing the infrastructure needed to achieve the universal energy access goals of the country, i.e. increasing oil and gas production as well as boosting refining capacity.

As discussed in Chapter Three, increasing investment in the energy sector and energy consumption will have a positive effect on the country's economy as well as in expanding Nigeria's industrial activities, including manufacturing (aggregate demand and supply). Considering Nigeria's natural resource wealth, as well as its young and vibrant population, among others, this potential, if harnessed, could transform Nigeria from a predominant exporter of raw commodities to a key participant in the global supply chain (GSC), exporting higher-value products. As discussed above, a stronger macroeconomic environment will strengthen Nigeria's capacity to finance a carbon-neutral future.

This potential, if harnessed, could transform Nigeria from a predominant exporter of raw commodities to a key participant in the global supply chain (GSC)

17 Page xv of the NIIMP.

However, it is important to note that a growing activity rate in trade, specifically international trade, has been considered by environmental groups to have a negative impact on the environment. The argument is hinged on the fact that international trade leads to enhanced levels of industrial activity, leading to higher levels of energy and material consumption in economies that initially had low industrialisation rates. Grossman and Krueger (1991) contradicted the argument using the Environmental Kuznets Curve theory in their paper entitled 'Environmental Impacts of a North American Free Trade Agreement', which was prepared for the conference on the US-Mexico Free Trade Agreement and published in the *National Bureau of Economic Research Working Paper Series* in 1991.

The paper specifically aimed to provide responses to opposition from environmental groups on the United States' Trade Agreement with Mexico on the grounds that increasing economic activities through international trade would have a damaging impact on Mexico's natural environment. In summary, Grossman and Krueger's (1991) econometrics model, based on an observation of 42 countries, demonstrates that environmental pollutants decline at higher income per capita levels.

Goodwin et al., (2021), however, show that the EKC may be true for some GHG emissions but not all, specifically CO₂. This statement may be strengthened by the fact that the United States, although now having negative growth in CO₂ emissions (BP, 202, p.15), has the largest CO₂ emissions per capita (12.98 tCO₂/capita), even higher than China (7.07 tCO₂/capita), the largest contributor to CO₂ emissions globally (see Table 4 in Chapter Two).

China's GDP per capita may be significantly less than that of the United States, hence the lower CO₂ emissions per capita, at least at face value. However, China has been able to lift millions of its population out of poverty, achieve universal electricity access and improved living conditions in general at that GDP per capita. Thus, the goal for African countries and Nigeria is not to achieve the same economic status as the wealthiest countries in the world but to achieve a level of economic growth that is good enough. This would require depending on fossil fuel only to the extent needed, increasing energy efficiency to the extent feasible and adopting cleaner technologies, such as

Goal for African countries and Nigeria is not to achieve the same economic status as the wealthiest countries in the world but to achieve a level of economic growth that is good enough

electric vehicles, at a rate possible. It is also expected what becomes feasible will progress as other factors, such as economic growth. These measures are behind the assumptions of the EKC hypothesis, i.e. adopting cleaner technologies as the economy strengthens¹⁸. Moreover, with the possibility of leapfrogging, Nigeria need not pollute as much as countries that had attained development status ages ago.

18 While econometrics models based on the EKC hypothesis can provide directions on the income per capita at which selected emissions begin to fall for Nigeria, if applicable, this is beyond the scope of this White Paper.

4.1. TEC BALANCE AND LESSONS FOR NIGERIA

The NIIMP notes that Nigeria will need US\$ 2.3 trillion investments to close her infrastructure gaps in the next 23 years and US\$ 150 billion of annual infrastructure investment from 2021 to 2025.

The macroeconomic environment of a country is a significant predictor of how investors may perceive the market and their willingness to invest in the economy's future. Thus, the goal of achieving carbon neutrality cannot be separated from the imperative of having a thriving economy, as carbon neutrality will require new substantial investments. No doubt, a failing economy will not be able to meet such conditions, hence the need to balance trade, energy and climate objectives. These are some of the ways by which trade is given preferential treatment in developed countries, even as contractionary instruments, e.g. carbon tax, are used.

The goal of achieving carbon neutrality cannot be separated from the imperative of having a thriving economy.

For instance, the EU Emissions Trading Scheme (ETS), dating back to 2003, places the EU as a global leader in tackling climate change. EU regulations on emission allocations and allowances are implemented with certain safeguards that minimise undue hardship on member states with smaller GDP per capita as well as protect certain EU sectors and industries while achieving the Union's global emissions reduction goal. This is specified in the EU Directive 2018/410 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments (EU, 2018). For example, the Directive notes thus: "The European Council of October 2014 confirmed that the option to give free allocation to the energy sector should continue until 2030...to promote real investments that modernise or diversify the energy sector in line with the objectives of the Energy Union" (Article 18).

Furthermore, to prevent energy-intensive, trade-exposed (EITE) industries from migrating outside the EU, the regulation specifies that "transitional free allocation should continue to installations in sectors and subsectors at genuine risk of carbon leakage" (Article 10). In addition to receiving emission allowances free of charge, such sectors are also eligible for State aid in accordance with Guidelines on certain State aid measures in the context of the system for greenhouse gas emissions allowance trading post-2021 (EU, 2021). For example, in March 2022, a press release from the European Commission reported that EITE companies in the Czech Republic will be eligible for aid totalling €1.4 billion, from 2021 – 2030, to help offset the high cost of electricity as a result of the EU carbon tax (EU, 2022).

The example from the EU market stresses the importance of balancing trade, energy and climate objectives. If well managed, this could create the right macroeconomic environment where each reinforces the other: Increased energy supply supports increased trade and trade supports the economy to meet the huge investment needed to achieve carbon-neutrality goals.

As discussed above, the objective is to increase material consumption (including usage of natural carbon sinks) to the extent necessary, not the extent possible, in order to achieve the goals of low greenhouse gas emissions, inclusive growth and sustainable economic development, i.e. the objectives of the Climate Change Act of Nigeria. Table 5 lists practical actions for the Nigerian government for the next five years. In terms of impact, point 3 on Shifting Consumption will have the strongest effect on increasing Nigeria's productivity and, hence, setting the economy on the path to financing her carbon-neutrality goals. As shown in chapter three, the objectives of the Climate Change Act will not be possible without the necessary macroeconomic conditions in Nigeria. Point 3 caters to these specific conditions.

Objectives of the Climate Change Act will not be possible without the necessary macroeconomic conditions in Nigeria. Point 3 caters to these specific conditions.

Table 5: **Actions for TEC Balance in Nigeria**

Actionable items under these three-point strategy include:

Sustainably increasing material consumption in a manner that creates the necessary local economic conditions to attract investment to achieve carbon neutrality.

Diversification of Nigeria’s energy mix should be done with energy security as a priority. Energy security investments that allow the country’s power sector to increasingly integrate variable renewables into the grid will be pivotal in achieving a low carbon power sector (grid stability, transmissions lines, cross border electricity networks, etc.).

Increasing capital for government spending through prudent and sustainable use of her natural resources and other forms of domestic resource mobilisation.

Prioritising energy efficiency and investments towards energy security in the power sector.

Improving energy efficiency would include reducing the GHG emissions under Fugitive Emissions from the oil and gas sector, increasing efficiency at the power generation, transmission, distribution segments of the market, through the use of best available technologies and, at the end-user level, through standards that limit import of inefficient appliances and facilitate households and businesses’ purchase of efficient appliances and equipment.

In the road transport sector prioritise the Avoid, Shift and Improve sustainable transport policy measures that lead to a significant reduction of very old vehicles on the road, increase public transport options and usage, using cleaner fuels including biofuels, address urban sprawling and reduce distance travelled.

Increase international climate finance inflows towards investments in Nigeria to complement public funds with the objective of stimulating businesses to invest in the economy.

Substituting waste removal mechanisms from material consumption to those that meet sustainability conditions, such as increasing biomass stock to remove added CO₂ emissions from the atmosphere, increasing recycling to reduce wasteful material consumption, etc.

Balancing natural capital depreciation. For instance, the use of fossil fuels should be offset by increasing the country’s natural carbon stock as well as increasing carbon sequestration through technology where feasible.

Combating deforestation through a wide-scale afforestation and reforestation programmes, implemented alongside economic development programmes that increase the capacity of households to afford modern cooking fuels.

For industries, the use of energy-efficient technologies as well as cleaner production practices (including recycling/resource efficiency) can substantially reduce emissions from this sector.

Shifting consumption from geographies/economies with very high CO₂ per capita/GDP per capita into geographies with levels too low to attain carbon neutrality, by meeting sustainability conditions for industrial activities of comparative advantages to be relocated to these economies, e.g., Nigeria.

Increase production capacity of firms and industries by increasing energy supply and consumption through her renewable and non-renewable energy resources as well as energy efficiency.

Nigeria’s trade partners must have interest beyond the country’s raw commodities to support diversification of the country’s export structure. New trade agreements should (1) aim to increase Nigeria’s export volumes and (2) a larger part of these new trade agreements must be on higher value-added products.

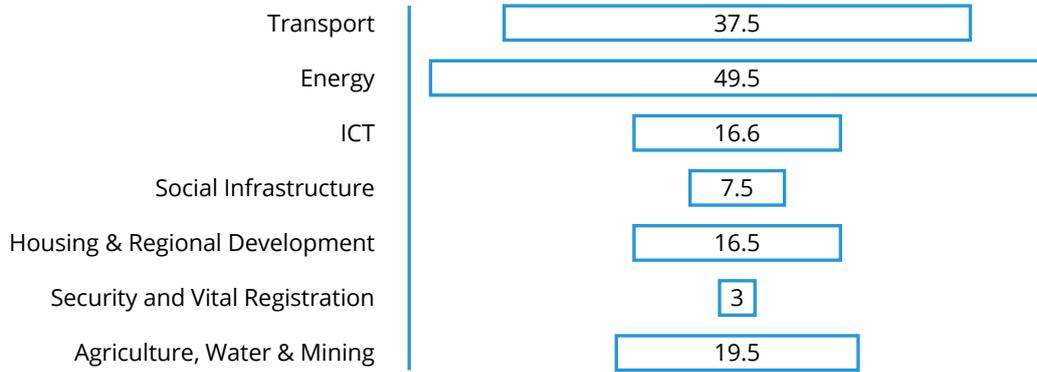
Realisation of Nigeria’s industrialisation goals must be considered a priority and implemented alongside a green industry plan where carbon capture utilisation and storage technologies and green and blue hydrogen feature strongly.

Increasing employment opportunities by increasing manufacturing, trade and export activities. Preferably, new investments in manufacturing and agricultural (e.g., production of fertilizer) industries that have forward and backward linkages with Nigeria’s extractive industries (mining and steel, petroleum).

In terms of impact, point 3 on Shifting Consumption will have the strongest effect on increasing Nigeria’s productivity and, hence, setting the economy on the path to financing her carbon-neutrality goals. This is where the larger part of new investments must go into in the next 5 to 7 years.

Figure t shows the sheer size of infrastructure investment needed in the first five years of the NIIMP. The Plan envisages that private finance will account for 56% and the government (Federal and States) will provide the remaining 44%.

Figure 7: Infrastructure investment needs in Nigeria in five years, US\$ billion



Source: National Integrated Infrastructure Master Plan of Nigeria (2021 – 2043)

It is important to note that doing nothing, i.e. maintaining the status quo of Nigeria’s 0.36% contribution to global GHG emissions by not ramping up economic growth and development, will not produce better global climate results.

Table 6 provides some likely outcomes: (1) choosing to do nothing and allowing the status quo to unfold as it pleases, i.e. doing business as usual; (2) allowing economic growth to happen haphazardly, without targeted and coordinated inflow of investment, referred to as accelerated growth; and (3) achieving trade, energy and climate balance through infrastructure investments aligned with the NIIMP.

Table 6: *Pathways Nigeria may follow.*

Theoretical pathways	Assumption/Characteristics	Sectors favoured for investment	Nigeria's contribution to global GHG emission reduction
Business as Usual	<ul style="list-style-type: none"> • Maintain the status quo where inadequate level of investment, economic growth and development is sluggish and investment is not sufficient to ensure that best available technologies (BAT) are used in capital projects. • Low trade levels and persisting negative net exports as manufacturing capacity remains slim and export structure continues to be driven largely by raw commodities. • Persisting low electricity consumption per capita. New electricity projects favour small-scale, decentralised solutions, captive power projects by industries and commercial centres – lacking economies of scale. • Lower GHG emissions from the power sector compared to high economic growth scenarios. But unable to attain net-zero status in the power sector owing to lack of infrastructure to support renewables as baseload (interconnections, storage, etc.). • With population growth, higher levels of deforestation and unsustainable use of forest resources for fuel (cooking and heating for industrial/commercial uses). • Road transport continue to drive oil consumption due to predominately old vehicles on road. • Etc. 	Raw commodities – oil and gas for exports.	<ul style="list-style-type: none"> • Some immediate actions for GHG emission reduction possible (e.g. tree planting) – but offset by population growth, high energy and income poverty leading to preferences for dirtier fuels and fuel combustion techniques.

Theoretical pathways	Assumption/Characteristics	Sectors favoured for investment	Nigeria's contribution to global GHG emission reduction
Accelerated Growth	<ul style="list-style-type: none"> Investment is above current levels but not sufficient and not managed or coordinated for climate goals. Outcomes are generally better than the status quo. However, the larger part of infrastructure investments needed does not occur in the next five to seven years. Thus, inefficient capital projects (energy and carbon intensive) are constructed. Owing to path dependencies and the lock-in effect, these structures derail and delay the country's net-zero timeline. Owing to increased investment in energy & power infrastructure, some factors driving adverse supply shocks and capacity constraints are alleviated. Thus, higher trade activity levels and economic growth, higher levels of material consumption, higher and sustained levels of negative environmental impacts, i.e. trajectory continues into the foreseeable future. High levels of manufacturing capacity, but Nigerian-made goods are more carbon-intensive. May be a problem for international trade outside the continent if carbon border adjustment (CBA) mechanism in some geographies. 	<p>Raw commodities – oil and gas for exports.</p> <p>Some manufacturing capacity addition to take advantage of opportunities presented by AfCFTA.</p> <p>Some level of export diversification but raw commodities still favoured as investment occurs sporadically.</p>	<ul style="list-style-type: none"> Immediate GHG emission reduction possible. Short/medium actions prolonged.
Trade, Energy and Climate Balance	<ul style="list-style-type: none"> Based on NIIMP (which combines the ETP funding needs), accelerated investment occurs in the short term to direct trajectory to net-zero emissions in the long term (next 30 – 40 years). High outputs, economic growth, high emissions but strategically set to change course in line with the EKC hypothesis. 	<ul style="list-style-type: none"> Manufacturing capacity – turning raw commodities to high-value product before exports. Oil & gas infrastructure to increase national utilisation as priority, then exports. Stronger spatial linkages between extractive industry and economy – use of natural resource receipts to scale up infrastructure. 	<ul style="list-style-type: none"> Short/medium actions implemented as planned. Carbon neutrality in the long-term.

CONCLUSION

Since the turn of the century, from 2001 to 2020, segments of the world's population classified by the World Bank as Middle Income has grown at a CAGR of 1%. In the decades before the new century, 1972 to 2000, more people were entering into the classification of Middle Income than compared to today, with a CAGR of 2% per year. For Lower Middle Income and Low-Income populations, the same growth rates have persisted at a CAGR of 2% and 3% respectively. Thus, in total, the global income inequality gap has been widening.

Furthermore, developing countries may have a large and growing population but not the market, owing to high income poverty in these countries. The significance of this could be observed in the fact that oil and gas assets are now being classified by some experts as stranded assets (or on the way to becoming stranded assets) in the face of widespread energy poverty in some countries, including Nigeria. The energy transition and move towards carbon neutrality may widen the global inequality gap as wealthier countries are able to deploy capital, technical knowledge, technology and other factors, thus pushing global demand when and where they will it to go. Eventually, developing countries, who are largely dependent on exports from their raw commodities, may one day witness declined receipts from their natural resource wealth if they are not able to develop their national markets. Thus, even with Article 4 (1) of the Paris Agreement, developing countries do not have the luxury to transition whenever it becomes possible, if they do not want to be left behind. Their development trajectory must be in harmony with other economies in the world, despite differing realities. To specify, the clause states thus: *"In order to achieve the long-term temperature goal set in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognising that peaking will take longer for developing country parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of the century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty."*

Even with the most ambitious climate targets, developing countries would need to create the right macroeconomic environment to enable these countries to attract investment for their energy transition. For Nigeria, this White Paper has considered the implications of this for Africa's largest population. The analysis shows that trade, by diversifying the country's export structure and increasing the country's export capacity, will be vital to improving Nigeria's macroeconomic conditions. Using the macroeconomic model of aggregate demand and aggregate supply as the analytical framework for Nigeria, the White Paper notes that to attract investment for the infrastructure development needed to transition, the country must mitigate sources of adverse supply shocks, including inadequate energy supply.

As shown in both chapters on Climate Change and Energy, Nigeria's strategy for contributing to global GHG emission reduction cannot be the same as the global strategies (which are actually the strategies of the world's wealthiest economies). The most substantial contribution Nigeria can make to reducing global GHG emissions is through reforestation and afforestation, without losing sight of the importance of tackling emissions in the energy sector as the country industrialises.

The urgency of not being left behind requires Nigeria to take the most advantage of her oil and gas resources to build up her hard infrastructure assets, which would also be necessary for the modernisation of her power/energy sector to meet carbon neutrality goals; diversity her economy (including manufacturing capacity) and create a broad-based economy that increases employment opportunities and the spending capacity of Nigerians—all of which will produce a multiplier effect on investment.

The Nigerian government has shown high ambitions for tackling climate change by adopting the same strategies as the world's wealthiest countries to curb carbon emissions, such as carbon tax, despite the country's low contribution to global GHG emissions. However, realising these ambitions would require significant investments, with these investments going into strategic sectors of her economy in the next 5 to 7 years. There would be need for investment partnerships and trade interests beyond Nigeria's raw commodities. In closing, it bears reiterating that climate change wears a human face.

Thus, in order for Nigeria's national concerns to be in harmony with global concerns on a net-zero future, the following three strategies would have to be followed:

- I. **Sustainably** increasing material consumption in a manner that creates the necessary local economic conditions to attract investment to achieve carbon neutrality.
- II. **Substituting** waste removal mechanisms from material consumption with those that meet sustainability conditions, such as increasing biomass stock to remove added CO₂ emissions from the atmosphere, increasing recycling to reduce wasteful material consumption, etc.
- III. **Shifting** consumption from geographies/economies with very high CO₂ per capita/GDP per capita into geographies with levels too low to attain carbon neutrality, by meeting sustainability conditions for industrial activities of comparative advantages to be relocated to these economies, e.g. Nigeria.

All of these three conditions are in line with achieving Article 4 (1) of the Paris Agreement.

REFERENCES

- Adenikinju, A. (2022). Comments on the White Paper on Trade, Energy and Climate Change. (Reviewer Comments). June 2022.
- Agbonghae, E. (2022) Comments on the White Paper on Trade, Energy and Climate Change. (Reviewer Comments). June 2022.
- BP (2021). Statistical Review of World Energy. 70th Edition. London: BP.
- BUR (2021): Second Biennial Update Report (BUR2) to the United Nations Framework Convention on Climate Change, 2021. Available at: <https://unfccc.int/documents/307085>
- Central Bank of Nigeria (2022). Money Market Indicators. Available at: <https://www.cbn.gov.ng/rates/mnymktind.asp>
- COP26(2021): Accelerating the transition from coal to clean power. Available at: <https://ukcop26.org/energy/>
- (EU, 2018): EU Directive 2018/410 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0410&from=EN>
- (EU, 2021): Guidelines on certain State aid measures in the context of the system for greenhouse gas emissions allowance trading post-2021. Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020XC0925\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020XC0925(01)&from=EN)
- (EU, 2022) State aid: Commission approves €1.4 billion Czech Scheme to compensate energy-intensive companies for indirect emission costs. Press Release. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1782
- FAO (2018). Emissions due to agriculture: Global, regional and country trends – 2000 – 2018. Available at: <https://www.fao.org/3/cb3808en/cb3808en.pdf>
- FAO (2020): The Global Forest Resources Assessment 2020. Available at: <https://www.fao.org/forest-resources-assessment/2020/en/>
- FGN (2021): Climate Change Act of Nigeria. Available at: <https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/112597/140749/F962932059/NGA112597.pdf>
- FMP (2022): Comments on the White Paper on Trade, Energy and Climate Change. (Reviewer Comments) June 2022.
- Goodwin, N. et al. (2019). Macroeconomics in Context. 3rd ed., London: Taylor and Francis.
- Grossman, G. M. and Krueger, A. B. (1991). Environmental Impacts of a North American Free Trade Agreement. NBER Working Paper Series. Working Paper No.3914.
- IEA (2022): Data and statistics. Available at: <https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource>
- Ikeonu, (2022): Comments on the White Paper on Trade, Energy and Climate Change. (Reviewer Comments). June 2022.
- IPCC (2006). Guidelines for National Greenhouse Gas Inventories. Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf

IPCC (2007): Climate Change 2007: Working Group I: The Physical Science Basis. Available at: https://archive.ipcc.ch/publications_and_data/ar4/wg1/en/faq-1-3.html

Maduekwe et. al., (2020). Road transport energy consumption and vehicular emissions in Lagos, Nigeria: An application of the LEAP model. *Transport Research Interdisciplinary Perspectives* 6 (2020) 100171.

McKinsey (2022): The net-zero transition: What it would cost, what it could bring. January 2020.

National Bureau of Statistics - NBS (2020). Labor Force Statistics: Unemployment and Underemployment Report (Q4 2020). Available at: <https://nigerianstat.gov.ng/elibrary/read/1238>.

NIIMP (2020). 2020 – 2043 National Integrated Infrastructure Master Plan. FGN. Nigeria

NDC (2021): Nigeria's First Nationally Determined Contribution – 2021 Update. FGN. Nigeria

UN (2015): Paris Agreement. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

UNCTAD (2020). Profile: Nigeria. Available at: <https://unctadstat.unctad.org/countryprofile/generalprofile/en-gb/566/index.html>

UNCTAD (2022). UNCTADSTAT. Available at: <https://unctadstat.unctad.org/countryprofile/GeneralProfile/en-GB/566/index.html>

UNDP (2022): Human Development Report Office 2020. Available at: <https://hdr.undp.org/content/human-development-report-2020>

UNEP (2021). Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions. Available at: <https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions>

UNEP (2022): The Montreal Protocol. Available at: <https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol>

UNFCCC (2015). Great Green Wall: 'Growing A World Wonder' - Restoring the productivity and vitality of the Sahel region. Available at: <https://unfccc.int/news/great-green-wall-growing-a-world-wonder-restoring-the-productivity-and-vitality-of-the-sahel-region>

UNFCCC (2020): Greenhouse Gas Inventory Data. Available at: https://di.unfccc.int/detailed_data_by_party

UNFCCC (2022): Introduction to Climate Finance. Available at: <https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance>

World Bank (2022): World Development Indicators. Available at: <https://databank.worldbank.org/source/world-development-indicators#>

PUTTRU

PUTTRU Technologies Limited
29 Mambilla St, Three Arms Zone, Abuja, Nigeria
info@puttru.com / www.puttru.com

