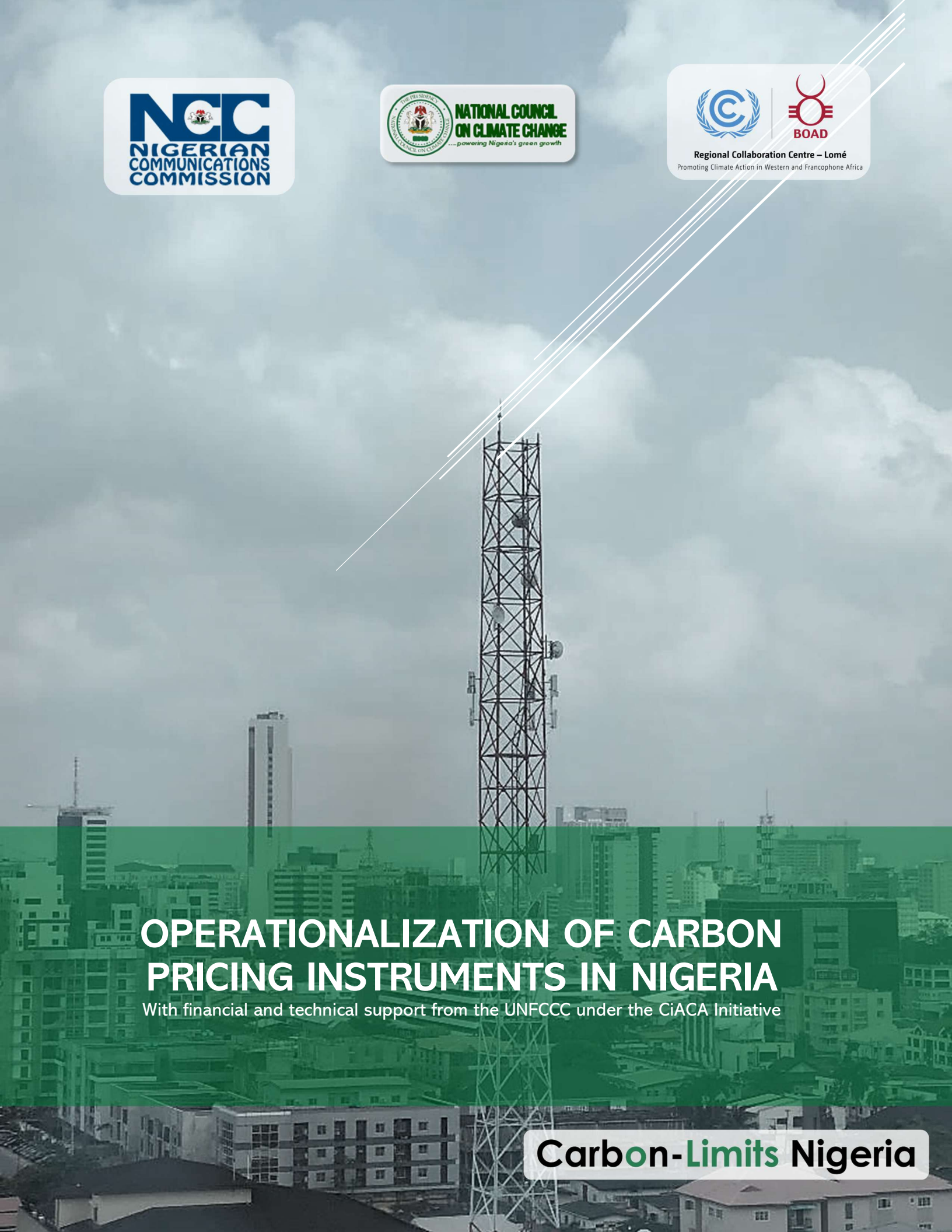

NCC
NIGERIAN COMMUNICATIONS COMMISSION

NATIONAL COUNCIL ON CLIMATE CHANGE
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Promoting Climate Action in Western and Francophone Africa
BOAD

OPERATIONALIZATION OF CARBON PRICING INSTRUMENTS IN NIGERIA

With financial and technical support from the UNFCCC under the CiACA Initiative

Carbon-Limits Nigeria

DISCLAIMER

This report was developed under the country support component of the Collaborative Instruments for Ambitious Climate Action (CiACA) initiative, implemented by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat with support from the Government of Germany, through the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN). The report has been prepared by an independent consultant hence, the findings, interpretations, and conclusions presented herein does not necessarily reflect the views of the UNFCCC secretariat, the United Nations, or the Government of Germany.

December 2025

EXECUTIVE SUMMARY

This document presents a merged report of deliverables from the study of the Operationalization of Carbon Pricing Instruments in Nigeria which was conducted from September 2024 to October 2025. This project emanated from a series of activities. In 2022[1], the Federal Ministry of Environment, through the Department of Climate Change (DCC), collaborated with the UNFCCC Regional Collaboration Centre for West and Central Africa (RCC WACA) in Lomé, and received financial and technical support from the UNFCCC secretariat under the Collaborative Instruments for Ambitious Climate Action (CiACA) initiative funded by the Government of Germany. The objective was to support Nigeria in the development of carbon pricing approaches for implementing its nationally determined contributions (NDCs) under the Paris Agreement. Carbon-Limits Nigeria was selected as the consultant to conduct a feasibility study on Nigeria's carbon pricing instruments (CPIs) and approaches.

General Overview of Previous Study

The first phase of the study focused on assessing carbon pricing initiatives in Nigeria. The objectives of this phase were to:

- Showcase Nigeria's readiness to implement carbon pricing initiatives in selected sectors; and
- Create awareness of the opportunities presented by carbon market instruments in supporting the achievement of Nigeria's NDC targets, strengthening the national climate framework, and increasing the potential for cooperative climate action.

This phase identified the oil and gas sector as the most immediate opportunity ("low-hanging fruit") and the sector best positioned for early adoption of carbon pricing. In the short term, a carbon tax was considered the most feasible instrument, while an emissions trading scheme (ETS) was recommended as a longer-term mechanism for implementation in Nigeria.

Outcome of Previous Study

The outcome of the study suggested that the Carbon Tax and the ETSwere viable approaches for managing Greenhouse Gas (GHG) emissions in Nigeria, and the carbon tax was recommended as the most promising option in the short term. The choice of the telecommunications sector for carbon pricing is driven by its potential to serve as a high-impact and scalable demonstration model for carbon pricing in Nigeria.

[1] Carbon Pricing Assessment in Nigeria.pdf

This document, however, presents the findings of the study on the operationalization of CPIs in Nigeria, with a specific focus on the telecommunications sector. The sector was selected and prioritized for short-term piloting due to its structured and centralized mode of operations. The document is organised into four sections, comprising the key deliverables developed and submitted over the course of the study.

- **Section 1: Stakeholders Identification and Mapping**

The Stakeholders Identification and Mapping section gives a comprehensive desktop report on the study of the telecommunications sector. It outlined the public and private institutions and stakeholders relevant for information (data) sharing, assessment of impact, and decision-making for the goal of designing a carbon tax for the telecommunication sector in Nigeria. Through a methodological approach, the review of relevant documents, policies, and the identification and consultations with stakeholders were conducted via virtual and physical engagements, and the information collated was duly analysed. The stakeholder Identification and Mapping classified the relevant institutions within the sector into the public institutions and the private sector institutions. The private sector is mostly involved in the key business and commercial aspects of the industry, with the Tower Company (TowerCo) helping in the management of telecommunications infrastructure. According to desktop research, there are over a thousand (40,656)[2] towers in Nigeria, and it was reported that over 50 million litres of diesel is consumed each month. The analysis of the energy consumption of the operators' sites was conducted, especially the diesel-powered towers and data centres, and other energy-intensive operations, to determine those that fall within the set bandwidth of either high or low emitters. This section reported on the review of essential policy documents such as the Nationally Determined Contributions (NDCs) document, National Telecommunications Policy, National Renewable Energy and Energy Efficiency Policy (NREEEP), National Digital Economy Policy and Strategy, Nigerian Communications Act (NCA) 2003, etc.

- **Section 2: Carbon Tax Design**

The desk review covered how the carbon tax should be applied based on the principles of the flare penalty in the oil and gas sector to reduce additional burden for the companies concerned and to provide an incentive for measures and practices that reduce GHG emissions. Also, it gathered and reviewed data (energy consumption data, emissions data from sustainability reports of the operators from relevant institutions such as National Communications Commission (NCC), Energy Commission of Nigeria (ECN), National Bureau of Statistics (NBS), Rural Electrification Agency (REA)).

[2] TowerXchange's Africa Guide, Q3 24 – www.towerxchange.com

The Carbon Tax Design section explains the rationale for introducing a carbon tax in the telecommunications sector, and this is driven by its potential to serve as a high-impact and scalable demonstration model for carbon pricing in Nigeria. The Telecoms sector has centralized and structured operations with substantial energy consumption. Its reliance on diesel fuel acts both as an incentive and a disincentive, encouraging cleaner technologies and broader climate action.

This section also describes the methodology for determining the carbon tax rate in the telecommunication industry, and these include:

- Review of available data (GHG Inventories).
- Categorizing emitters or operators into high and low emitters based on their reliance on fossil fuels, operational footprint, and adoption of sustainable energy solutions.
- Establishing a tax rate: The suggested Carbon Tax Price Range was an Initial Price of $1-2 per tonne of CO_2e. This range strikes a balance between incentivizing cleaner energy use and not overwhelming telecom operators with costs.
- Setting a Price per tonne of CO_2 for a carbon tax for Nigeria's telecommunications sector.

Furthermore, the multifaceted approach to how carbon tax in the telecommunications industry can be implemented was explained, and this involves conducting a GHG inventory, adopting green technologies, transitioning to renewable energy, aligning with regulatory policies, and managing the financial impact of the carbon taxes on the telecommunications industry so that the industry's sustainability goals are met. A phased approach process of 0-2 years (short term), 2-4 years (mid-term), and 4+ years (long-term) was proposed for the implementation process.

Phase 1 (0-2 years) will involve stakeholders engagement, inventory and emission audit, and establishment of the necessary legal and institutional frameworks; Phase 2 (2-4 years) will focus on piloting and capacity building, during which a pilot programme will be launched, tested and refined; while, Phase 3 (4+ years) will involve the national roll-out of carbon tax, alongside the introduction of incentives to promote green investments.

Lastly, this section reported the survey conducted to give an insight into the Carbon Tax. The survey was conducted virtually to assess public perception and insights on the proposed implementation of a carbon tax. “Introduction of Carbon Tax in Nigeria’s Telecom Sector – Service Users’ Perception’’. The survey revealed that awareness of environmental issues was high, where 62% of the respondents being aware of carbon emissions. Assessing the policy fairness, 85% of the respondents advocated for a differentiated tax structure, and the big polluters are expected to pay more. Respondents are sensitive to cost, and 50% opposed any increase, while 94% of the respondents asked that the government should incentivize eco-friendly operators.

- **Section 3: National Measurement, Reporting and Verification (MRV) System for Nigeria's Telecommunications Sector**

The section on the National MRV System for Nigeria's Telecommunications Sector provides an overview of the MRV concept and its principles, explaining the MRV framework within the context of the UNFCCC. This report reveals that the existing MRV practices in the sector are still at the infancy stage, and the monitoring practices in this sector focus on operational metrics with no direct focus on climate impact. Importantly, this section examines the regulatory and institutional landscape, with a proposed institutional arrangement for MRV and key roles and responsibilities for the key stakeholders. The step-by-step approach to implementing the MRV was explained, based on a phased approach comprising short-term, mid-term, and long-term objectives i.e. short term (0-6 months): awareness, sensitization, and initial capacity building; mid-term (6 months): role assignment and expanded capacity building will be concluded; and in the long term (3-4 years) will involve the full implementation of the MRV system.

- **Section 4: Carbon Tax Operational Guide**

The concluding section on Carbon Tax Operational Guide provided a practical direction for the design, implementation, and administration of a carbon tax framework in Nigeria. The guide outlines key operational components, including sectoral coverage, MRV systems, compliance mechanisms, institutional roles, and revenue utilization strategies. This document seeks to ensure that the carbon tax is not only effective in reducing emissions but also equitable, transparent, and conducive to long-term sustainable development.

In conclusion, this study confirms that Nigeria is well positioned to begin the phased operationalization of carbon pricing, starting with a carbon tax as the most practical near-term instrument. Building on earlier findings, this phase provides a clear and actionable pathway for implementation through a pilot in the telecommunications sector. The telecommunications sector offers a strong starting point due to its structured operations, centralized data systems, and significant diesel-related emissions.
Overall, the study demonstrates that a carefully sequenced, well-supported carbon pricing framework can contribute meaningfully to Nigeria's NDC implementation while strengthening national climate governance and encouraging low-carbon investment. As such, key recommendations include

1. Introduce a modest initial carbon price with a pathway for gradual increases over time.
2. Complement carbon pricing with incentives such as fiscal and financial support for clean energy adoption.
3. Strengthen stakeholder engagement and communication to build trust, ensure fairness, and enhance public and industry acceptance

Additional recommendations are presented in the subsequent chapters of this document.

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Abbreviations

AfriNIC	African Network Information Centre
AMN	Africa Mobile Networks
API	Application Programming Interface
ATC	American Tower Corporation
BTR	Biennial Transparency Report
BTS	Base Transceiver Station
BUR	Biennial Update Report
CiACA	Collaborative Instruments for Ambitious Climate Action
CO_2	Carbon dioxide
CPI	Carbon Pricing Instrument
CTIN	Carbon Taxpayer Identification Number-0
DCC	Department of Climate Change
DEFF	Department of Environment, Forestry and Fisheries
ECN	Energy Commission of Nigeria
EIA	Environmental Impact Assessment
EF	Emission Factor
ESCO	Energy Services Company
ESG	Environmental, Social, and Governance
ETF	Enhanced Transparency Framework
ETS	Emission Trading Scheme
FEC	Federal Executive Council
FIRS	Federal Inland Revenue Services
FMCIDE	Federal Ministry of Communications, Innovation, and Digital Economy
FMEnv	Federal Ministry of Environment
FTTH	Fibre-to-the-home
FRC	Financial Reporting Council of Nigeria
GHG	Greenhouse gas
HTN	Helios Towers Nigeria
HVAC	Heating, Ventilation, and Air Conditioning
IEA	International Energy Agency
ICA	International Consultation and Analysis
ICANN	Internet Corporation for Assigned Names and Numbers

ICT	The Information and Communication Technology
IFRS	International Financial Reporting Standards
IGF	Internet Governance Forum
IHS	Intelligence, Human Capital, and Sustainability Towers
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ipNX	Internet Protocol Next Generation
ISSB	International Sustainability Standards Board
ISP	Internet Service Providers
ITMOs	Internationally Transferred Mitigation Outcomes
KPIs	Key Performance Indicators
KWH	Kilowatt-Hours
LPG	Liquefied petroleum gas
LULUCF	Land Use, Land-use Change and Forestry
Mbps	Megabits per second
MDAs	Ministries, Departments, and Agencies
MID	Maurice Ile Durable Concept
MLL	Mobile Line Leasing
MNOs	Mobile Network Operators
MRV	Measurement, Reporting and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NARSDA	National Space Research and Development Agency
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Statistics
NC	National Communications
NCA	Nigerian Communications Act
NCC	Nigerian Communication Commission
NCCCS	National Council on Climate Change Secretariat
NDC	Nationally Determined Contribution
NDPA	Nigeria's Data Protection Act
NDPB	Nigeria Data Protection Bureau
NERC	Nigerian Electricity Regulatory Commission
NESREA	National Environmental Standards and Regulations Enforcement Agency

NGOs	Non-Governmental Organizations
NiRA	Nigeria Internet Registration Association
NITDA	National Information Technology Development Agency
NOx	Nitrogen Oxides
NREEEP	National Renewable Energy and Energy Efficiency Policy
OBPS	Output-Based Pricing System
OPEX	Operating Expenditure
PAT	Pan African Towers
PACM	Paris Agreement Crediting Mechanism
PUE	Power Usage Effectiveness
QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RCC	Regional Collaboration Centre
REA	Rural Electrification Agency
SLB	Site Lease Buyback
SME	Small and Medium-sized Enterprises
SWAP	Sustainable Wireless Access Providers Technologies
TACCC	Transparency, Accuracy, Consistency, Completeness, and Comparability
TB	Terabytes
UNFCCC	United Nations Framework Convention on Climate Change
VDT	Virtual Data Technologies
WIOCC	West Indian Ocean Cable Company

SECTION 1: STAKEHOLDERS IDENTIFICATION AND MAPPING

1.1 Introduction

The Paris Agreement's collective ambition and long-term objectives are to limit the rise of global average temperatures to below 2°C relative to pre-industrial levels and pursue efforts to limit warming to 1.5°C. This objective requires Parties to the agreement to reduce their greenhouse gas (GHG) emissions, thereby marking the beginning of a shift towards a world with net-zero emissions.[3] In the face of global energy challenges and the critical need for sustainable practices, Nigeria must explore innovative solutions to enhance energy efficiency and reduce its carbon footprint.

The telecommunications industry in Nigeria has experienced growth and transformation, with a rapid increase in data usage and the development of infrastructure to cater to the ever-growing demands of customers; however, this growth has also brought about environmental concerns due to the industry's operations, especially the powering of towers with heavy use of fossil fuel (diesel) generators for their power hence contributing to GHG emissions.

According to a 2024 report by the World Bank Group, the Information and Communication Technology (ICT) sector contributes at least 1.7% to GHG emissions globally[4]. Also, a study carried out on emission inventory of GHG and sustainable energy for mobile telecommunication facilities in Nigeria[5] showed that over the past 35 years, the mobile telecommunication industry in Nigeria has contributed about 5% of the total gasoline and diesel consumed in Nigeria.

The updated 2021 NDC document shows that the energy sector is the highest emitter in Nigeria, accounting for 60% (209 $MtCO_2e$) of emissions, with fugitive emissions from oil and gas being the largest contributor, accounting for about 36% of emissions, while transport and electricity generation contributing 21% and 24% respectively. Energy consumption in residences and industries accounts for 19%. The NDC document also highlights key elements in the national context that could support the introduction of carbon pricing instruments (CPIs) in Nigeria, including the socio-economic context, regulatory framework, stakeholders' analysis, and responsibilities on climate and energy matters.

In 2022, a consultant commissioned by the Federal Ministry of Environment through the DCC conducted a comprehensive study and analysis of priority sectors and engaged several relevant stakeholders to investigate elements important for the setting up of a CPI. The study determined that

[3] https://www.un.org/en/climatechange/paris-agreement
[4] https://www.nigeriacommunicationsweek.com.ng/a-greener-future-for-the-telecoms-industry/
[5] Oyetunji B. Okedere, Seun Oyelami (2021), Emission inventory of greenhouse gases and sustainable energy for mobile t elecommunication facilities in Nigeria

carbon tax and Emission Trading Scheme (ETS) are viable approaches for managing GHG emissions in Nigeria. However, implementing a carbon tax is the most recommended option in the short term, while the ETS can be considered in the long term.

According to Nigeria's First Biennial Transparency Report (BTR1) to the UNFCCC, released in December 2024, Nigeria's total GHG emissions for the year 2024 excluding emissions from Land Use, Land-Use Change, and Forestry (LULUCF) were reported to exceed 328 $MtCO_2e$. Of this total, the energy sector accounts for approximately 43%[6]. In the Telecommunications sector, estimates made based on a report by Punch[7] indicates that mobile network operators contribute about 1.6 $MtCO_2e$ annually through fuel consumption for operational services which represents about 0.46% of Nigeria's total annual emissions. Data centres, however, have emissions from their operations to be about 2 $MtCO_2e$ which is about 0.6% of Nigeria's total annual emissions.

The study also recommends adopting an economy-wide CPI based on existing tax collection systems in Nigeria. However, a functional measurement, reporting, and verification (MRV) framework must be in place before implementing an ETS. Nigeria has already created a national climate registry and taken steps towards MRV framework development. The study recommends introducing CPIs gradually, with a short-term focus on the oil and gas sector and other heavy polluters in the industrial sector. In contrast, in the mid-long term, it can introduce the power and waste sectors. The Telecommunication sector has been prioritized for a pilot in the short term, while other sectors will be considered in the near future. This is because of the sector's structured and centralized mode of operations and its GHG emissions contributions due to its significant use of fossil fuel as its energy source which accrues to about 1.6 $MtCO_2e$ of Nigeria's total annual emissions as aforementioned.

Following Nigeria's adoption of IFRS Sustainability Standards developed by the International Sustainability Standards Board (ISSB), the Nigerian telecommunications sector, like other companies in Nigeria, will be required to report under the IFRS Sustainability Disclosure Standards in 2026. This will involve submitting necessary documents to the Financial Reporting Council of Nigeria (FRC), ensuring compliance with various IFRS standards, and possibly adopting the standards early.

This report aims to map out key stakeholders (regulators, tower companies, policymakers, operators, data centres, etc) in the telecommunication sector that would be relevant for information (data) sharing for the goal of designing a carbon tax for the telecommunication sector in Nigeria.

1.1.1 Scope and Deliverables

The goal of this report is to determine and outline public and private institutions and stakeholders that would be relevant for information (data) sharing, assessment of impact and decision-making for

[6] https://unfccc.int/documents/645210
[7] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/

the goal of designing a carbon tax for the telecommunication sector in Nigeria. Therefore, this report identifies key stakeholders in the telecommunications sector who can provide accurate and relevant data to support the analysis of energy consumption and energy usage, to inform on emission sources and quantity; oversee or supervise the operations of the sector; formulate policies; etc. This feedback and information from such consultation process would ultimately inform decisions on the development and implementation of the pilot carbon tax within the telecommunication sector. Engagement meetings (Virtual and/or Physical) would be held to align the projects' main objectives with those of the stakeholders. The scope of this report is presented in Table 1 below.

Table 1: Description and approach to stakeholder identification and mapping

Tasks	Description	Deliverable
Task 1: Identification of Relevant Institutions	Through desk review and consultations identify institutions that operate potential high-emitting infrastructure in the telecommunication sector and of their operations to uncover potential emission sources and the degree of their emissions[8]. To identify the high emitters within the sector, CLN shall analyse the energy consumption of the operators' sites, especially the diesel-powered towers and data centres and other energy-intensive operations within the industry, to determine those that fall within the set bandwidth of either high or low emitters. This shall be presented in detail in the carbon tax and MRV design documents. Recognising that these entities operate under policy and legal frameworks of Nigeria and serve a consumer base, the identification, mapping and consultation process has taken into account policymakers, regulators and consumers organizations.	Categorization Mapping Report
Task 2: Mapping of Key Stakeholders in the Telecommunication Sector.	Map out key stakeholders in the telecommunications sector through desk review to determine relevant data needed and areas of synergies or level of support needed. Identified stakeholders, such as Fixed and Mobile Operators, Infrastructure Providers, Data Centres, Internet Service Providers, Regulators, etc., would be consulted (virtually or physically if needed) to engage in addressing data-related issues, opportunities, impacts and infrastructure necessary for the setup of a carbon tax. Expected outcomes of the engagements would include establishing data collection procedures and an alignment with the stakeholders on the framework for implementing the carbon tax.	

[8] Potential emission sources, the degree of emissions and the GHGs associated with operations would be discussed in th e Carbon Tax Design document.

1.1.2 Methodological Approach

The methodological approach is based on a desk review of relevant documentation, consultations with stakeholders, and analysis of the collected information. The delivering approach involves identifying and segregating operators in the telecommunication sector into different subsections based on their roles and functions.

The documents reviewed include those related to the information and data reported from institutions in the telecommunications sector in Nigeria. Some of the reviewed documents specific to Nigeria are as follows:

- Nigeria Nationally Determined Contribution 2021
- National Telecommunications Policy
- National Renewable Energy and Energy Efficiency Policy (NREEEP)
- National Digital Economy Policy and Strategy
- Nigerian Communications Act (NCA) 2003
- Nigerian Communication Commission (NCC) publications
- Nigeria Telecom Market Competition Analysis
- Global System for Mobile Communications' Environmental, Social, and Governance (ESG) Metrics for Mobile
- Annual Reports for related telecommunication stakeholders (MTN, Airtel, etc.)
- Climate Reports for related telecommunication stakeholders (MTN, Airtel, GLO, etc.)
- Articles & Publications[9][10][11]

The mapping of stakeholders will focus on key business and commercial institutions in the telecommunication industry based on their roles, functions, and/or activities performed to gauge their emission profiles based on desk research and available data. The mapping output is presented in charts and will be seen in the following chapters.

[9] The Cost of Telecommunications Evolution in Nigeria
[10] Suleiman et.al., (2023) Exploring the Complex System of Energy Consumption Associated with 5G Network Deployment in Nigeria
[11] Abubakar Sambo, Nasiru Bello, (2023) Alternative clean energy for sustainable growth and development of the Nigerian telecommunications sector

1.2 Mapping of Relevant Institutions in the Telecommunications Sector

The telecommunication sector consists of various institutions which can be largely classified into the public and private sector institutions.

1.2.1 Public Sector Institutions

The public sector institutions vary from Ministries, Departments, and Agencies (MDAs). These institutions play important roles in regulating, developing, and promoting telecommunications infrastructure, policies, training, research and development, and services. Some of the ministries directly linked to the telecommunication sector include the Federal Ministry of Communications, Innovation, and Digital Economy (with supervisory agencies such as the Nigerian Communications Commission (NCC), National Information Technology Development Agency (NITDA), Nigerian Postal Service (NIPOST), etc.), Nigeria Internet Registration Association (NiRA), National Space Research and Development Agency (NASRDA).

Engagement with the public sector institutions is integral to the development and operationalization of a carbon tax in the sector and the objective is to align with national policies and facilitate infrastructure for measuring and reporting emissions. It will also drive stakeholder collaboration to ensure effective implementation. Expected outcomes include enhanced regulatory compliance, improved emission monitoring through robust MRV systems and the promotion of sustainable practices that would support Nigeria's overall climate goals.

- **Federal Ministry of Communications, Innovation, and Digital Economy (FMCIDE)**

Initially established as the Ministry of Communications, has undergone several transformations to reflect changes in its focus and the evolving digital landscape. In 2019, the ministry was rebranded to include innovation and the digital economy, marking a broader mandate to advance Nigeria's participation in the global digital space.

The Federal Ministry of Communications, Innovation, and Digital Economy of Nigeria is a governmental body that plays a vital role in shaping the country's digital transformation and ICT landscape. The ministry is dedicated to promoting and harnessing the potential of communications technology, fostering innovation, and accelerating the growth of Nigeria's digital economy. Some departments and agencies that operate under the Ministry to execute its mandates are highlighted in the table 2 below:

Table 2: Agencies under FMCIDE and their Roles

Agencies	Roles	Functions
Nigerian Communications Commission (NCC)	Regulatory Authority	Responsible for issuing licenses, managing spectrum, and ensuring quality services

National Information Technology Development Agency (NITDA)	IT Policies & Guidelines Development	Focuses on policy formulation, standards, and regulations around information technology
Nigeria Postal Service (NIPOST)	Postal & Courier Services Management	Provides digital financial services, logistics, and e-commerce solutions
Galaxy Backbone	ICT Infrastructure Services Provider	Facilitates the establishment of e-government platforms and initiatives
Nigeria Data Protection Bureau (NDPB)	Data Privacy & Cybersecurity	Ensures digital activities and personal data in the country are secure and protected.

- **Nigeria Internet Registration Association (NiRA)**

NiRA was established in 2005 and was created because of the re-delegation of the management of Nigeria's Internet country code domain, '***.ng***,' by the Internet Corporation for Assigned Names and Numbers (ICANN). Before NiRA's formation, individual stakeholders handled the management of the '.ng' domain. However, the need for a more structured, nationally accountable body led to the creation of NiRA as a 'not-for-profit', self-regulating organization. NiRA is the official body responsible for managing the country code Top Level Domain (ccTLD) '***.ng***.' It plays a key role in Nigeria's digital ecosystem by ensuring the availability, stability, and growth of internet resources tied to Nigeria's national identity on the web.

NiRA facilitates the registration of '.ng' domain names through accredited registrars. This includes various second-level domains (e.g., com.ng, *.org, .ng, .edu.ng*) catering to different entities, from commercial organizations to educational institutions. NiRA is an independent organization but works closely with various stakeholders within Nigeria, including businesses, academic institutions, and government agencies like NITDA and the NCC, as well as international governmental bodies like Internet Corporation for Assigned Names and Numbers (ICANN), African Network Information Centre (AfriNIC), and the Internet Governance Forum (IGF).

- **National Space Research and Development Agency (NASRDA)**

NASRDA was established in 1999 under the Federal Ministry of Science and Technology to implement the country's space policy and strategy as a government agency responsible for space science, technology, and research. Its mission is to leverage space technologies for national development, improve the country's scientific and technological capabilities as well as supervise key regulatory agencies in the telecom sector, such as the Nigerian Communications Commission (NCC), Nigerian Postal Service (NIPOST), and National Information Technology Development Agency (NITDA).

NASRDA provides satellite technology (important for communication services) and operates under the Federal Ministry of Science, Technology, and Innovation.

1.2.2 Private Sector Institutions

The key business and commercial aspects of the telecommunication industry are largely carried out by private sector institutions, which include the following service providers:

- Mobile network operators
- Mobile network Infrastructure providers (TowerCos)
- Data centres
- Internet service providers
- Internet support providers
- Software & hardware service providers

➢ Mobile Networks

There are four GSM mobile network operators in the Nigerian market: **MTN** with over 78million subscribers, **Airtel** with over 53 million**, Glo** with over 19 million, and **9mobile** (formally Etisalat Nigeria) [12], with approximately 3.6 million subscribers bringing the total active subscribers to over 150 million, according to the last review of subscriber data by NCC.

Key Mobile Operators in Nigeria Stakeholders
MTN Nigeria
Airtel Nigeria
Globacom Limited
9Mobile

➢ Mobile network Infrastructure Providers (Tower Companies - TowerCos)

Over the past two decades, the Tower Company (TowerCo) model has emerged as a strategic solution to streamline and optimize the management of a wide array of telecommunications infrastructure[13]. TowerCos are specialized firms that own, operate, and lease telecommunications towers and related infrastructure to mobile network operators (MNOs) and other service providers. This model allows MNOs to focus on their core business, providing mobile network and data services while outsourcing the management and maintenance of passive infrastructure and services such as towers, rural connectivity projects, remote management systems, and energy management systems to specialized companies that own, operate, and lease telecommunication towers and related infrastructure to MNOs and other communication service providers.

[12] https://www.ncc.gov.ng/statistics-reports/industry-overview#gsm
[13] https://businessday.ng/backpage/article/why-telco-towers-are-critical-to-nigerias-economic-growth-security/

One of the key demand-side drivers behind the rationale that has pushed the TowerCo business model to gain momentum as MNOs seek to improve profitability is the intensity of increasing competition that has resulted in tighter profit margins for the MNOs[14]. According to the Regional Guide for TowerXchange's Africa Guide, Q3 2024, there are over forty thousand (40,656)[15] towers in Nigeria, however a September 2024 report by Punch.ng had reported that over 50 million litres of diesel is consumed each month[16] (about 1.67 million litres per day) to power base transceiver stations (BTS). This fuel consumption would result in an estimated 1.6 $MtCO_2e$/yr of GHG emissions per year, which amounts to about 0.46% of the country's total annual emissions. This significant fossil fuel consumption is primarily due to the country's unreliable electricity grid, which necessitates the use of diesel generators as a primary or backup power source for these towers.

By facilitating infrastructure sharing, the TowerCo model can also generate operating expense (OPEX) savings (e.g., sharing of the cost of electricity, land rents, and site maintenance costs), which can alleviate a continuous drop in the revenue per user for MNOs and, therefore, improve profitability. In Nigeria and Ghana, MNOs (MTN, Airtel, and Etisalat) carved out their towers to independent TowerCos (IHS, ATC, PAT, etc.). Below is a chart (See, Figure 1) showing each tower company's estimated number of towers.

Telecom tower companies are actively transitioning telecom towers to clean, off-grid alternative energy sources like solar power. This shift is driven by the need to reduce operational costs and environmental impact, especially in remote or off-grid locations. This reveals that TowerCos are actively exploring and implementing solar power solutions for telecom base stations, particularly in off-grid and remote locations, with pilot projects also occurring in developed markets. While full-scale adoption is still emerging, solar-powered telecom towers are becoming a key part of the industry's strategy to reduce operational costs and environmental impact. An interview with the CEO of one of the Nigeria telecom companies by Punch revealed that most telecom operators no longer own their base stations, having transferred them to tower companies that manage and maintain infrastructure for multiple network providers and over 20% of base stations in Nigeria are currently powered by solar energy. This figure highlights a significant gap and an opportunity for transformation. The industry has coined the term "tower power" to describe this ongoing move toward energy-efficient infrastructure.

[14] Georges et. al., (2021) Enabling A Competitive Mobile Sector in Emerging Markets Through the Development of Tower Companies
[15] TowerXchange's Africa Guide, Q3 24 – www.towerxchange.com
[16] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/

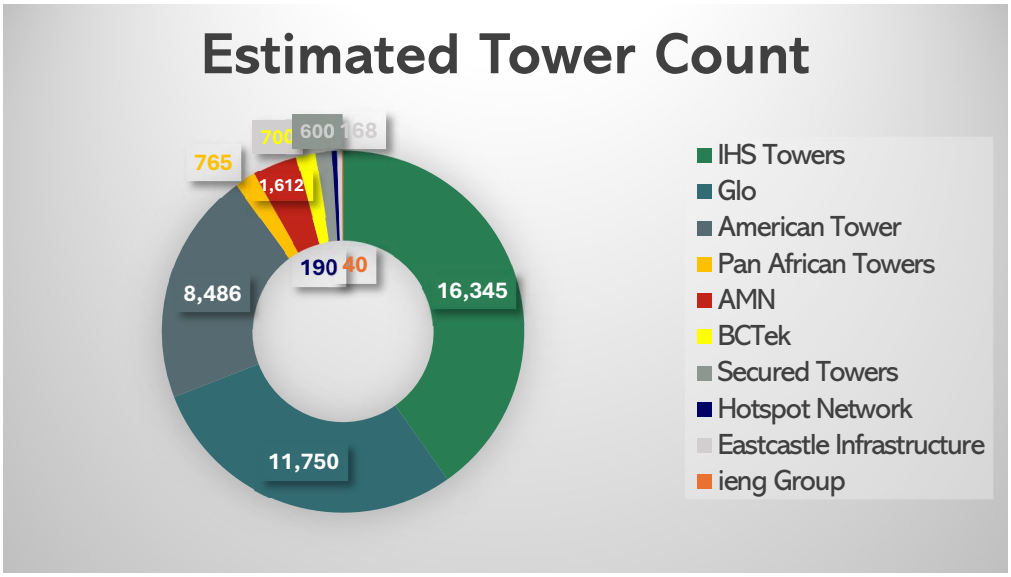


Figure 1: Chart showing the number of towers owned by TowerCos in Nigeria

Nigeria is a benchmark for the tower market model because it has been the oldest independent TowerCo market in Africa. Some of the major key players in the TowerCos operating globally and in Nigeria include:

AMN (Africa Mobile Networks): Africa Mobile Networks (AMN) builds, owns, operates and maintains mobile network infrastructure, delivering services for the biggest MNOs in Africa. AMN's Network-as-a-Service (NaaS) model allows Africa's tier-1 Operators to expand their network coverage deep into rural areas, with no capex investment and no OPEX risk.

AMN uses highly advanced technology to enable services to be delivered economically and sustainably to smaller communities than has ever been possible before. AMN is bringing 2G, 3G and 4G voice and data connectivity to towns and villages which have previously been unconnected. AMN currently operates more than 4,000 base stations in 15 countries and ultimately will cover almost every country in sub-Saharan Africa. In August 2020, AMN announced the completion of the acquisition of US-based Range Networks Inc., as the basis for the development of its own in-house Radio Access Network (RAN) equipment.

AMN's radio access network (RAN) uses a standard design which integrates power, backhaul connectivity and the local access network in a single structure for lowest capex and most efficient deployment. AMN Standard base stations are deployed in typically 4 hours.

The power system is based on solar technology, which is environmentally friendly and comes with zero opex. Solar panels, mounted on the Standard (12m monopole) or Extended (20m self-supporting lattice) tower, generate energy from the sun, which charge a highly sophisticated Lithium-Ion

battery pack, made up of 288 cells controlled by a management computer and offering up to 3 days of autonomy.

In 2019, the rural specialist tower AMN entered the market, providing a low-cost rural network revenue share model. Since their first contract with MTN to deliver 420 rural sites in 2020, AMN has reached over 1,000 towers[17].

American Tower Corporation (ATC): ATC is a global TowerCo with operations in Nigeria. It became a significant player in the Nigerian market after acquiring Eaton Towers in 2019. ATC leases its infrastructure to major operators like **Airtel and MTN**, promoting infrastructure sharing to improve coverage, particularly in rural areas. American Tower entered the market in 2014 after acquiring over 4,500 of Airtel's towers while working with both Airtel and MTN.

Under American Tower and Airtel's partnership, new sites will adhere to American Tower's new green site specifications, which will reduce emissions while advancing American Tower's ambitious Science-Based Targets (SBTs). ATC has had a leading portfolio of wireless communications sites in all 36 states and the Federal Capital Territory, with over 8,600 towers in prime locations, **97% of their tower sites run on renewable energy** and have 99.9% uptime availability.

ATC has implemented several measures to reduce emissions in its Nigerian operations. The company has invested in energy efficiency improvements, renewable energy deployments, and energy storage solutions to decrease on-site reliance on fossil fuels[18]. Additionally, ATC has adopted science based GHG emissions reduction targets, aiming to reduce GHG emissions by at least 40% by 2035 against a 2019 baseline[19]. These initiatives are part of ATC's broader strategy to align with global climate goals and promote sustainable operations.

IHS Towers: IHS Towers has been running a small rural pilot of about 400 sites with MTN but was largely unsuccessful due to the price sensitivity of the towers. IHS Towers is investing heavily in upgrading power systems through their 'Big Five' initiative, replacing diesel generators with solar hybrid solutions on over 10,000 towers, and is looking now at options to supply power beyond the tower, which may require tripling the energy generation capacity of some sites. IHS has also signed an ESCO contract with Energy Vision.

IHS Towers acquired the portfolios of Etisalat and MTN and further consolidated their position by acquiring over a thousand of HTN Towers' sites as well as sites from Hotspot Network. IHS Towers

[17] https://developingtelecoms.com/telecom-technology/satellite-communications-networks/15809-intelsat-and-afn-to-deploy-new-towers-in-madagascar-rwanda-and-drc.html
[18] https://www.businesswire.com/news/home/20221009005035/en/American-Tower-and-Airtel-Africa-Announce-Strategic-Partnership?utm
[19] https://www.businesswire.com/news/home/20221106005088/en/American-Tower-and-PowerX-Announce-Strategic-Partnership-to-Drive-Sustainability-in-the-African-Telecommunications-Industry-Through-Innovative-AI-Solutions?utm

have a license to deploy fibre in Nigeria, and they are starting to formulate their fibre strategy, having identified about a third of their towers that they think have a good business case to deploy fibre to. IHS Towers is the largest TowerCo in Nigeria, having acquired the portfolios of Etisalat (now 9mobile) and MTN and consolidating TowerCo HTN Towers, in addition to buying up sites from Hotspot Network. IHS Towers also operates a fibre business and have deployed about 10,000km of cabling.

After a long, tumultuous period, IHS Towers recently renewed its lease on about 14000 sites with MTN until 2032 with new financial terms that reduced the USD-indexed component of the leases. IHS Towers, ATC Nigeria, and MTN Nigeria have agreed to a revision and reallocation of over 2,000 contracted sites that MTN did not renew with IHS Towers in 2023. ATC Nigeria will host MTN on over 2,000 new sites, while IHS will retain about 1,500 co-locations. This includes an addition of about 1,000 new sites to be rolled out over the next few years, allocated between both TowerCos.

ATC deploy solar energy, hybrid power sources and deep cycle battery technology to reduce our diesel dependency and CO2 emissions[20]—by working to decrease use of diesel, increase use of renewable energy wherever possible, and carefully manage our environmental risk—while also improving network availability. They have developed cutting-edge network operating centres to monitor tower sites in real time and ensure diesel deliveries are as efficient as possible.

Pan African Towers (PAT): PAT is a Nigerian-owned TowerCo with a strategic focus on providing affordable and efficient tower solutions to mobile operators in the country. PAT collaborates with both local and international players to increase its tower portfolio and extend coverage to more areas. Pan African Towers currently has over 750 towers in the country and is working with an ESCO partner to switch away from diesel.

Pan African Towers is one of Nigeria's largest TowerCo and has an injection of new capital from new shareholders, such as Development Partners International and Verod Capital. The TowerCo has been decommissioning sites over the last couple of years, causing their total count to drop from well above 1,000 to approximately 800 sites, as over 200 sites are inactive and unlikely to come back online soon.

PAT has implemented various emission reduction strategies, including optimizing its energy mix. The company remains firmly committed to minimizing its carbon footprint, with ongoing efforts that include, but are not limited to, the following:

1. Implementation of solar power for our sites (79nos) at the Northern, Nigeria. This provides complementary and significant power for our infrastructure, supporting the diesel-powered generator in a balance ratio, thereby reducing significant percentage of the associated

[20] https://www.ihstowers.com/sustainability/four-pillars/environment-and-climate-change

emission. We are determined to implement the solar system for more sites and extend to other regions of the country.

2. Unlocking the national grid power provision for our infrastructure in Southwest, with Lagos as pilot (128 sites). This giant stride reveals our intentions to reduce our associated emission (especially scope 1), whilst we review the efficiency of this energy mix, we hope to extend same to other regions.

RAK Unity (formerly SWAP Technologies & Telecoms Plc): RAK Unity is an indigenous TowerCo in Nigeria that evolved from SWAP Technologies (Sustainable Wireless Access Providers Technologies). It has been involved in building and leasing telecom infrastructure since the early 2000s. They serve as Tier-2 mobile operators and Internet Service Providers (ISPs) alongside the larger MNOs, providing tailored solutions for smaller market players.

Globacom: Glo ranks among the top three mobile network operators in Nigeria, (alongside MTN and Airtel) and operates an extensive tower network across the country with over 8000 telecom towers. These towers support its nationwide mobile and data services, but like much of Nigeria's telecom infrastructure, they rely heavily on diesel generators due to the country's inconsistent grid power supply. It is worth mentioning that while Glo operates an extensive tower network, it does not provide infrastructural services beyond its own operations.

Table 3: Africa's biggest tower transactions till 2023 – Nigeria Specific[21]

Year	Seller	Buyer	Tower Count	Deal Value (MUS$)	Cost/tower (US$)	Deal Structure
2016	Hotspot Network	IHS	85	Unknown	Unknown	Portfolio Acquisition
2016	HTN Towers	IHS	1,211	Unknown	Unknown	Company Acquisition
2015	Etisalat	IHS	555	Unknown	Unknown	SLB
2014	Airtel	American Tower	4,717	1,060	224,719	SLB
2014	MTN	IHS	8,850	984	226,911	Joint venture (IHS 49%, MTN 51%)
2014	Etisalat	IHS	2,136	485	227,060	SLB
2010	Starcomms	SWAP	407	81	199,017	SLB
2010	Visafone	IHS	800	67	83,750	SLB
2010	Multilinks	HTN	400	Unknown	Unknown	MLL

Source: TowerXchange's Sub-Saharan African guide, Q3 2024 Update

[21] TowerXchange's Africa Guide Q3 24

- **Data Centres**

Data centres are an important aspect of the telecommunication industry. They are responsible for housing the infrastructure required to manage large data, ensure network reliability, and support cloud services. Some of the functions of the data centres include providing network infrastructure, storing and managing vast amounts of data, cloud services, deploying edge computing technologies (distributed computing,) and ensuring sustainability and efficiency. Nigeria has seen a remarkable increase in data centres due to increasing digital demand across various sectors, including telecommunications, banking, and government services.

Data Centres contribute to the country's GHG emissions due to their high energy consumption and reliance on electricity, often generated from diesel powered generators which in most cases serve as the main source of power generation. It should be emphasized that based on research the Nigerian data centre industry, data centres had a capacity of about 116 megawatts (MW) in 2024 which translates to 2 MtCO2e (0.5% of Nigeria's total annual emissions.) Cooling systems, essential for maintaining equipment performance, can contribute to emissions using hydrofluorocarbons (HFCs), potent greenhouse gases. Diesel or natural gas-powered generators emit CO_2 and nitrogen oxides (NO_x) during power outages.

Several data centres in Nigeria are actively implementing sustainability measures to reduce emissions and enhance energy efficiency. For instance, Africa Data Centres has partnered with Distributed Power Technologies to develop solar photovoltaic power plants for its facilities in Lagos, aiming to decrease reliance on non-renewable energy sources[22]. Additionally, the adoption of green computing initiatives, such as virtualization and energy-efficient hardware, has led to significant reductions in energy consumption across various Nigerian data centres[23].

The objective of engaging data centres is to enable them to adopt and internalize carbon taxes as part of a broader strategy to regulate and to further reduce their emissions. The expected outcome includes incentivising data centres to adopt energy-efficient technologies, transition to renewable energy, and improve operational practices. This will ultimately reduce emissions, encourage sustainability, and ensure compliance with environmental regulations while generating revenue to fund climate action initiatives.

Data Centres
Africa Data Centres (Cassava Techologies)
Digital Realty
WIOCC (Open Access data Centres)

[22] https://www.cassavatechnologies.com/africa-data-centres-turns-to-solar-solutions/?utm
[23] https://ajpojournals.org/journals/index.php/AJCE/article/view/1905?srsltid=AfmBOookhvEut-2zYevYCfNbZykGS0og-CMwEqCdm0rJFSl0HetVYE1ZY&utm

Data Centres
Jovis Nigeria Limited
Rack Centre

- **Internet Service Providers (ISPs)**

These companies offer services such as internet access, email hosting, and domain registration to consumers and businesses. In Nigeria, the top ISPs include a mixture of mobile network operators and dedicated internet companies. Identification is based on factors such as:

i. **Coverage and Availability**: Here, MTN, Airtel, Glo, and 9Mobile dominate due to their extensive mobile network.
ii. **Internet Speed**: This is measured in Megabits per second (Mbps) and the providers that offer fast and reliable speeds (5g, 4GLTE, or fibre optic network).
iii. **Customer Service:** Responsive and effective customer service qualifies an ISP as top-ranked.
iv. **Pricing:** This includes a competitive pricing and data plan. ISPs that provide affordable and flexible data plans attract a large customer base.
v. **Reliability:** Consistency in the provision of stable and uninterrupted service makes the company top-ranked within the sector.
vi. **Technology and innovation:** The use of new technologies, such as fibre-optics, in Fibre One and the rollout of the 5G network in MTN Nigeria qualifies a provider as top-ranked.

Internet Service Providers (ISPs)
Spectranet
FiberOne Broadband Ltd
Starlink Internet Services Nigeria Ltd
Tizeti Network Ltd
ipNX Nigeria Ltd
Broadbased Communications Ltd
VDT Communications Ltd
Cobranet Ltd
Radical Technology Network Ltd (Coollink.Ng)
Cyberspace Network Ltd

MTN has been identified to have the largest subscriber base, exceeding 78 million users, according to NCC's Q3 2024 report[24]. The attainment is specifically born of their extensive network coverage (3G, 4GLTE, and recently 5G) and consistent brand marketing.

[24] https://ncc.gov.ng/

Table 4: Network providers and digital capacity

Network Provider	Subscription	Standard Network
MTN Nigeria	Over 78 million subscribers	3G, 4GLTE, and 5G
Airtel Nigeria	Over 53 million subscribers	4GLTE
Glo Nigeria	Over 19 million subscribers	4GLTE
9 Mobile	Subscriber base exceeds 3 million	4GLTE
Spectranet	Over 110 thousand active subscribers[25]	4GLTE
Smile	Over 200 thousand subscribers[26] (October 2024).	4GLTE
ipNX	Over 15 thousand subscriptions[27]	Fibre-to-the-home (FTTH) using Fiber-optic network
FibreOne	About 27,000 active subscribers 2023.[28]	Fiber-optic network

Like data centres, ISPs contribute primarily to GHG emissions through their energy-intensive operations, which depend on fossil fuel sources for electricity generation, emitting CO_2 and other GHGs. Given the role of ISPs in the telecommunication sector, engaging them will facilitate the smooth implementation and operationalization of the carbon tax in relation to their activities. Over time, the tax is expected to incentivise ISPs to transition to renewable energy sources, adopt energy-efficient technologies, and improve operational practices. These measures will ultimately contribute to GHG emissions reduction and support the country's alignment with its climate targets.

- **Integrated bodies (Data Centres & Providers)**

Integrated data providers or centres help aggregate and deliver data from multiple sources into a unified platform to provide a complete, accurate, and up-to-date dataset. They play a crucial role in data management by ensuring that users have access to comprehensive and consistent datasets. The basic role of integrated data providers includes:

- **Data Aggregation**: Collection of data from various sources, such as databases, APIs[29], and other data repositories.
- **Data Normalization:** Processing of data to ensure consistency in format and structure, ensuring ease of analysis and use.

[25] https://www.ncc.gov.ng/statistics-reports/subscriber-data#internet-service-operator-data
[26] https://www.ncc.gov.ng/statistics-reports/industry-overview#voip-2
[27] https://www.ncc.gov.ng/statistics-reports/subscriber-data#internet-service-operator-data
[28] https://www.ncc.gov.ng/statistics-reports/subscriber-data#internet-service-operator-data
[29] A telecom API (application programming interface) is a set of protocols, tools, and definitions that allow different software applications to communicate and interact with telecom network services.

- **Real-time Access**: This is offered as real-time data access, allowing users to make timely decisions based on the most current information.
- **User-friendly Interfaces:** Provision of dashboards or user interfaces that simplify data retrieval and analysis for users, even those without technical expertise.
- **Enhanced Analytics**: Integrating data from different sources enables providers to present more sophisticated analyses and insights, which can lead to better decision-making.

Integrated data centres and providers rely on servers, storage systems, networking equipment, cooling systems, power backup systems, rack systems, etc., all of which depend on fossil fuel sources for power generation, resulting in significant CO_2 emissions. Additionally, the cooling systems used to regulate the temperature of critical hardware typically rely on HFCs as refrigerants. Engaging these integrated data providers would facilitate the acceptance and operationalization of the carbon tax, which in turn will create economic incentives for reducing their carbon footprint. The goal is to encourage operators to transition to renewable energy sources, adopt more energy-efficient technologies, and explore low-emission cooling alternatives. The expected outcome is a reduction in overall GHG emissions, increased energy efficiency, and a more sustainable operational model for data centres. Moreover, the carbon tax could generate valuable funds for reinvestment in environmental initiatives, supporting broader climate mitigation efforts and ensuring alignment with national and international sustainability standards.

- **Consumer Segment (End-Users)**

Consumers, encompassing individuals, businesses, and institutions, are essential stakeholders in the telecommunication sector and will play a pivotal role in developing a carbon tax. Their influence can include advocacy for green practices, compliance with tax-induced cost adjustments, and driving market shifts toward sustainable solutions. Notably, Nigeria's telecommunication industry serves over 220 million active subscribers, though mobile broadband penetration declined to 41.56% in September 2024.

One critical role of consumers is their ability to advocate for sustainable practices. Increasingly aware of environmental issues, they can push demand for service providers to adopt renewable energy sources and low-emission technologies. This demand can be a strong driver for regulatory changes, including the introduction of the carbon tax.

However, the implementation of a carbon tax may have financial implications for consumers. Telecommunication companies might transfer some of the costs associated with the tax to end-users through higher prices for services such as mobile data, voice calls, and broadband. Studies in similar

economies suggest that taxes on emissions can lead to a 2-5% increase in service costs[30], which could pose a challenge to low-income consumers. To manage these impacts, policymakers may consider offering subsidies or incentives for affordable services and ensuring a gradual tax implementation to allow consumers time to adjust.

Engaging consumers in the development of the pilot carbon tax for Nigeria's telecommunication sector is crucial for ensuring fairness and increasing public support. Their feedback would help to ensure that the carbon tax structure aligns with public priorities. Ultimately, consumer engagement would foster a more inclusive, effective, and widely accepted carbon tax that would benefit the environment and society.

[30] https://nypost.com/2025/01/12/us-news/nys-kathy-hochul-to-unveil-cap-and-invest-plan-critics-warn-could-send-gas-prices-soaring-12-cents-per-gallon/?utm

1.3 Stakeholders Mapping Quadrant

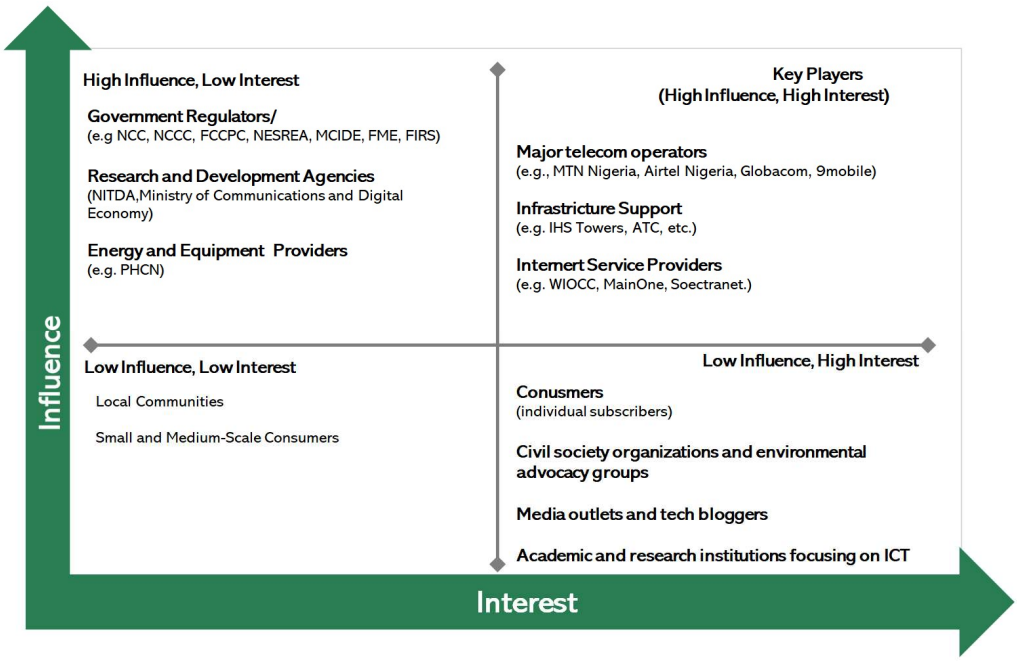


Figure 2 Quadrant showing categorization of stakeholders

The stakeholder quadrant analysis for the development of a carbon tax in Nigeria's telecommunication sector provides a comprehensive view of how different groups can influence or be impacted by the initiative. Key stakeholders, including consumers, telecommunication companies, government bodies, and environmental organizations, each play distinct yet interconnected roles. Consumers, as active participants, can drive demand for greener practices and influence market trends. Telecommunication companies will be directly impacted by the tax (and intermittently internet service and infrastructure support providers), potentially facing cost increases and adjustments to business models but also contributing to emission reductions. Government bodies responsible for policymaking and regulation will need to balance economic and environmental goals, ensuring effective tax implementation and fair pricing. Environmental organizations will advocate for robust environmental policies, providing expertise and public support. Engaging these stakeholders is critical for ensuring the carbon tax's success, as their feedback helps to ensure the tax is fair, effective, and the wide acceptance of the tax.

1.4 Assessing Influence and Interest in Nigeria's Telecommunication Industry

The assessment of influence in Nigeria's telecommunication sector is based on the degree of authority, decision-making power, and control that stakeholders exert over policies, infrastructure, and industry operations. High-influence stakeholders typically have regulatory oversight, financial investment, or operational control over critical aspects of the telecom value chain. For instance, government regulators such as NCC, NCCCS hold significant power due to their ability to enforce compliance and shape industry regulations. Similarly, major telecom operators like MTN, Airtel, and Globacom are considered highly influential because they control infrastructure, market expansion, and service delivery, directly affecting industry performance.

On the other hand, interest is assessed based on stakeholders' level of engagement, and concern regarding the sector's growth, sustainability, and regulatory policies. Key factors influencing stakeholder interest include economic incentives, business dependency, advocacy focus, and operational priorities. Major telecom operators and infrastructure providers, for example, demonstrate both high influence and high interest because their revenue and strategic expansion are directly tied to the sector's performance. Meanwhile, consumers, civil society organizations, and advocacy groups exhibit high interest but lower influence, as they actively seek better service quality, regulatory reforms, and sustainability initiatives but lack direct control over industry decisions.

Stakeholders within the same quadrant may have varying degrees of both influence and interest, requiring further differentiation. For instance, within the high influence, low interest category, regulators such as the NCC are more engaged in industry governance than organizations like NESREA, which primarily focuses on environmental compliance. Similarly, within the low influence, high interest quadrant, civil society groups and research institutions may have more capacity to drive discussions on telecom sustainability compared to individual consumers, who remain largely passive.

The table below provides a quick summary of relevant stakeholders operating in the telecommunications sector.

Table 5: Key stakeholders in the Telecommunication sector based on category.

Stakeholder Category	Stakeholders
Mobile Network Operators	MTN Nigeria
	Airtel Nigeria
	Globacom Limited
	9Mobile (Emerging Markets Telecommunication Services Ltd)
Data Centres	Africa Data Centres (Cassava Technologies)
	Digital Realty

Stakeholder Category	Stakeholders
	WIOCC (Open Access Data Centres)
	Jovis Nigeria Limited
	Rack Centre
Internet Infrastructure	MainOne
Internet Services	Spectranet
	FiberOne Broadband Ltd
	Starlink Internet Services Nigeria Ltd
	Tizeti Network Ltd
	ipNX Nigeria Ltd
	Broad-based Communications Ltd
	VDT Communications Ltd
	Cobranet Ltd
	Radical Technology Network Ltd (Coollink.Ng)
	Cyberspace Network Ltd
Infrastructure Support/ Tower-Cos	IHS Towers
	American Tower Cooperation Nigeria (ATC)
	Pan African Towers (PAT)
	RAK Unity
	Africa Mobile Network (AMN)
Software and Hardware Services	Ericsson Nigeria
	Huawei Technologies Nigeria
	Nokia Networks Nigeria
	ZTE Corporation
	Cisco Systems
	Samsung Networks
Regulators	Nigerian Communications Commission (NCC)
	National Environmental Standards and Regulations Enforcement Agency (NESREA)
	Federal Competition and Consumer Protection Commission (FCCPC)
Policy Maker	Federal Ministry of Communications and Digital Economy
Revenue	Federal Inland Revenue Services (FIRS)
Training Institute	Digital Bridge Institute (DBI)
Research & Development	National Information Technology Development Agency (NITDA)
Consumers (End Users)	Individual Subscribers, Large companies using Internet services

The table below shows the key stakeholders in the telecommunications sector recommended to be considered under the carbon tax framework.

Table 6: Telecommunication Operators to be considered for the carbon tax.

Stakeholder Category	Stakeholders	Emission Data Remarks
Mobile Network Operators	MTN Nigeria	1.6 $MtCO_2e$ [Estimated from 50 million litres of diesel consumed per month[31] — about 1.67 million litres per day]
	Airtel Nigeria	
	Globacom Limited	
	9Mobile (Emerging Markets Telecommunication Services Ltd)	
Data Centres	Africa Data Centres (Cassava Technologies)	2 $MtCO_2e$ [116 megawatts (MW) in 2024 which translates to 2 MtCO2e]
	Digital Realty	
	WIOCC (Open Access Data Centres)	
	Jovis Nigeria Limited	
	Rack Centre	
Internet Services	Spectranet	Data is unavailable.
	FiberOne Broadband Ltd	
	Starlink Internet Services Nigeria Ltd	
	Tizeti Network Ltd	
	ipNX Nigeria Ltd	
	Broad-based Communications Ltd	
	VDT Communications Ltd	
	Cobranet Ltd	
	Radical Technology Network Ltd (Coollink.Ng)	
	Cyberspace Network Ltd	
Infrastructure Support/ Tower-Cos	IHS Towers	975 $MtCO_2e$ [32] (Carbon footprint includes data from Brazil, Colombia, Peru, Cameroon, Côte d'Ivoire, Nigeria, Rwanda, South Africa, Kuwait, UAE, the UK, USA, Egypt and Zambia)
	American Tower Cooperation Nigeria (ATC)	13.7 $MtCO_2e$[33] (No Nigeria-specific data available)
	Pan African Towers (PAT)	12.76 $ktCO_2e$ (estimated based on assumptions)
	RAK Unity	Data is unavailable

[31] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/
[32] https://www.ihstowers.com/content/dam/ihs/corporate/documents/sustainability/Sustainability-reports/IHS-Towers-2023-Sustainability-Report.pdf
[33] Energy and Greenhouse Gas Emissions Data - https://pardot.americantower.com/l/25692/2024-07-10/7vby66/25692/1721263478tBVZz3pl/atc_2023_energy_and_greenhouse_gas_emissions_data_supplement.pdf

Stakeholder Category	Stakeholders	Emission Data Remarks
	Africa Mobile Network (AMN)	26.88 $ktCO_2e$ (estimated based on assumptions)

The table below provides a comparative analysis of key operators, highlighting the rationale for consideration, their emission reduction potential, and the associated pros and cons of introducing a carbon tax across the sector.

Table 7: Evaluation of Carbon Tax for Telecom Sector Operators

Stakeholder Category	Rationale for consideration	Emission Reduction Potential	Pros	Cons
Mobile Network Operators	High energy use, reliance on diesel generators	Significant reduction by adopting renewable energy	i. Encourages reduction in fossil fuel use ii. Supports achievement of emission reduction targets iii. Possible eligibility for international green funding as incentive for energy efficiency	i. High operational cost associated with transitioning from diesel to renewable energy systems, including installation, maintenance, and other technology upgrades ii. Potential tax impact on consumers via increased tariff iii. Capital strain and operational challenges for transition iv. Potential Service disruptions as renewables do not have capacity for 24/7 reliability in off-grid areas.
Data Centres	Moderate to high emissions, depending on energy source	Can invest in renewable energy sources to reduce emissions	i. Renewable energy adoption potential ii. Eligibility for international green funding	i. High capital costs for energy transition ii. Grid-tied renewable challenges and grid instability i.e. brownouts, surges
Infrastructure Support/ TowerCos	Moderate emissions, high reliance on electricity for tower operations	Potential for energy efficiency improvements	i. Encourages the full scaling of existing green technologies. ii. Lower long-term operational cost.	i. Operational risks during transition due to inaccessibility to remote tower sites. ii. Increased costs of lease rates passed on to MNOs

Internet Infrastructure Providers (ISPs)	Low emissions from fibre-optic and wireless systems	Lower emissions, but potential for more efficiency	i. Promote green initiatives and energy-efficient infrastructure ii. Lower long-term operational cost.	Possibly lower incentives for reduction as they already emit far less that other considered stakeholders.

SECTION 2: CARBON TAX DESIGN

2.0 Introduction

Carbon tax is a mitigation tool that helps address climate change issues. It is designed to reduce GHG emissions by putting a price on carbon emissions (levied per tonne of GHG (tCO_2e) emitted) from production activities. A carbon tax is a policy measure that properly imposes the socio-economic cost of carbon emissions on the polluter. The tax is levied per tonne of GHG (tCO_2e) emitted. According to the International Monetary Fund's (IMF') assessment, some of the key points of the carbon tax are highlighted as follows[34]:

- Carbon tax plays a central role in reducing GHGs.
- It has both economic and social implications, which can mitigate the economic impact on consumers, especially in low-income households.
- Through the carbon tax, there is a proposed International Carbon Price Floor (ICPF) among major emitting countries to establish a minimum carbon price to drive emission reductions.
- IMF emphasizes that carbon taxation should be part of a broader climate mitigation strategy.

Carbon Tax and the Pigouvian Tax

The carbon tax aligns with the principles of a Pigouvian tax[35] by correcting market inefficiencies and restoring social equilibrium. Pigouvian tax discourages negative externality, seemingly, the carbon tax is designed to address the externality of carbon emissions. A carbon tax directly charges a fee on each unit of carbon emitted, thus making the price of carbon-intensive goods and services reflect their true social costs (environmental and health impacts), internalising the externality of carbon emissions and creating incentives for individuals and businesses to reduce emissions.

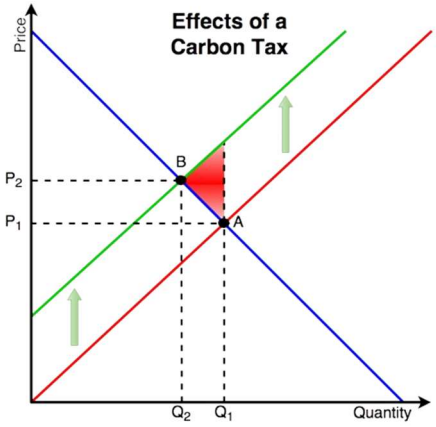


Figure 3: Pigouvian Tax showing the effect of the carbon Tax

[34] https://www.imf.org/en/Publications/fandd/issues/2019/06/what-is-carbon-taxation-basics
[35] https://energyeducation.ca/encyclopedia/Pigouvian_tax

From the **Figure 3** above, at Point A, the market is efficient, and supply meets demand. However, the market is not socially efficient because the cost to others is not accounted for. To compensate for the negative effects of an externality, a tax is imposed, raising the price from P1 to P2. The implementation of the tax and the subsequent rise in the price to the consumer reduce the quantity demanded from Q1 to Q2.

For the telecommunication industry, the tax reduces the demand for fossil fuels to generate electricity, thus reducing overall emissions. The revenue generated can be used to remediate environmental damage or invest in cleaner generation technologies. At Point B, the market is socially efficient as the external costs to others have been internalised using the tax.

2.1 Country Specific Examples

Globally, several countries and jurisdictions have implemented carbon taxes. As of the end of 2024, there are 39 carbon tax programs implemented across the world[36]. However, below are selected countries we consider critical for the carbon tax design in Nigeria. These countries were selected based on their diverse economic structures, resource dependency, and varied approaches to carbon pricing. Also, these countries are relevant in making informed decisions, and they provide valuable insights for Nigeria's pilot carbon tax. However, it should be noted that no country has a direct telecommunication focal tax, but they possess taxes that can influence the telecommunications industry. Canada, with its federal and provincial carbon tax frameworks, offers lessons on balancing national and subnational regulatory autonomy an important consideration for Nigeria's multi-tiered governance system. Argentina, as an emerging economy with significant fossil fuel reliance, highlights the challenges and opportunities in integrating carbon pricing into an energy-dependent economy. Colombia, with its gradual approach to carbon taxation and reinvestment in sustainable initiatives, provides insights into ensuring policy acceptability and effectiveness. South Africa, as the only African country with an operational carbon tax, presents a critical regional reference point, particularly in addressing economic competitiveness concerns and mitigating the socio-economic impact of carbon pricing on industries and consumers.

These case studies serve to inform Nigeria's pilot carbon tax design by demonstrating different pathways to implementation, enforcement mechanisms, revenue utilization strategies, and stakeholder engagement approaches. Understanding these international experiences will help tailor a carbon pricing system that aligns with Nigeria's economic structure, energy realities, and climate commitments.

Carbon Tax in Canada[37]

The two main ways of putting a price on carbon currently used in Canada are the carbon tax and the cap-and-trade system. As of 2019, carbon pricing applies throughout Canada. The GHG Pollution Pricing Act, adopted on June 21, 2018, established a federal carbon pricing initiative called the Federal Backstop system. This follows the Pan-Canadian Approach to Pricing Carbon Pollution announced by the Prime Minister of Canada in October 2016. The approach gave provinces and territories flexibility to develop their carbon pricing initiative and outlined all initiatives' criteria, thus

[36] https://carbonpricingdashboard.worldbank.org/
[37] https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information.html

establishing a federal benchmark for carbon pricing. The federal backstop system comprises a carbon tax, baseline, and credit ETS component.

Since 2019, the Canadian government has ensured it is no longer free to pollute by establishing a national minimum price on carbon pollution starting at $20 (CAD) per tonne in 2019, increasing at $10 (CAD) per tonne to $50 (CAD) in 2022. The Government's approach to pricing carbon pollution gives provinces and territories the flexibility to implement the type of system that makes sense for their circumstances as long as they align with minimum national stringency standards, or 'benchmark' criteria. Following engagement with provinces, territories and Indigenous leaders, it was decided that the minimum price on carbon pollution (for direct pricing systems) will increase by $15 (CAD) per tonne per year starting in 2023 through to 2030. The initial tax rate in Canada was $20 (CAD) ($14 (USD)), while the rate as of 2024 was $80 (CAD) ($59 (USD)) (See, **Table 10**).

Carbon Tax in Argentina[38]

In total, 17.4% of GHG emissions in Argentina are subject to a Net Effective Carbon Rate (ECR) in 2023. Explicit carbon prices in Argentina consist of carbon taxes, which cover 16.5% of GHG emissions in CO2e. Fuel excise taxes, an implicit form of carbon pricing, cover 35.7% of emissions in 2023. Fossil fuel subsidies cover 26.9% of emissions. Argentina's carbon tax was enacted in 2017 as part of a broader tax overhaul and was enacted in 2019. The tax replaced the ad valorem tax system. The carbon tax applies to CO_2 emissions from all sectors and includes practically all liquid fuels and coal, accounting for 20% of total Argentine GHG emissions. The carbon tax in Argentina covers all primary fossil fuels used as motor fuels or for heating purposes, excepting natural gas and Liquefied petroleum gas (LPG) used for heating purposes. The carbon tax exempts the use of fossil fuels in specific sectors and for purposes such as international aviation and shipping, export of the fuels covered, the share of biofuels in mineral oils, and raw materials in petrochemical operations. The initial tax rate in Argentina was ~10% of the full rate (on solid fuel), and the rate as of 2024 was 50-60 % of the full rate, given that there is an annual increase of 10% on coal and fuel oil, to reach 100% by 2028 (SeeSee, **Table 10**).

Carbon Tax in Colombia[39]

The Colombian carbon tax was implemented in 2017 as part of structural tax reform. The tax applies to all GHG emissions from all sectors with a few minor exceptions. It includes all liquid and gaseous fossil fuels used for combustion, which account for 24% of all GHG emissions in Colombia. Natural

[38] https://www.oecd.org/tax/tax-policy/carbon-pricing-argentina.pdf
[39] Colombia Carbon Tax at a Glance
https://ieta.b-cdn.net/wp-content/uploads/2024/02/Colombia-business-brief_Jan-23.pdf

gas consumers, not in the petrochemical and petroleum industries, are eligible for tax exemptions, as are consumers of fossil fuels certified to be carbon neutral. For 2023, the carbon tax price in Colombia is set between $4.60 (USD) and $5.80 (USD) (depending on the fuel type) and will increase every year in line with the consumer price index plus one percentage point. However, the initial tax rate was COP 20,500 ($4.8/tCO2) while the rate as of 2024 was COP 74,833 (~$19tCO2e)

Carbon Tax in South Africa[40]

Within the African region, South Africa has had success stories with the implementation of a carbon tax, and several other countries are already developing frameworks for its implementation. South Africa is one of the world's most carbon-intensive developing countries and its government is committed to substantially reducing GHG emissions by 2025 through the introduction of a carbon tax. The carbon tax in South Africa went into effect in 2019 and covers GHG emissions from industry, power, buildings, and transportation, regardless of the fossil fuel used. Under the Carbon tax, business entities that engage in activities that produce direct GHG are required to report under the 2017 National Greenhouse Gas Emission Reporting Regulations of the Department of Environment, Forestry and Fisheries (DEFF). The approach of the carbon tax is aligned to this mandatory emissions reporting to DEFF and any natural or juristic persons who exceed the DEFF thresholds for reporting, which also functions as the carbon tax threshold, are subject to the carbon tax. Emissions resulting from fossil fuel combustion, industrial processes and fugitive emissions are taxed in the equivalent of CO_2 at a rate of ZAR 120/tCO2e (~$8/tCO2e) for 2019[41] and ZAR 159/tCO2e (~$9-10/tCO2e) for 2024[42]. The Carbon offset allowance system provides flexibility to firms to reduce their carbon tax liability by either 5 or 10 % of their total GHG emissions. This is achieved by investing in projects that reduce their emissions. This system allows the reduction of GHG emissions in sectors or activities that are not directly covered by the tax.

The Carbon tax was gradually introduced in two phases: the first phase starting from 1 June 2019 to 31 December 2022 and the second phase from 2023 to 2030. The carbon tax rate increases annually by inflation plus 2% until 2022 and annually by inflation thereafter. However, tax exemptions ranging from 60% to 95% in numerous industries are also available to allow significant emitters time to transition their operations into cleaner technologies through investments in energy efficiency, renewables, and other low-carbon measures. Generally, the exemptions offered to industries strongly reduce the compliance cost, while preserving the incentive to cut emissions.

[40] https://esc-production-2021.s3.eu-west-2.amazonaws.com/2021/09/South-Africa-Carbon-Tax-Case-Study-FINAL.pdf
[41] Best exchange rate in 2019: 0.0693 USD
https://www.exchangerates.org.uk/ZAR-USD-spot-exchange-rates-history-2019
[42] Best exchange rate: 0.0585 USD 2024
https://www.exchangerates.org.uk/ZAR-USD-spot-exchange-rates-history-2024.html

African Countries' Efforts Towards Implementation of Carbon Taxes

Mauritius[43]

In 2008, Mauritius introduced the Maurice Ile Durable (MID) concept, which is aimed at making the country a world model for sustainable development and increasing the use of renewable energy in the country. MID puts a price on fossil fuels, and the instrument is only close to an explicit carbon tax. However, the current tax design in the country provides platforms to develop and implement an explicit carbon tax mechanism. Also, policies within the country, such as the National Environment Policy, the National Climate Change Adaptation Policy Framework, and the Masterplan for the Environment 2020-2030 can support the further development of CPI in Mauritius.

Senegal[44]

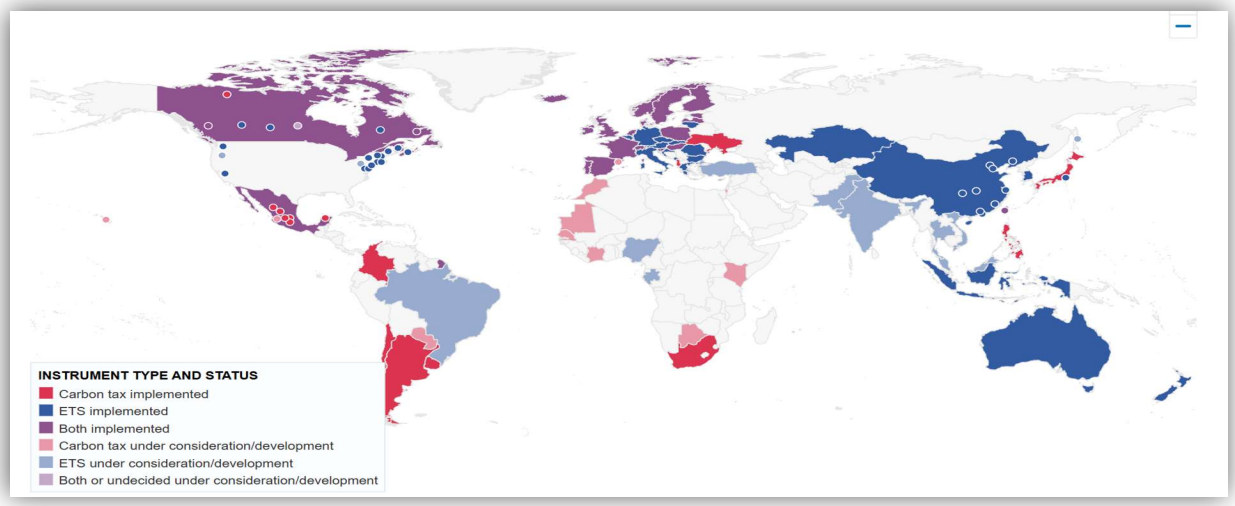
Senegal, in 2019, published a report on the study of the implementation of CPIs. The study aimed to assess the country's various options for introducing CPIs. While the study provided a detailed analysis of the country's national context, a carbon tax is preferable to an ETS if a generally acceptable redistribution of revenues can be achieved. The country is currently engaged in efforts to assess in a quantified manner the impact of a carbon tax under various parameters of the application and regarding the use of revenues.

Ghana[45]

Ghana's Parliament has passed the Emissions Levy Act, 2023, Act 1112, which became effective on 1 February 2024. The Act imposes a levy on carbon dioxide equivalent emissions from the Construction, Manufacturing, Mining, Oil and gas, Electricity, and heating and combustion emissions from vehicles. The set price is GHS100 per tonne ($ 6.4 (USD)/tonne)[46] of emissions per month.

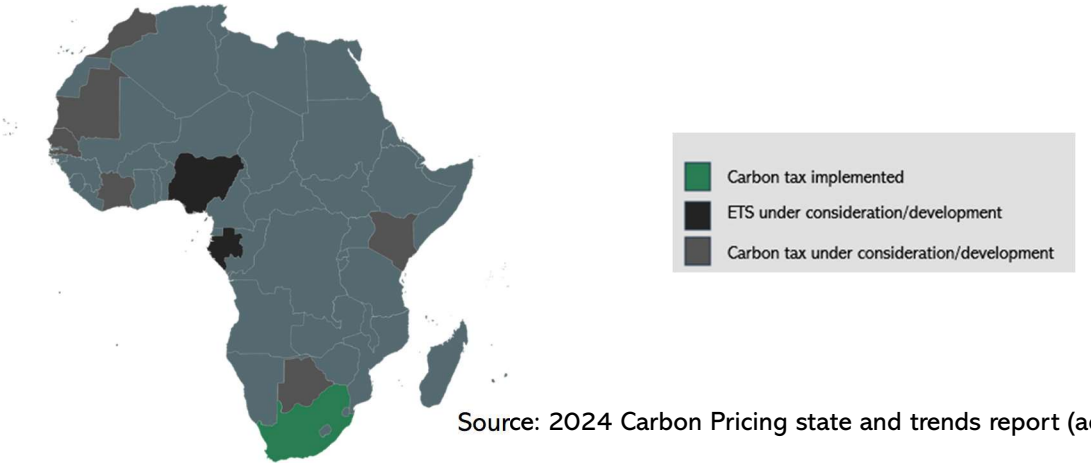
[43] Maurice Ile Durable (MID) Policy, strategy, and Action Plan https://www.greenpolicyplatform.org/sites/default/files/downloads/policy-database/MAURITIUS)
[44] https://unfccc.int/sites/default/files/resource/Carbon%20Pricing%20Assessment%20in%20Nigeria.pdf
[45] https://taxnews.ey.com/news/2024-0391-ghana-imposes-emissions-levy
[46] This is at the exchange rate of 064 cedi to a dollar

Figure 4: Map showing status of carbon taxes and ETS Globally



Source: 2024 Carbon Pricing state and trends report

Figure 5: Map showing status of carbon taxes and ETS in Africa



Source: 2024 Carbon Pricing state and trends report (adapted by CLN)

2.1.1 Rationale for selecting the Telecommunications sector for Carbon Tax

The rationale for introducing a carbon tax in the telecommunications sector is driven by its potential to serve as a high-impact and scalable demonstration model for carbon pricing in Nigeria. By leveraging the sector's structured (centralized) operations, substantial energy consumption, and reliance on diesel fuel, a carbon tax can act as both an incentive and a disincentive: encouraging the adoption of cleaner, renewable energy technologies while discouraging continued reliance on high-emission energy sources. Furthermore, due to the operations of the telecommunications sector, a pilot in the sector would play a special role that enables the telecommunications sector to drive and influence broader climate action beyond its own operations contributing to Nigeria's Nationally Determined Contributions (NDCs) and broader climate commitments under the Paris Agreement. The sector's transition to low-carbon operations can catalyze cross-sectoral decarbonization by showcasing how carbon pricing mechanisms work effectively. Reducing emissions in the telecoms industry would positively impact the achievement of the NDC goals by enabling climate action, promoting green innovations, facilitating a transition to low-carbon energy use, and ultimately leading to sector decarbonization.

According to Nigeria's First Biennial Transparency Report to the UNFCCC (BTR1), released in December 2024, Nigeria's total GHG emissions for the year 2024 excluding emissions from LULUCF were reported to exceed 328 $MtCO_2e$. Of this total, the energy sector accounts for approximately 43%[47]. In the Telecommunications sector, estimates made based on a report by Punch[48] indicates that mobile network operators contribute about 1.6 $MtCO_2e$ annually through fuel consumption for operational services which represents about 0.46% of Nigeria's total annual emissions. Data centres, however, have emissions from their operations to be about 2 $MtCO_2e$ which is about 0.6% of Nigeria's total annual emissions.

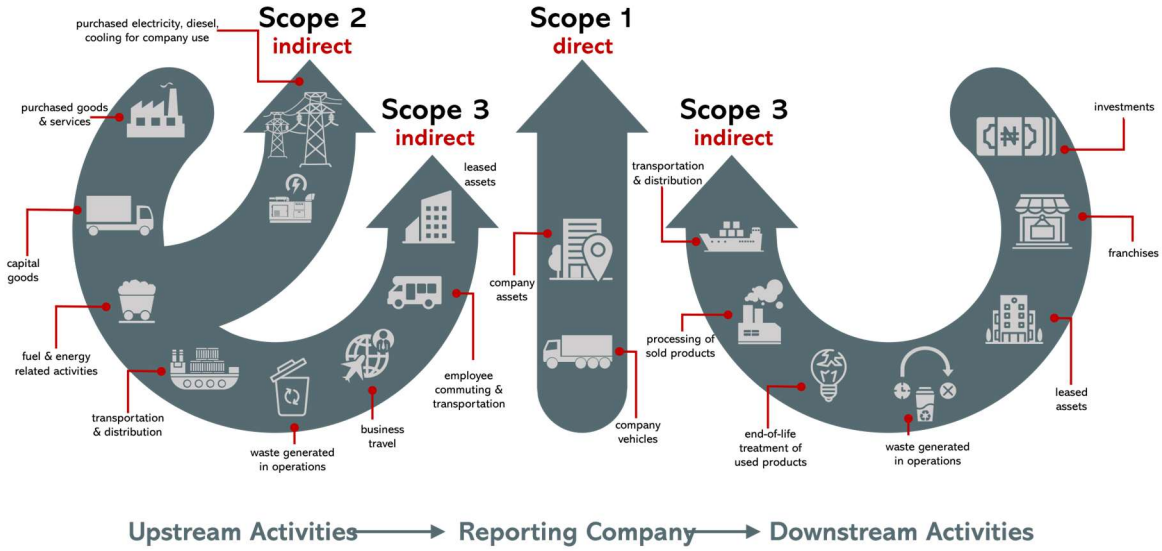
2.1.2 Sources of Carbon Emissions in the Telecommunication Industry

Similar to most industries, carbon emissions and greenhouse gases are produced in the telecommunication industry primarily by burning fossil fuels (diesel and petrol). These fuels are used to power the diesel or petrol generators that provide backup electricity for the insufficient supply from the grid. Emissions are measured in tonnes of greenhouse gas emissions converted into carbon dioxide equivalent (CO_2e). These emissions, or GHGs, are responsible for global warming and climate change, which has impacted the globe in various ways.

[47] https://unfccc.int/documents/645210
[48] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/

Sources of Carbon Emissions: Generally, the sources of emissions from any production value chain include scope 1 emissions, scope 2 emissions, and scope 3 emissions.

Figure 6: GHG Emissions Breakdown by Scope



Source: 2021 National Emissions Update Report (adapted by CLN)

Scope 1 Emissions: These include all direct emissions generated from sources directly owned or controlled by the telecommunication industries. Examples of these include majorly electricity generated directly by the telecommunication companies e.g., emissions from the use of diesel generators, backup batteries, Heating, Ventilation, and Air Conditioning (HVAC) systems, or cooling units used in server farms of the telecommunications industry.

Scope 2 Emissions: These include all indirect emissions from purchased electricity and other utilities. An example of Scope 2 emissions is electricity from the grid.
However, it should be stressed that, on average, the daily time of supply of electricity from the grid and diesel generators is about 50:50 in ratio.

Scope 3 Emissions include all indirect emissions in the telecoms value chain. These are emissions that an organization does not own or control. Examples are the emissions generated from vehicles supplying diesel used in generators by the telecommunication industries (See annex for sample questions).

2.1.3 Alternative Energy Sources Used to Reduce Emissions Globally

A variety of innovative technologies are being deployed globally to reduce emissions, and these have been documented in different sectors. Some examples are listed below.

a. **Renewable Energy Technologies**
   - **Solar Power**: Solar photovoltaic (PV) panels convert sunlight into electricity. In addition, solar thermal energy is used for heating applications, reducing reliance on fossil fuels.
     Hydropower: These are large-scale dams and smaller, run-of-river systems that harness water flow to generate electricity with minimal emissions.
   - **Geothermal Energy**: Geothermal plants tap into the Earth's internal heat to produce electricity or provide direct heating, significantly reducing carbon emissions.
   - **Biomass and Bioenergy**: Using organic materials (like plant or waste products) to generate energy, bioenergy can be carbon-neutral or even negative when paired with carbon capture.

b. **Energy Storage and Grid Technologies**
   - **Battery Storage**: This includes large storage battery technology, such as lithium-ion and solid-state batteries, enabling the storage of renewable energy, and addressing intermittency issues in solar and wind.
   - **Grid Modernization**: Smart grids help integrate renewable energy sources by improving the efficiency and resilience of power distribution and enabling real-time monitoring and control of electricity flow.

c. **Carbon Capture, Utilization, and Storage (CCUS)**
   - **Carbon Capture**: These are technologies used in capturing CO_2 emissions from industrial processes (cement production and power plants) before they are released into the atmosphere.
   - **Carbon Utilization**: Captured CO_2 can be used to produce chemicals, fuels, or even building materials like carbonated concrete.
   - **Storage**: CO_2 can be injected into deep underground geological formations (like depleted oil fields) for long-term storage.

d. **Electric and Hydrogen-Based Transportation**
   - **Electric Vehicles (EVs)**: EVs are powered using electricity instead of gasoline or diesel.
   - **Hydrogen Fuel Cells**: Hydrogen-powered vehicles are gaining attention, especially for heavy-duty transport, where battery electric vehicles might not be feasible. Hydrogen is a clean fuel when produced through renewable methods (green hydrogen).
   - **Electrification of Public Transit**: Electric buses, trams, and trains are becoming more common in cities to reduce transportation-related emissions.

e. **Industrial Decarbonization Technologies**
   - **Green Steel and Cement**: Traditional steelmaking and cement production are highly carbon intensive. Innovations like direct reduction of iron (using hydrogen) and alternative cement formulations are aiming to reduce emissions in these sectors.

- **Electrification of Industry**: Electrifying industrial processes instead of using fossil fuels is a key strategy in reducing emissions, especially in manufacturing and chemical production.

f. **Circular Economy and Waste Management**
   - **Recycling and Upcycling**: Increased recycling rates and using waste materials as raw materials for new products reduce the need for virgin resources, saving energy and cutting emissions.
   - **Waste-to-Energy**: Technologies that turn municipal waste into energy can reduce landfill emissions and generate electricity or heat.

g. **Nature-Based Solutions**
   - **Reforestation and Afforestation**: Planting trees or restoring forests helps sequester carbon, providing a natural way to offset emissions.
   - **Wetland Restoration**: Wetlands absorb carbon and serve as natural filters, making them important for both climate mitigation and biodiversity conservation.

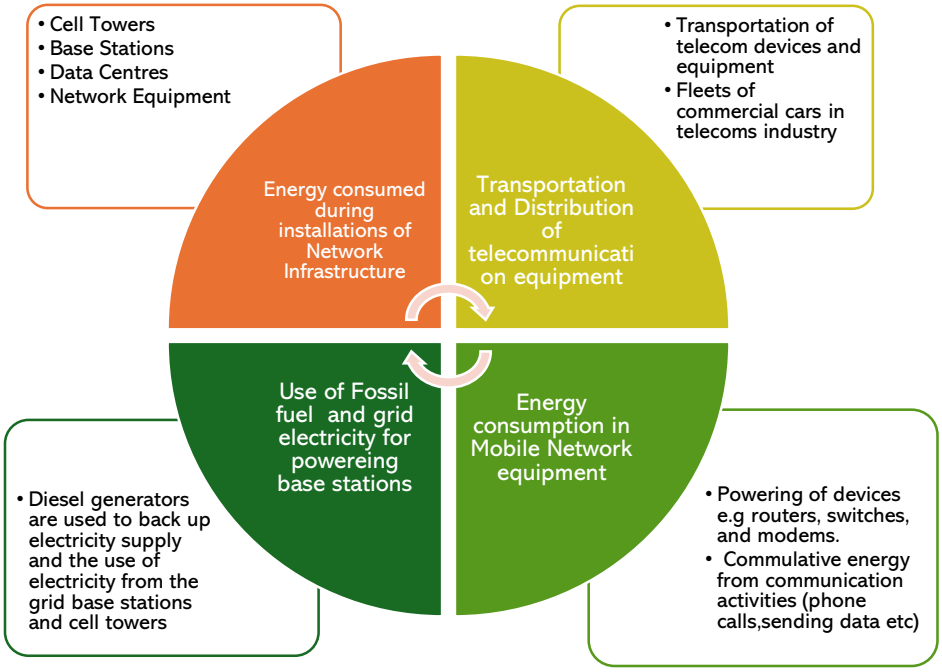
2.1.4 Sufficiency of Carbon Tax Incentives in Selecting Alternative Energy Solutions

Carbon tax provides a financial incentive for businesses, industries, and consumers adopting sustainable practices and alternative solutions to reduce emissions. However, the sufficiency of the incentive depends on several factors that justify that it may not be sufficient on its own to drive the sweeping global changes needed to reduce emissions. Carbon tax works best as part of a broader policy framework that includes subsidies, regulatory measures, international coordination, and investments in clean technologies. The right carbon price and complementary policies can catalyse a shift toward more sustainable practices and alternative solutions, but the level of the tax, how it's implemented, and the broader policy environment will determine its overall effectiveness.

2.1.5 Categorization of Emissions Sources in the Telecommunication Industry

Carbon emissions can be generated from different sources in the telecommunication industry. These emissions are primarily produced through the energy consumption associated with infrastructure installations relying on electricity from the grid and generators, transportation of telecommunication equipment, and commercial fleets, using generators as backup in base stations and towers, and activities involving mobile networks.

Figure 7: Sources of emissions from the telecommunications industry



Source: Carbon-Limits Nigeria

Figure 7 above shows the different sources of emissions from the telecommunications industry and each quadrant is summarised in the highlights below.

- The most common GHG (in order of atmospheric concentration) include water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and a suite of halogen-bearing gases (like fluorocarbons).
- The first quadrant explains that installations and operations of equipment at the base stations (rely on electricity from the grid and use diesel generators as backup as such contributing more carbon emissions into the environment. The key GHGs emitted mainly result from diesel generator use and reliance on fossil fuel-powered grid electricity. The primary emission is CO_2 from diesel combustion and electricity generation, while CH_4 and N_2O are released in smaller amounts from incomplete combustion.
- Transportation of telecommunications equipment generates emissions from the use of diesel and petrol. Also, the fleet of vehicles used for commercial activities contribute to CO_2 emitted.
- Nigeria's data centres infrastructure is primarily located in Lagos (13) and Abuja (3), as of 2024[49]. In the data centres, a constant supply of electricity is required to run the servers

[49] https://www.datacentermap.com/nigeria/

and cool the systems. As such there is a need for backup for the grid electricity using diesel generators.

- The use of mobile networks, phones, and smart devices contributes indirectly to carbon emissions. As of 2024, there were 224 million[50] mobile cellular subscribers in Nigeria. Powering of the mobile network and activities such as making calls, sending data, or using mobile services, energy is consumed in transmitting signals between devices and towers. Though each action may seem small, the total cumulative energy use is substantial across billions of devices, and if that energy comes from fossil fuel-based power, it results in more CO_2 emissions.

Generally, emissions from the operations of the telecom sector primarily stem from energy-intensive infrastructure supported using electricity generators which contribute significantly to carbon emissions. One of the largest sources of emissions is the use of generators in network infrastructure and operations. Additionally, generators used in cooling systems for data centres and network equipment consume substantial energy, as air conditioning and other cooling technologies are necessary to maintain optimal operating conditions. Another major contributor to emissions is data centres and cloud computing, which form the backbone of modern telecom services. These facilities operate high-powered servers around the clock, processing vast amounts of data and consuming significant electricity, often sourced from fossil fuels.

Reducing these emissions however requires practical, cost-effective solutions that address reliance on diesel generators and inefficient infrastructure. A key strategy is solar-hybrid power for base stations which cuts diesel use while ensuring energy reliability. Energy-efficient cooling systems, such as free air and liquid cooling, can reduce data center electricity consumption. Battery storage solutions, like lithium-ion systems will provide cleaner backup power, minimizing generator dependence. Power Purchase Agreements (PPAs) with Independent Power Producers (IPPs) allow telecom firms to secure renewable energy, reducing fossil fuel reliance. While a carbon tax could incentivize these transitions, its success depends on gradual implementation, government incentives for clean energy adoption, and improvements in grid reliability to ensure long-term feasibility.

[50] https://www.statista.com/statistics/501044/number-of-mobile-cellular-subscriptions-in-nigeria/

2.2 Methodology for Determining Carbon Tax

Determining the carbon tax requires a series of steps, including setting a price on GHG emissions to encourage emission reduction and promote clean energy use, and reducing pollution (externality). The carbon tax is modelled after the Pigouvian tax, whose goal is to make carbon-intensive activities more expensive, encouraging lower emissions and cleaner alternatives. This involves internalizing the external costs of carbon pollution (Climate change, health issues, environmental damage), such that the price of fuel consumed in the telecommunication industry reflects its true social cost.

- The carbon tax, which is a form of Pigouvian tax is equal to the costs associated with the negative externality (See Figure 3).
- This cost would incentivize the company to invest in cleaner technology, reduce energy use, and switch to renewable energy.

In the telecoms sector, emissions come primarily from:

- Diesel-powered base transceiver stations
- Generator use in data centres
- Fuel combustion in logistics/fleet operations
- Electricity use from a carbon-intensive national grid

A Carbon Tax just like the Pigouvian tax is levied to reflect the Marginal External Cost (MEC) of a harmful activity. In this case, emissions from energy use and equipment by telecom firms.
Without a tax, only a Marginal Private Cost (MPC) of production would be incurred by the telecom's operators. Society, however, faces a higher Marginal Social Cost (MSC):

$$MSC = MPC - MEC$$

Pigouvian Tax Rate:

$$T = MEC$$

The equation above gives the tax rate **per tonne of CO_2e emitted** i.e., the amount that internalizes the externality. However, the total tax imposed on emitters is given as:

$$T_{total} = T \, x \, E = MEC \, x \, E$$

Where:

T_{total} = total carbon tax collected (₦)

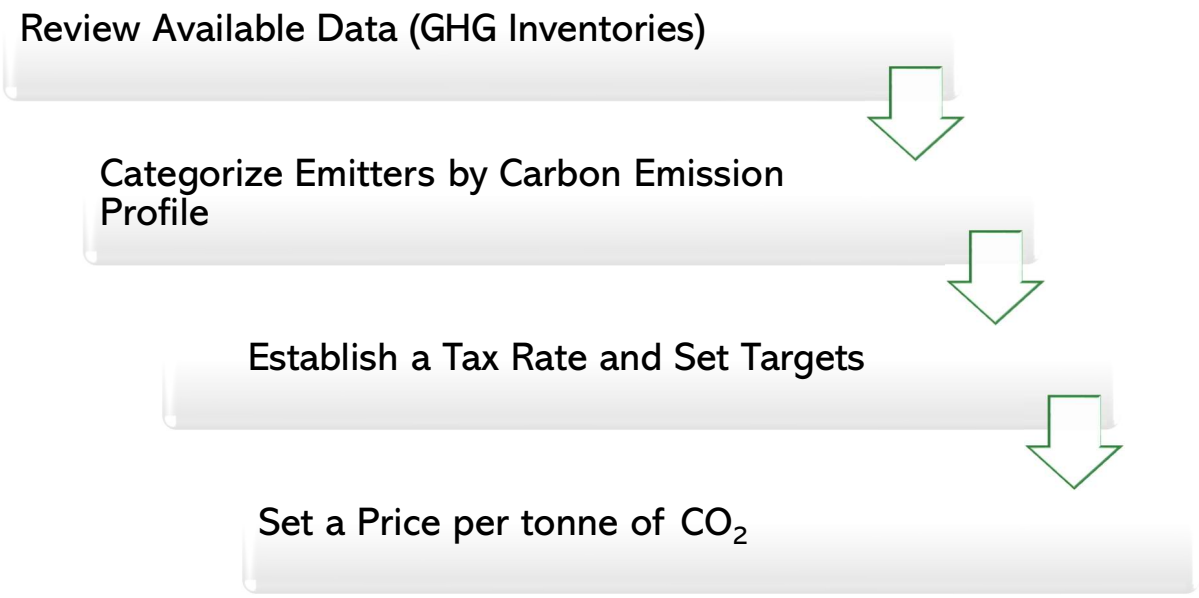
T = Pigouvian tax rate per tonne of CO_2e (₦/tonne)

E = quantity of emissions generated (tonnes of CO_2e)

MEC = marginal external cost per tonne

The methodology for determining the carbon tax rate in the telecommunication industry is highlighted below. The steps are summarized in the chart.

Figure 8: Summary of Methodology Steps



Source: Carbon-Limits Nigeria

2.2.1 Review Available Data (GHG Inventories)

Carbon Emissions Inventory: An inventory of carbon emissions should be conducted across the telecommunication company's operations. This would involve measuring energy usage and calculating the carbon footprint based on the fuel combustion reported across the telecoms industry. The primary action would include data collection from the various sources of emissions (scope 1 and 2), while scope 3 would be carried out as an add-on and based on data availability.

Data Collection: This would involve collecting data on energy usage from telecom infrastructure such as towers, servers, network equipment, and office buildings. The data collected would be from the identified direct and indirect emissions associated with the telecoms industry (emissions from energy consumption in data centres, mobile networks, transmission equipment, and fleet operations)

- **Scope 1 emission data**: Data of direct emissions from owned or controlled sources (e.g., company-owned vehicles, on-site power generation) of the telecommunication company.

- **Scope 2 emission data:** Data on indirect emissions from purchased electricity and other utilities.
- **Scope 3 emission data**: Data on other indirect emissions, including emissions from the production of telecom equipment, travel (business flights etc), and supply chain emissions within telecom.

2.2.2 Categorize Emitters by Carbon Emission Profile

This carbon tax leverages the climate ambition of the Nigerian government to reduce emissions across various sectors and achieve a net zero by 2060. Particularly, this tax design document profiles two major groups of carbon emitters in the telecommunication industry: the high-carbon emitters and the low-carbon emitters. The high carbon emitters are considered based on their large energy consumption, while the low emitters consume less energy for their activities and operations. The bandwidth of energy consumption to ascertain the high emitters and the low emitters would be based on the greenhouse gas inventory received from the telecommunication companies, which would help draw out the emission baseline for the industry. It is important to note that the use of renewable energy reduces the number of emissions generated by the companies and this is evident in the innovation and integration of the hybrid system using solar power backups in some of the telecoms base stations, cell towers, and data centres.

The table below shows a categorization of the various operators and their estimated emissions profiles. Based on their emissions profiles and operations coverage of the various operators, can be considered for the pilot carbon tax.

Table 8:Telecommunication Operators to be considered for the carbon tax.

Stakeholder Category	Stakeholders	Emission Data Remarks (Per Year)
Mobile Network Operators	MTN Nigeria (Over 78 million subscribers)	1.6 $MtCO_2e$ [Estimated from 50 million litres of diesel consumed per month[51] — about 1.67 million litres per day]
	Airtel Nigeria (Over 53 million subscribers)	
	Globacom Limited (Over 19 million subscribers)	
	9Mobile (Emerging Markets Telecommunication Services Ltd) (Over 3 million subscribers)	
Data Centres	Africa Data Centres (Cassava Technologies)	2 $MtCO_2e$ [116 megawatts (MW) in 2024 which translates to 2 MtCO2e]
	Digital Realty	
	WIOCC (Open Access Data Centres)	

[51] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/

Stakeholder Category	Stakeholders	Emission Data Remarks (Per Year)
	Jovis Nigeria Limited	
	Rack Centre	
Internet Services	Spectranet	Data is unavailable.
	FiberOne Broadband Ltd	
	Starlink Internet Services Nigeria Ltd	
	Tizeti Network Ltd	
	ipNX Nigeria Ltd	
	Broad-based Communications Ltd	
	VDT Communications Ltd	
	Cobranet Ltd	
	Radical Technology Network Ltd (Coollink.Ng)	
	Cyberspace Network Ltd	
Infrastructure Support/ Tower-Cos	IHS Towers	975 $MtCO_2e$ [52] (Carbon footprint includes data from Brazil, Colombia, Peru, Cameroon, Côte d'Ivoire, Nigeria, Rwanda, South Africa, Kuwait, UAE, the UK, USA, Egypt and Zambia)
	American Tower Cooperation Nigeria (ATC)	13.7 $MtCO_2e$[53] (No Nigekia-specific data available)
	Pan African Towers (PAT)	12.76 $ktCO_2e$ (estimated based on assumptions)
	RAK Unity	Data is unavailable
	Africa Mobile Network (AMN)	26.88 $ktCO_2e$ (estimated based on assumptions)

High and Low Emitters in the Nigerian Telecom Sector

In the Nigerian telecom sector, emissions vary significantly depending on the scale of operations, energy sources, and infrastructure efficiency. Operators can generally be categorised into high and low emitters based on their reliance on fossil fuels, operational footprint, and adoption of sustainable energy solutions.

[52] https://www.ihstowers.com/content/dam/ihs/corporate/documents/sustainability/Sustainability-reports/IHS-Towers-2023-Sustainability-Report.pdf

[53] Energy and Greenhouse Gas Emissions Data - https://pardot.americantower.com/l/25692/2024-07-10/7vby66/25692/1721263478tBVZz3pl/atc_2023_energy_and_greenhouse_gas_emissions_data_supplement.pdf

High Emitters

High-emitting telecom operators are typically those with extensive infrastructure and heavy reliance on fossil fuels for power generation. The primary contributors to high emissions in the sector include:

- **Base Transceiver Stations (BTS) and Network Towers:** Telecom operators with many BTS sites and towers tend to have higher emissions, particularly if these sites rely on diesel generators due to unreliable grid power. The higher the number of off-grid or hybrid-powered sites, the greater the emissions footprint.
- **Data Centres and Cloud Infrastructure:** Operators managing large-scale data centers require significant power for servers and cooling systems, contributing to increased energy consumption and emissions. The absence of renewable energy integration in these facilities further elevates their carbon footprint.
- **Fleet and Logistics Operations:** Telecom companies with large vehicle fleets for network maintenance and logistics contribute to high emissions through fuel consumption.
- **Supply Chain and Equipment Manufacturing**: The sourcing, transportation, and deployment of telecom equipment—such as routers, fibre-optic cables, antennas, and mobile devices add to emissions, particularly when components are imported from distant locations.

Low Emitters

Low-emitting telecom operators are those who have taken proactive steps to reduce their carbon footprint through energy efficiency and sustainable practices, companies whose emissions are considered to be below average. These include:

- **Use of Renewable Energy Solutions**: Operators that have integrated solar-powered BTS sites or hybrid energy solutions tend to have lower emissions. Deploying energy-efficient batteries and reducing reliance on diesel generators significantly lowers carbon output. MTN Nigeria network has already connected over 250 low-cost solar powered Base Transmission Stations (BTS), covering 319 communities[54], where transmission has been provided using satellite mesh technology to optimise backhaul and guarantee latency of calls.
- **Use of Hydrogen for Clean Fuel for Power Generation:** Hydrogen can significantly reduce emissions across the telecoms sector when adopted as a cleaner alternative to fossil fuels.

Based on the **Table 8** above, operators such as Mobile Network Operators, TowerCos, Data Centers should be considered as high emitters while operators like the internet service providers can be considered as low emitters. An assessment of the operations of key Internet Service Providers such

[54] Hybridizing renewable energy systems in Nigeria
https://www.idpublications.org/wp-content/uploads/2016/07/Full-Paper

as Spectranet, FiberOne, Starlink Nigeria, Tizeti, ipNX, etc, indicates that their carbon emissions are generally low[55]. Unlike mobile network operators that maintain extensive diesel-powered infrastructure, these ISPs largely operate through fiber-optic networks, fixed wireless systems, and limited ground facilities with lower energy demands. While a few providers may rely on backup power systems, the overall emissions profile of ISPs remains significantly lower than that of traditional mobile network operators. According to a 2024 study by Fiber Broadband Association, Fiber-to-the-Home (FTTH) networks exhibit up to 96% lower carbon emissions during operation compared to Hybrid Fiber Coaxial (HFC) networks. The carbon footprint associated with network component manufacturing is 60% less in FTTH networks compared to HFC, and installation carbon is 7% less[56].

The table below provides a comparative analysis of key operators, highlighting the rationale for consideration, their emission reduction potential, and the associated pros and cons of introducing a carbon tax across the sector.

Table 9: Evaluation of Carbon Tax for Telecom Sector Operators

Stakeholder Category	Rationale for consideration	Emission Reduction Potential	Pros	Cons
Mobile Network Operators	High energy use, reliance on diesel generators	Significant reduction by adopting renewable energy	• Encourages reduction in fossil fuel use • Supports achievement of emission reduction targets • Possible eligibility for international green funding as incentive for energy efficiency	• High operational cost • Potential tax impact on consumers via increased tariff • Capital strain and operational challenges for transition • Potential Service disruptions as renewables do not have capacity for 24/7 reliability in off-grid areas.
Data Centres	Moderate to high emissions, depending on energy source	Can invest in renewable energy sources to reduce emissions	• Renewable energy adoption potential • Eligibility for international green funding	• High capital costs for energy transition • Grid-tied renewable challenges and grid instability i.e. brownouts, surges

[55] World Bank - Measuring the Emissions & Energy Footprint of the ICT Sector https://documents1.worldbank.org/curated/en/099121223165540890/pdf/P17859712a98880541a4b71d57876048abb.pdf

[56] https://fiberbroadband.org/2024/07/29/fiber-broadband-deployment-is-paramount-to-achieving-zero-carbon-footprint/?utm

Infrastructure Support/ TowerCos	Moderate emissions, high reliance on electricity for tower operations	Potential for energy efficiency improvements	• Encourages the full scaling of existing green technologies. • Lower long-term operational cost.	• Operational risks during transition due to inaccessibility to remote tower sites. • Increased costs of lease rates passed on to MNOs
Internet Infrastructure Providers (ISPs)	Low emissions from fiber-optic and wireless systems	Lower emissions, but potential for more efficiency	• Promote green initiatives and energy-efficient infrastructure • Lower long-term operational cost.	• Possibly lower incentives for reduction as they already emit far less that other considered stakeholders.

A balanced approach might be to apply a base rate of carbon tax (e.g., 1-2 USD/t CO_2) to all operators, with possible rebates or lower rates for operators demonstrating a commitment to reducing their emissions (e.g., those using renewable energy or maintaining lower emissions). This way, there's an equal starting point for all operators, but those who make extra efforts to reduce their emissions can be rewarded, providing an incentive to transition to greener practices.

2.2.3 Establish a Tax Rate and Set Targets

Establishing a starting price for the tax rate and a set target for the carbon tax would involve considering several parameters stated in the sections below (setting a price per Tonne of CO_2, Carbon tax structure and adjustment, revenue allocation strategy), to reduce economic shocks and ensure that a threshold is gradually attained.

2.2.3.1 Setting a price per Tonne of CO_2

Determining the appropriate price for a carbon tax for Nigeria's telecommunications sector requires careful consideration of several factors, including the sector's unique energy consumption patterns, the financial capacity of operators like MTN, Airtel and 9mobileas well as broader economic implications. It should be mentioned that the Tax should cover only for CO_2 emissions as this constituent the most significant source of emissions in telecoms operations.

MTN: The operational cost[57] of the company revealed that direct network operating costs surged from N655.2 billion (0.42 billion USD) in 2023 to N1.232 trillion (0.78 billion USD) in 2024. Also, the company's energy consumption pattern involves the use of diesel, grid electricity, gas generators, CNG, solar energy, and efficiency measures, which are integral to its strategy to reduce emissions

[57] https://saharareporters.com/2025/02/28/mtn-nigeria-posts-n400billion-loss-amid-rising-operating-costs-forex-challenges

and support Nigeria's net-zero targets[58]. Report reveals that MTN Nigeria deployed three 1.1-megawatt (MW) gas generators, leading to significant reductions in greenhouse gas emissions and energy costs, saving over N570 million (0.36 million USD)[59].

Airtel: The energy consumption pattern of Airtel Nigeria largely involves diesel usage. Airtel operates over 15,000 base stations across Nigeria, each typically powered by diesel generators. Collectively, these sites consume approximately 22 million litres of diesel monthly, resulting in an expenditure of about N28 billion (18 million USD)[60]. However, Airtel is transitioning to solar power, adopting advanced technology and other renewable energy sources to mitigate environmental impact and reduce operational cost[61].

9mobile: 9mobile majorly relies on diesel-powered generators to ensure consistent service delivery, which is not obtainable from the grid. Alternative energy sources include off-grid solution in which the company collaborated with Raeanna Nigeria Limited and Clear Blue Technologies International to pilot smart off-grid technology for powering telecom sites[62]. Also, the company has invested in energy-efficient measures as reported that between 2021 and 2022, it invested in alternative clean energy solutions, resulting in a reduction of energy consumption by 21 million kilowatt-hours[63]

Key Factors to be Considered Setting a Price for the Carbon Tax

1. Energy Profile of the Sector

MTN, Airtel, 9mobile, and Globacom dominate the telecom industry in Nigeria. Due to unreliable grid power, these companies rely heavily on diesel generators to power base stations. The companies face high operational costs related to energy. A significant portion of their expenses goes toward fuel for generators. For instance, in 2023, the industry's spending on diesel rose by 34.57%, reaching about ₦429.43 billion (0.28 billion USD), up from ₦319.11 billion (0.21 billion USD) in 2022[64]. MTN through its third-party vendor spends over ₦30 billion (18.9 million USD) monthly on diesel to power its approximately 25,000 base stations.[65] Any carbon tax on diesel usage could impact their cost structures. Therefore, these must be carefully managed to avoid overly burdening the sector.

2. Ability to Pass Costs to Consumers

[58] https://businessday.ng/technology/article/mtn-nigeria-targets-net-zero-emissions-with-clean-energy-investment
[59] https://tribuneonlineng.com/mtn-nigeria-invests-in-green-energy-technologies-to-achieve-nigerias-net-zero-target/
[60] https://guardian.ng/business-services/n28b-per-month-diesel-expenditure-forces-airtel-to-consider-solar-energy
[61] https://theelectricityhub.com/airtel-nigeria-plans-to-reduce-its-n28-billion-monthly-diesel-expenditure-by-transitioning-to-solar-power-and-investing-in-lithium-ion
[62] https://punchng.com/9mobile-to-power-100-sites-off-grid
[63] https://www.thisdaylive.com/index.php/2023/04/24/9mobile-invests-over-n70bn-on-network-modernisation
[64] https://punchng.com/telcos-spending-on-diesel-rises-by-35-hits-n429bn/?utm
[65] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/?utm

The sector's market is price-sensitive, with consumers already facing high costs for mobile services. Telecom operators might pass on the carbon tax costs to consumers, leading to higher prices for calls, data, and other services. Therefore, the carbon tax would be designed to be moderate initially and phased in gradually. This will give operators time to adopt greener technologies and minimise the need to increase service prices.

3. Incentivizing a Shift to Clean Energy

The carbon tax is designed to incentivise telecom operators to shift from diesel to renewable energy solutions like solar or hybrid systems. If the tax is too high, it could discourage investment or innovation within the sector by significantly increasing operational costs for telecom operators, especially those still reliant on diesel-powered infrastructure. This financial burden may limit their ability to invest in cleaner technologies, expand network coverage, or upgrade existing systems, thereby slowing overall sectoral progress. And if it is too low, it would be ineffective. The goal is to set a price that encourages operators to reduce emissions by moving to greener energy sources but does not stifle business growth.

4. Benchmarking with International and Regional Carbon Pricing Models

Global carbon tax prices vary widely, from as low as $1 per tonne of CO_2e (in certain countries) to over $100 in others. For instance, as of March 2020, Ukraine's carbon tax was 10 UAH per tonne of CO_2e, approximately $0.40 USD at that time. This rate is considered one of the lowest globally.[66] However, as of April 1, 2024, Sweden's carbon tax was approximately $127 per metric tonne of CO_2 equivalent (USD/tCO_2e)[67].

Nigeria's economy and the telecom sector's energy challenges suggest that a carbon tax on the lower end would be appropriate in the initial phase with gradual increases planned. A similar approach was used in South Africa with an initial rate of $8 per tonne of CO_2e.

Suggested Carbon Tax Price Range

Initial Price: $1-2 per tonne of CO_2e

This range strikes a balance between incentivizing cleaner energy use and not overwhelming telecom operators with costs. For example, if a telecom operator emits 100,000 tonnes of CO_2e annually from diesel generators, an assumption of carbon tax of $2 per tonne would result in an additional cost of $200,000.

[66] https://www.climatescorecard.org/2020/03/ukraine-has-the-worlds-lowest-carbon-tax/?utm_source
[67] https://www.statista.com/statistics/1429643/prices-of-carbon-taxes-in-the-nordics-by-country/

Hypothetically, a larger operator emitting around 500,000 tonnes, the additional cost in terms of the carbon tax will be $1 million at an indicative rate of $2 which is about 0.067% of the total revenue (N2.4trillion)[68] reported by one of the big operators as of September 2024. Given the revenues and size of operators like MTN and Airtel, this is a manageable cost in the short term, and it would encourage gradual investment in alternative energy solutions.

Applying this into the Pigouvian Tax Model discussed above:

1. $Per-tonne\ Tax\ Rate: T = MEC$

2. $Total\ Tax\ collected: T_{total} = T\ X\ E = MEC\ X\ E$

Where:

$Marginal\ External\ Cost\ (MEC)\ or\ proposed\ tax\ rate\ =\ \$2/ton$

$Total\ Emissions\ (E)\ by\ a\ large\ operator\ =\ 500{,}000\ tons\ CO_2e$

$Exchange\ rate\ =\ ₦1600\ =\ \$1$

$Annual\ revenue\ of\ the\ operator\ =\ ₦2.4\ trillion\ =\ \$1.5\ billion$

$T_{total} = T\ X\ E = 2 * 500{,}000 = 1{,}000{,}000\ USD$

$Convert\ to\ naira: T_{total} = 1{,}000{,}000\ X\ 1600 = N\ 1.6\ billion$

To Determine % of Total Revenue

$Total\ Tax\ (T_{total})\ =\ \$1{,}000{,}000$

$Operator's\ Revenue\ =\ ₦2.4\ trillion\ =\ \$1.5\ billion$

$Tax\ as\ a\ Percentage\ of\ Revenue\ =\ (Revenue/Tax)\ \times\ 100$

$Tax\ as\ a\ Percentage\ of\ Revenue\ =\ (1{,}500{,}000{,}000/1{,}000{,}000)\ \times\ 100$

$=\ 0.067\%$

Administrative Costs: The administrative costs of implementing the carbon tax (e.g., regulatory setup, monitoring, enforcement) are typically separate from the tax revenue calculation and depend on the efficiency of the government's implementation process.

Marginal Abatement Cost (MAC): The MAC, which represents the cost to the government of reducing one additional tonne of CO_2 emissions, is linked to the emissions reduction achieved by the tax.

Cost to Reduce 1 Tonne of CO_2: Based on the assumption that the carbon tax leads to a reduction of 10,000 tonnes of CO_2e, the cost to reduce one tonne of CO_2 is $100.

[68] https://techafricanews.com/2024/11/01/mtn-nigeria-sees-revenue-growth-but-faces-profit-challenges-amid-forex-impact/?utm

Rationale for a $1- $2 Carbon Tax in Nigeria's Telecom Sector

Setting a range of $1- $2 per tonne CO_2e carbon tax for Nigeria's telecom sector is a strategic balance between economic feasibility, industry competitiveness, and environmental impact. Below is the justification for why this rate is optimal compared to a higher tax.

1. **Comparison with Nigeria's Gas Flare Penalty**

Nigeria's gas flare penalty provides a relevant precedent for designing the telecom sector's carbon tax. Initially set at $0.50 per 1,000 standard cubic feet (scf) of flared gas, the penalty was later increased to $2.50 per 1,000 scf for large producers and has now risen to $3.50 per 1,000 scf. This gradual increase allowed industry players to adjust while achieving the intended policy objective of discouraging flaring. Similarly, a $1 - $2 per tonne CO_2e carbon tax in the telecom sector provides a starting point that balances economic feasibility with environmental responsibility, with room for future adjustments as the industry adapts.

2. **Ensuring Industry Competitiveness and Minimizing Cost Burden**

Nigeria's telecom sector is already burdened by high operational costs, primarily due to diesel dependency, constituting 35% of telecom operators' operating expenses (OPEX).

According to the most recent National Communication Commission's (NCC) 2023 Year-End Performance Report for the TelCos, operating costs climbed from N2.09tn in 2022 to N3.16tn in 2023, representing a 50.92% increase in the OPEX[69]. A higher carbon tax (e.g., $5–$10 per tonne CO_2e) could significantly increase operational costs, leading to higher consumer tariffs and reduced operator profit margins. This, in turn, could discourage investment in green alternatives. A $1- $2 per tonne CO_2e carbon tax ensures the financial impact remains marginal.

3. **Benchmarking Against Global Carbon Pricing Trends**

Globally, many emerging economies introduce low-carbon pricing strategies to build market acceptance and avoid economic shocks. For instance, China's Emissions Trading System (ETS) initially priced carbon permits in the $2–$5 range to allow businesses to transition smoothly. A $1- $2 carbon tax aligns Nigeria's telecom sector with global best practices, ensuring a smooth transition without excessive financial strain.

4. **Encouraging Renewable Energy Adoption Without Penalizing Business Growth**

A key objective of carbon pricing is to incentivise clean energy adoption without imposing excessive costs that hinder business growth. Telecom operators in Nigeria require significant capital investment

[69] https://punchng.com/telcos-operating-costs-surged-by-50-92-ncc/

to transition from diesel-powered base stations to solar hybrid solutions. Setting a high carbon tax ($5–$10 per tonne CO_2e) from the outset could divert funds away from renewable investments, as operators may prioritize compliance costs over infrastructure upgrades. A range of ($1-2) tax strikes the right balance, encouraging gradual efficiency improvements while allowing telCos to reinvest in sustainable energy solutions, ultimately reducing long-term operating costs.

In summary, a low starting price of the initiative reflects the current economic realities, including reliance on diesel and foreign exchange pressures. Its revenue impact is minimal (0.067%), ensuring it does not disrupt major operators like MTN or Airtel. The pricing also serves as a clear signal for transitioning to solar or hybrid systems, particularly for rural Base Transceiver Station (BTS) sites.

2.2.3.2 Carbon Tax Structure and Adjustments

1. Initial Gradual Implementation

The tax rate should start with a moderate rate ranging from $1- $2 per tonne of CO_2e, giving operators time to adjust. This could be reviewed and increased to $5 over 3–5 years, based on the sector's ability to transition to greener energy.

The table below shows the gradual rate increases for the countries reviewed above.

Table 10: Gradual Annual Tax Rate Increases for The Carbon Tax-Implementing Countries

Country	Start Year	Initial Tax Rate (USD/tCO_2e)	Rate as of 2024	Planned/Actual Increases
Canada[70]	2019	C$20 (~$15)	C$80 (~$59)	+C$10/year until 2022, then +C$15/year to reach C$170 by 2030
Argentina[71]	2018	~10% of full rate (on solid fuels)	~50–60% of full rate (2024)	Gradual annual increases of 10% on coal and fuel oil, to reach 100% by 2028
Columbia[72]	2017	COP 20,500 (~$4.8)	COP 74,833 (~$19)	Proposed: COP 74,833 (~$19) by 2024; full application to coal by 2026
South Africa[73]	2019	R120 (~$8)	R159 ($9–10)	Increases by inflation + 2% until 2022, then by inflation

[70] https://www.reuters.com/markets/carbon/alberta-files-federal-court-challenge-canada-carbon-tax-exemption-2024-10-29/?utm
[71] https://climateactiontracker.org/countries/argentina/2021-09-15/policies-action/?utm
[72] https://ieta.b-cdn.net/wp-content/uploads/2024/02/Colombia-business-brief_Jan-23.pdf?utm
[73] https://kpmg.com/us/en/taxnewsflash/news/2024/02/tnf-south-africa-increase-carbon-tax-rate-carbon-fuel-levies.html?utm

2. **Incentive for Early Action**

It is important to provide tax reductions for operators that invest in low-carbon infrastructure early on (e.g., companies that use solar-powered base stations or battery storage systems). This would encourage proactive investments in cleaner technologies. Operators could receive tax credits for the percentage of their network that is powered by renewable energy, reducing the overall carbon tax burden.

3. **Periodic Review and Adjustment**

The government (FIRS) could assess the impact of the tax annually or biannually to ensure it remains effective without overly burdening the sector. Adjustments can be made based on emissions reductions achieved, technology adoption rates, and sectoral growth.

4. **Revenue Use and Support**

A portion of the revenue from the carbon tax could be used to subsidize renewable energy projects within the telecom sector, helping offset some of the costs to companies like MTN, Airtel, and others.

To ensure that the carbon tax on Nigeria's telecom sector remains revenue-neutral and mitigates potential financial burdens on stakeholders, a structured revenue recycling approach should be adopted. This approach should align with policy objectives, promote energy efficiency, and support stakeholders across the telecom value chain.

2.2.3.3 Revenue Allocation Strategy

Revenues generated from the carbon tax should be reinvested in ways that support consumers, telecom operators, and the broader digital economy, ensuring that the tax does not stifle sectoral growth or consumer access. The expected revenue from the carbon tax will depend on several factors, including the tax rate, the emissions levels and the size of the taxable base (i.e., the number of companies or facilities subject to the tax). The actual revenue generated would need to be estimated through a model that factors in these variables. However, the exact proportion to be used for offsets would need to be aligned with national priorities and fiscal capacity, ensuring a balance between revenue generation and social equity goals.

Revenue Recycling Measures

A. Direct Rebates & Cost Offsets for Consumers

I. Lower Tariffs for Low-Income Users: Use a portion of tax revenues to offset network infrastructure in low-income and rural users to prevent digital exclusion. Low-income and rural users can be identified based on geographic location, income thresholds, participation in

social programs, limited access to digital services, and data from telecom operators regarding low-revenue subscribers.

II. Provide shared infrastructure in rural areas.

III. Green Energy Access Support: Fund telecom-led initiatives that provide solar-powered charging stations in underserved areas, reducing reliance on diesel generators.

B. Support for Telecom Operators & Businesses

I. Renewable Energy Transition Grants: Provide tax rebates or subsidies for telecom companies investing in renewable energy solutions like solar-powered base stations.

II. Energy Efficiency Incentives: This form of support is a financial or policy-based reward such as a tax break, rebate, grant, or low-interest loan offered to encourage businesses or individuals to adopt technologies or practices that reduce energy consumption and improve efficiency. In the telecom sector, this could include support for upgrading to low-power equipment, smart cooling systems, or advanced energy management tools.

III. Infrastructure Expansion Support: Use revenues to co-fund telecom infrastructure expansion in off-grid and rural areas, reducing reliance on fossil-fuel-powered generators.

To ensure that recycled revenues deliver intended outcomes, the following governance mechanisms should be established:

I. Stakeholder Engagement: Regular consultation with telecom operators, consumer groups, and industry regulators to optimize revenue recycling effectiveness.

II. Periodic Audits & Reporting: Public disclosure on how revenue is recycled to benefit stakeholders.

III. Performance Metrics: Establish measurable KPIs (e.g., reduction in carbon emissions per telecom site, increase in renewable-powered sites, lower consumer costs).

It should be mentioned that currently, Nigeria lacks specific legislative measures for the collection, management, and recycling of carbon tax revenues, particularly within the telecom sector. However, to ensure effective and efficient use of these funds, there is a need to introduce new legislation or amend existing laws to establish a clear legal framework. This should include the creation of a dedicated fund, define institutional roles, mandate transparent reporting and stakeholder engagement, and incorporate safeguards against mismanagement. Such legal backing would strengthen governance, align with international best practices, and build public and investor confidence in the carbon pricing initiative.

2.3 Phased Implementation of the Carbon Tax

Implementing a carbon tax in the telecommunications industry requires a multifaceted approach. The approach includes measuring emissions, reducing energy consumption, adopting green technologies, transitioning to renewable energy, and aligning with regulatory policies within the country. This multifaceted approach would enable telecom companies to manage the financial impact of carbon taxes while striving towards sustainability. Also, this would enhance the telecommunication companies' corporate image, improving their competitive advantages in a growing environmentally conscious market. It is important to note that a crucial aspect of implementing a carbon tax in the telecoms industry is the implementation of penalties for non-compliance and offering incentives for exceeding emissions reduction targets.

2.3.1 Implementation in the Short Term (0-2 years)

This is the no-payment era for the telecommunications industry. The short term would be within 0-2 years, and the focus during this period would be on awareness creation, designing the Carbon Tax document, ensuring actionable steps that can deliver quick results, and align with regulatory expectations. Some of the steps in the short term include.

Step 1: Stakeholder Engagement and Buy-In

Key Actions: The following are the key activities that are required under this stage.

I. Conceptualisation and design of the carbon tax design document
II. Organize roundtable discussions with key stakeholders, including the Nigeria Climate Change Council Secretariat (NCCCS), NCC, telecom operators (MTN, Airtel, Glo, etc.), civil society organizations, and all other relevant stakeholders. These engagements aim to align the objectives of the carbon tax.
III. Gauge industry sentiment and concerns, particularly around infrastructure challenges and potential cost impacts on consumers.
IV. Build consensus on the benefits of implementing the carbon tax within the telecom sector and identify common goals.

Step 2. Inventory and Emission Audit:

Key Actions: The following are the key activities required under this stage.

I. Conduct a comprehensive audit of the telecom sector's energy consumption, fossil fuel use (particularly diesel), and GHG emissions.
II. Identify primary emission sources (e.g., base stations, data centers, network operations).
III. Evaluate telecom operators' readiness to transition to greener alternatives and determine the potential financial impacts of a carbon tax.

Step 3: Legislative and Policy Development

Key Actions: the following are the key activities required under this stage.

I. Develop a legislative framework outlining the carbon tax structure, reporting requirements, and tax rates in consultation with policymakers and the NCC.
II. Ensure alignment with existing environmental regulations and the Nigerian NDC targets.
III. Draft a policy document that sets the basis for carbon tax implementation and sets up a regulatory oversight body.

2.3.2 Implementation in the Medium Term (2-4 years)

Pilot and Capacity Building

Step 1: Capacity Building and Training

Key Actions:

I. Train telecom operators and relevant regulators on carbon accounting and reporting in partnership with technical experts.
II. Organize workshops on energy-efficient solutions and alternative renewable energy options for telecom operations.

Step 2: Launch of Carbon Tax Pilot Program

Key Actions: The following are the key activities required under this stage.

I. Roll out a pilot program with selected telecom operators, focusing on a limited geographical area or specific facilities (e.g., base stations with the highest emissions).
II. Test the reporting system for energy consumption, fuel usage, and emissions.
III. Collect carbon tax based on calculated emissions and fossil fuel use.
IV. Monitor progress in emissions reduction and any financial burdens on operators and consumers.

2.3.3 Implementation in the Long Term (4 years and above)

Phase 3: Full Implementation and Scaling

Step 1: National Rollout of Carbon Tax

Key Actions: the following are the key activities required under this stage.

I. Expand the carbon tax program nationwide, covering all telecom operators and major facilities (e.g., base stations, data centers, etc.).
II. Implement mandatory emissions reporting for all telecom operators using the established reporting system.
III. Begin full carbon tax collection and enforcement.

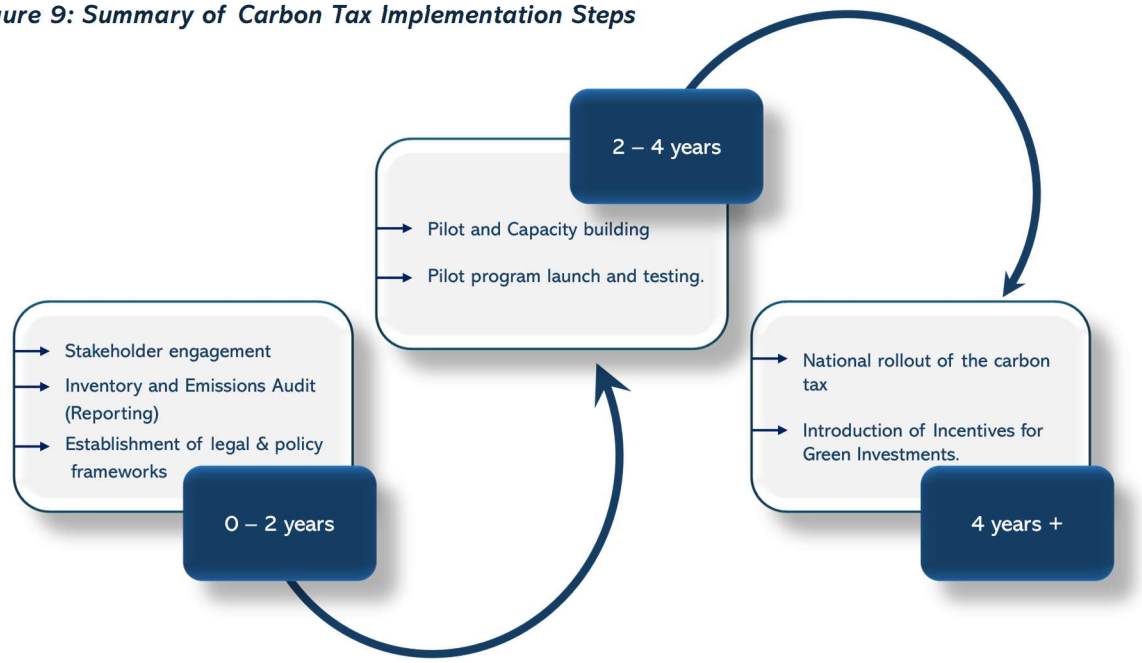
Step 2: Introduction of Incentives for Green Investments

Green investments in the telecommunications sector refer to strategic capital and operational expenditures aimed at reducing GHG emissions through the adoption of renewable energy technologies (e.g., solar-powered base stations), energy-efficient infrastructure (e.g., low-energy cooling systems), and other emissions-reduction initiatives such as fleet electrification and smart energy management. To support and incentivize such investments during the pilot carbon tax phase, the government through the NCCCS and relevant ministries should introduce a suite of financial and non-financial mechanisms. These include capital subsidies covering a portion of the cost of clean energy installations, concessional (low interest) green loans offered in collaboration with development banks, and tax rebates or carbon tax reliefs for companies achieving verifiable emission reductions. In addition, the implementation of a green certification and recognition program can enhance brand value for compliant companies, while results-based financing (RBF) models can ensure accountability by linking financial disbursements to measured performance. All incentive mechanisms should be supported by a robust monitoring and evaluation system, with periodic reviews to assess uptake, impact, and cost-effectiveness, and to inform future adjustments and scale-up.

Key Actions: The following are the key activities required under this stage.

I. Develop and introduce financial incentives for telecom operators investing in renewable energy sources (e.g., solar-powered base stations) and energy-efficient technologies.
II. Create a tax rebate system for companies that achieve significant emission reductions or transition to clean energy.
III. Monitoring, Evaluation, and Adjustments.

Figure 9: Summary of Carbon Tax Implementation Steps



2.4 Monitoring and Evaluation

Step 1: Preliminary Implementation Review

Key Actions: The following are the key activities required under this stage.

I. Establish a continuous monitoring and evaluation system to track emissions reductions, the financial impact of the carbon tax, and telecom operators' transition to cleaner energy.
II. Regularly update stakeholders, including the NCCCS and NCC, etc., and telecom operators on progress.
III. Analyse the carbon tax's effectiveness and identify improvement areas.

Step 2: Review and Adjust Tax Rates

Key Actions: the following are the key activities that are required under this stage.

I. Review the carbon tax rates based on initial implementation outcomes and feedback from operators.
II. Adjust tax rates progressively to incentivize further reductions in emissions without over-burdening operators or consumers.

It is recommended that the adjustment should be progressively approached following the rationale behind the tax rate.

Step 3: National Expansion and Reporting

Timeline: Ongoing

Key Actions: the following are the key activities required under this stage.

I. Expand the carbon tax system to other sectors such as Oil and Gas, Manufacturing, Power etc. and align with global carbon pricing frameworks and carbon reduction commitments, such as the NDC.
II. Ensure that Nigeria's telecom sector can participate in international carbon markets, potentially allowing operators to trade carbon credits.

2.4.1 Exemptions and Discounts

Exemptions on carbon tax would be granted to promote fairness and to support critical infrastructure development within the telecoms industry. Small and medium enterprises and emerging Telecom companies should be considered for exemptions to help ease the financial burden of the carbon tax. Operators would be classified into high-carbon and low-carbon emitters depending on their operations or by their inventory data. Companies with lower emissions intensity, particularly those using renewable energy solutions or energy-efficient technologies, could qualify for discounted tax rates compared to higher-emitting counterparts. This sector-specific discount would serve as an incentive

for cleaner operations and reward proactive investment in low-carbon technologies. New and emerging telecom businesses may receive temporary exemptions but must demonstrate a transition plan toward low-carbon operations. This ensures that exemptions are not arbitrary but instead support emission reductions while fostering industry growth. Exemption and Discounts would include lowering the tax rate based on criteria such as revenue, number of subscribers, or operational scale.

Regular Monitoring: A robust monitoring system should be established to track the effectiveness of the carbon tax and ensure compliance. This would involve annual reporting from telecom companies on their emissions reductions and sustainability efforts. For example, South Africa's carbon tax law imposes penalties on companies that fail to report or pay their carbon tax, with additional fines for inaccurate reporting. Similarly, in Canada, businesses that do not comply with the federal carbon pricing system face financial penalties and potential legal action.

Penalties for non-compliance: In ensuring effective implementation, telecom companies must be penalised if there is a failure to meet emissions reduction targets, inaccuracy in reportage, or failure to pay the necessary carbon tax levied amounts.

2.4.2 Implement Monitoring and Verification Framework Carbon Tax

This would involve several steps to ensure that carbon emissions are properly tracked, reported, and verified to comply with regulatory standards and achieve the targeted emission reductions. The various steps include:

- **Define Clear Carbon Tax Policies and Metrics:** This involves determining the types of emissions subject to the tax, establishing how emissions will be measured, and setting specific emission reduction targets; they should be clearly outlined in the policy.
- **Setting up a Comprehensive Data Collection System:** This would involve identifying emission sources and ensuring that data is collected in standardized formats to allow consistent reporting.
- **Develop a Reporting Structure:** This would involve establishing how often telecoms should submit reports to regulators (e.g., quarterly or annually), specifying data required, define what data will be required in the reports, such as energy consumption, emissions per service, carbon intensity per kWh, fleet emissions, and any actions taken toward reducing emissions.
- **Employing an independent Third-Party Verification**: This would involve engaging third-party auditors: Implement external verification mechanisms where an independent third party verifies the accuracy and integrity of the reports, regular audits should be conducted, and compliance with standards should be ensured. Operators would set up internal teams to audit data collected however; it is recommended that the NCCCS engage qualified third-party auditors to audit and ascertain the information submitted.

- **Establishing Corrective Action and Penalty:** Penalties for non-compliance should be established. This could include fines, additional taxes, or requirements to invest in carbon offset programs, adopt energy-efficient technologies, or purchase carbon credits.
- **Review and Improve the Framework:** Continuous monitoring and establish processes for ongoing monitoring and review of the system should be adopted, this would allow for updates as technologies evolve or new carbon reduction practices are developed.
- **Regular Communication and Transparency:** Adequate transparency in reporting should be ensured and the public should be allowed access to certain emissions data through the companies' sustainability reports in line with Nigeria's Data Protection Act (NDPA), which will allow for greater accountability and transparency in how telecom companies are performing on sustainability. Also regularly communicate with regulators, shareholders, and other stakeholders about progress and challenges faced in reducing emissions.
- **Incentivizing Performance:** Incentivizing performances would encourage the adoption of green technology and energy efficiency practices. This would encourage telecom companies to shift to renewable energy sources such as using solar to power their infrastructure. The carbon tax revenue could be allocated as subsidies or tax credits, which would encourage the adoption of clean energy technologies. Also, energy efficiency devices and practices should be promoted within the companies to enhance the reduction of emissions.

2.4.3 Potential Use of Domestic Emission Reduction Units Against the Carbon Tax

The integration of domestic emission reduction units into the carbon tax framework for Nigeria's telecom sector presents an innovative way to balance financial obligations with impactful climate action. This approach incentivizes telecom operators to invest in emission reduction initiatives that directly benefit Nigeria's environment, economy, and energy landscape. Below is a detailed exploration tailored to the Nigerian telecom sector.

Domestic emission reduction units represent verified reductions in GHG emissions achieved through local projects. These units are quantified, monitored, and certified to ensure credibility and compliance with environmental standards. In Nigeria's telecom sector, these emission reduction units can be generated from projects such as:

- Renewable Energy Deployment: Solar or hybrid energy systems for telecom towers to reduce reliance on diesel generators.
- Energy Efficiency Upgrades: Retrofitting existing telecom infrastructure with energy-efficient technologies.
- Waste-to-Energy Solutions: Capturing emissions from telecom facilities and converting them into energy.

- Carbon Sequestration Projects: Reforestation efforts near telecom sites or facilities to offset emissions.

It is envisaged that Nigeria's implementation of Article 6.2 would allow for international carbon trading, which can be linked to the domestic carbon tax by enabling companies to use verified domestic offsets to reduce their tax liability. Businesses subject to the tax, such as telecom firms, can earn carbon credits by adopting renewable energy or emission reduction projects. These credits can either be used for tax compliance or traded internationally as ITMOs (Internationally Transferred Mitigation Outcomes), generating foreign revenue while supporting Nigeria's NDC commitments. However, this would be achievable by implementing a robust MRV system which is essential to ensure the credibility of these offsets.

Mechanism for Offsetting Carbon Tax in the Telecom Sector

Telecom operators in Nigeria could use domestic emission units to offset a portion of their carbon tax liability, providing financial relief while supporting domestic sustainability projects. The mechanism would involve:

- Offset Allowances: Establishing a cap on how much of the tax liability (e.g., 50%) can be offset using the units.
- Project Verification: Ensuring the unit are generated through credible, locally verified projects using standards such as Nigeria's National Monitoring, Reporting, and Verification (MRV) framework.
- Submission Process: Operators would submit the verified units to the regulatory authority (e.g., Nigeria's Council for Climate Change) for tax offset purposes.

Practical Examples and Local Context

In Nigeria, telecom operators like MTN and Airtel have begun exploring renewable energy solutions for their operations, such as solar-powered telecom towers. Expanding these efforts would allow operators to offset tax liabilities while scaling up green infrastructure.

For example, a telecom operator could invest in a solar farm near its operational hubs, generate emission reduction units for the emission reductions achieved, and use these units to offset its carbon tax obligations. This approach would reduce costs, enhance brand reputation, and support local energy development. Similarly, an operator can purchase verified emission units and use as offsets from another operator who has surpassed his emission reduction targets. This may be within the sector or across other sectors. Emission reduction units must however be verified and certified by a third-party auditor/consultant.

2.4.4 Recommendations on the Extent and Modalities for the Use of Offsets

To implement the use of carbon offsets effectively in Nigeria's telecom sector, it is critical to define the extent of their use and establish clear modalities. These recommendations ensure alignment with Nigeria's climate goals while fostering adoption and compliance by telecom operators.

1. Recommendations on the Extent of Offset Use

The extent to which offsets can be utilized should balance financial relief for telecom operators and the need to drive sustainable behavioural change. Below are recommendations:

- Cap on Offset Usage: Allow telecom operators to offset their carbon tax liabilities using domestic emission reduction units. This ensures that operators still contribute financially to the tax while incentivizing investments in emission reduction projects.
- Sector-Specific Thresholds: Define offset usage limits based on the emission profiles of operators. For instance:
  - Higher thresholds for operators transitioning from diesel generators to renewable energy.
  - Lower thresholds for operators with minimal emissions or existing renewable energy infrastructure.
- Annual Review of Caps: Establish a mechanism to periodically review and adjust offset caps based on sectoral emission trends, technological advancements, and policy updates.
- Focus on Domestic Offsets: Prioritize offsets generated from projects within Nigeria to stimulate local climate action and economic benefits.

2. Modalities for the Use of Offsets

A clear framework is necessary for telecom operators to integrate offsets into their carbon tax obligations. Key modalities include:

A. Project Approval and Registration

- Approved Project Types: Limit offsets to projects that align with Nigeria's NDC, such as renewable energy deployment, energy efficiency, and reforestation.
- Mandatory Registration: All offset projects must be registered with Nigeria's Council for Climate Change and other authorized entities.

B. Validation, Verification and Certification

- Independent Validation and Verification: Require all offset projects to undergo third-party validation and verification to ensure credibility and accuracy of emission reductions.

C. Certification Standards

- Use established protocols, such as the Verified Carbon Standard (VCS), Gold Standard or Paris Agreement Crediting Mechanism (PACM). Nigeria finalized its long-awaited Carbon Market

Activation Policy, positioning it to unlock as much as $2.5 billion in high-integrity carbon credit investments by 2030[74]. The policy introduces new market infrastructure, including a national carbon registry, project eligibility rules aligned with Article 6 of the Paris Agreement and incentives to scale private-sector credit generation. The registry has been developed under the Africa Carbon Market Initiative (ACMI) and has been operational since 2024. In contrast to some African countries like Kenya, which already host a sizable number of projects under voluntary carbon standards like Verra and Gold Standard, Nigeria's market is still in a development phase, but recent policy actions indicate a rapid ramp-up. However, to enhance international coherence and support compliance markets, Nigeria is also preparing to formally integrate the PACM under Article 6 thereby enabling ITMO-based transactions, fostering transparency through corresponding adjustments, and reinforcing the framework's integrity and market credibility.

- Offset Submission Timelines: Operators should submit offset certificates annually during the carbon tax compliance cycle.
- Digital Submission Platform: Develop a user-friendly online platform for operators to upload offset documentation and monitor compliance status.

D. Cost Considerations

- Offset Pricing Mechanism: Introduce a standardized price range for offsets to ensure affordability while reflecting their environmental value.
- Incentives for Early Adoption: Offer tax discounts or additional offset allowances for operators that adopt offsets early in the compliance period.

Implementing a structured approach to offsets will not only ease the financial burden of carbon taxes on Nigeria's telecom sector but also drive meaningful environmental and economic change. It is important to build the capacity of the operators to understand the dynamics and how offsets can be effectively utilized. Compliance should also be monitored to ensure that only quality emission reduction units (carbon credits) are purchased or traded for offsets.

[74] https://www.fastmarkets.com/insights/nigeria-finalizes-carbon-market-policy-targets-2-5-bln-in-climate-investment-by-2030/ The Carbon Market Activation Policy was finalized in April of 2025 as announced by President Bola Ahmed Tinubu.

2.5 Conclusion and Recommendations

2.5.1 Conclusion

A carbon tax in the telecommunications industry can be implemented using a multifaceted approach. The various steps or activities include conducting the GHG inventory, adopting green technologies to enhance emissions reduction, transitioning to renewable energy, aligning with regulatory policies, and managing the financial impact of the carbon taxes on the telecommunications industry so that the industry's sustainability goals are met.

2.5.2 Recommendations for Regulators and Other Implementing Agencies

To ensure a smooth and effective implementation of the pilot carbon tax, the following governance-focused recommendations are proposed:

1. Establish Clear Governance and Institutional Roles

- Clarify responsibilities among relevant agencies such as the NCCCS, FIRS, NCC, and NBS regarding monitoring, reporting, verification, and enforcement of the carbon tax.
- Develop a coordinated implementation framework that outlines the workflow from emissions reporting to tax collection.

2. Implement Measurement, Reporting, and Verification (MRV) Guidelines

- Implement the MRV framework for the telecommunications sector to guide emissions data collection and reporting.
- Address capacity gaps by training operators and third-party verifiers on MRV procedures and emissions factors relevant to telecom infrastructure (e.g., BTS, data centres).

3. Address Data Gaps and Methodological Challenges

- Prioritize the development of baseline emissions data for telecom operators to ensure accurate tax calculations during the pilot phase.
- Consider simplified methodologies or default emissions factors for smaller operators lacking the capacity for precise emissions tracking.

4. Strengthen Stakeholder Engagement and Transparency

- Maintain an inclusive consultation process with telecom operators, civil society, and development partners throughout the pilot.
- Establish a Carbon Tax Implementation Advisory Committee with telecom representation to guide sector-specific issues and ensure buy-in.

5. Monitoring, Evaluation, and Adjustment

- Develop a monitoring and learning framework for the pilot to assess effectiveness, economic impact, compliance behaviour, and administrative feasibility.
- Use pilot results to inform scaling-up, including adjustments to tax design, MRV systems, and institutional coordination.

Overall, to effectively design and implement a carbon tax in Nigeria's telecommunications sector, a robust and comprehensive data set is required. The data will help evaluate the sector's emissions profile, understand current energy consumption patterns, and assess the financial and operational implications of a carbon pricing mechanism. This information is essential to ensure that the tax is equitable, practical, and aligned with national sustainability goals. The table below outlines the recommended categories of data that should be collected and analysed to support the evaluation and formulation of a carbon tax policy tailored to the telecom sector.

Table 11: Key Data Requirements for Evaluating a Carbon Tax in Nigeria's Telecommunications Sector

	Category	Description
1	Energy Consumption Data	- Amount and sources of energy consumed by telecom operators (diesel, grid electricity, renewable energy).
2	Emissions Data	- Direct emissions (Scope 1) from diesel generators and company-owned vehicles. - Indirect emissions (Scope 2) from electricity use. - Estimations of Scope 3 emissions where applicable.
3	Operational Data	- Number and type of telecom infrastructure assets (e.g., base transceiver stations, fiber optic networks, data centers).
4	Electricity Billing Records	- Power bills indicating consumption trends and tariffs paid
5	Technology Profile and Equipment Efficiency	- Types and efficiency ratings of network equipment and generators. - Data on retrofits, upgrades, or energy-saving technologies deployed.
6	Financial Data	- Revenue and cost structures that could influence the economic impact of a carbon tax.
7	Data on Mitigation Measures	- Information on renewable energy adoption, energy-efficient upgrades, or carbon offset activities already in place.
8	Growth Projections and Future Infrastructure Plans	- Anticipated expansion or technology changes that might affect future emissions and tax base.

2.5.3 Recommendations for Telecoms Operators

For a successful implementation of the carbon tax, the telecommunication industry should adapt and manage the impact of the carbon tax. This can be achieved through practices such as:

- **Shifting to the use of Renewable Energy**: The telecoms industry should adopt a shift from the use of non-renewable energy sources to renewable energy (e.g., solar) to reduce emissions and avoid the levy of the carbon tax.
- **Adopting the concept of Energy Efficiency**: Investing in, deploying, and upgrading to the use of energy-efficient equipment and energy-saving technologies in the telecommunication industry will help reduce carbon tax liabilities in the long term.
- **Leverage Carbon Offsets**: To avoid a drastic effect on operations, telecommunication companies should consider purchasing carbon offsets to meet future emissions targets.
- **Promoting Sustainability Messaging**: Prioritizing sustainability as the selling point in the telecommunication industry would significantly enhance the sector's competitive market. This can be achieved through the disclosure of emissions and the annual publicizing of the company's sustainability and ESG report.

SECTION 3: NATIONAL MRV SYSTEM FOR NIGERIA

3.1 Introduction

3.1.1 Overview of the Telecommunication Sector

Operations in telecoms, especially the powering of towers, heavily rely on diesel generators due to the limited and often unreliable electricity supply from the national grid. This dependence on diesel power results in substantial carbon dioxide (CO_2) emissions and the release of particulate matter and nitrogen oxides (NOx), impacting air quality and the health of local communities where towers are located. According to the National Communication Commission (NCC), in 2021, there are over forty thousand (40, 000) towers in Nigeria, however a September 2024 report by Punch.ng had reported that over 50 million litres of diesel is consumed each month (about 1.67 million litres per day) to power base transceiver stations (BTS). This fuel consumption would result in an estimated 1.6MtCO2e/yr of GHG emissions per year given that the density of the diesel (kg/litre) is 0.85, the Net Calorific Value (NCV in MJ/Kg) is 43 and the Emission Factor (EF in kgCO2/MJ) is 0.0741[75]. Beyond emissions from power generation, the carbon footprint is intensified by the logistics of delivery of the diesel fuel which is trucked frequently to the various telecoms' base stations.

Emissions from the telecoms sector are from various sources such as emissions from power generation for network operations, equipment manufacturing/disposal, network infrastructure, supply chain logistics, data transmission services etc., therefore, there is a need to set up sector-wide comprehensive data gathering process. The data required encompasses both direct emission data (e.g., fuel consumption, electricity usage) and activity data essential for assessing GHG emissions, such as operational hours, equipment specifications, and maintenance practices across telecom sites.

According to Nigeria's BTR1 to the UNFCCC, released in December 2024, Nigeria's total GHG emissions for the year 2024 excluding emissions from LULUCF were reported to exceed 328 $MtCO_2e$. Of this total, the energy sector accounts for approximately 43%[76]. In the Telecommunications sector, estimates made based on a report by Punch[77] indicates that mobile network operators contribute about 1.6 $MtCO_2e$ annually through fuel consumption for operational services which represents about 0.46% of Nigeria's total annual emissions. Data centres, however, have emissions from their operations to be about 2 $MtCO_2e$ which is about 0.6% of Nigeria's total annual emissions.

Considering the country's current emission profile and the continuous rapid expansion of the telecoms sector, the urgent need for a robust MRV system cannot be overemphasised. Implementing robust MRV system is essential for telecom operators to effectively track and monitor their emissions,

[75] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[76] https://unfccc.int/documents/645210
[77] https://punchng.com/telcos-shift-to-renewables-as-diesel-cost-hits-n570bn/

comply with regulatory standards, and drive meaningful sustainability initiatives which will enhance GHG emission reductions. Some of the critical importance of MRV in Nigerian telecommunications are highlighted below:

- ***Emissions Tracking and Monitoring*:** MRV systems are essential for tracking and monitoring GHG emissions, particularly from the energy consumption in telecommunication mobile network operations and data centres. Accurate measurement of these emissions enables telecom companies to reliably quantify their carbon footprint and identify verifiable reduction opportunities.
- ***Regulatory Compliance*:** Nigeria has been improving its regulatory framework regarding environmental protection and emission reduction. MRV ensures that telecom operators comply with local regulations, such as the National Environmental Regulations, and international standards.
- ***Performance Assessment*:** Implementing MRV enables telecom companies to assess the effectiveness of their energy efficiency and emissions reduction initiatives. This is critical for identifying successful strategies and making necessary adjustments to achieve sustainability targets.
- ***Data-Driven Decision Making*:** The Nigerian electricity grid faces challenges such as unreliability and frequent outages. Accurate MRV provides data that can guide telecom companies in optimizing their energy consumption and making choices of energy sources based on low carbon and low cost of fuel.

3.1.2 MRV Concepts

MRV systems provides the frameworks for measuring, tracking, documenting, and validating GHG emissions, mitigation actions, and climate finance data. These systems ensure transparency and credibility in climate change mitigation efforts, enabling stakeholders to assess progress, align with international standards, and make informed decisions.

Measurement/Monitoring (M): Measurement sets the path for the reporting and verification concept. Measurement applies to data and information related to GHG emissions, mitigation actions and support. Measurement/monitoring can be carried out at the industry (facility), sectoral, or national level. However, for the telecommunication sector, measurement shall be peculiar to the facility level, and this shall be achieved through direct and or estimated measurement methods.

- ***Direct Emissions (Scope 1):*** These arise primarily from the use of diesel generators at telecom sites. To accurately capture these emissions, direct measurement will be conducted using specialized devices such as smart meters and IoT-enabled sensors. This approach allows for continuous monitoring, ensuring reliable data collection for GHG quantification.

- ***Indirect Emissions (Scope 2):*** These are associated with electricity consumption. In cases where direct measurement cannot be applied, emissions will be estimated using established calculation methods. These estimations will adhere to strict guidelines and protocols as outlined in the Intergovernmental Panel on Climate Change (IPCC) Guidelines or other widely recognized methodologies. This ensures consistency in the assessment of electricity-related emissions across telecom facilities.

While estimation methods can be deployed, direct measurements, as much as applicable, is encouraged to ensure continuous improvement of data quality.

Reporting (R): The Reporting process involves the compilation and documentation of the collected information or measured data from the respective facilities or companies. This includes the GHG inventory, mitigation actions, their effects, constraints, and gaps encountered, support needed and received, and any other relevant information. At national level, reporting is communicated through national reports such as the National Communications (NC), NDC and the Biennial Transparency Report (BTR) to the UNFCCC. However, reporting at the company/facility level would be through GHG Inventory reports, Sustainability Reports etc. It should be mentioned that currently, there is no legal basis for inventory reporting in the telecom sector.

Verification (V): This process involves assessing the credibility and accuracy of the reported information/data to check and ensure its consistency with established guidelines/framework. Verification can either be internal or external to ensure that the reported information follows the established guidelines.

Verification processes can be conducted internally or by a third party however, for transparency, it is encouraged that third-party verifiers should conduct verification.

3.1.3 MRV Principles

The principles of MRV systems include Transparency, Accuracy, Consistency, Completeness, and Comparability (TACCC) serve as the basis for robust GHG Inventories. These principles ensure that GHG emissions, mitigation activities, and climate finance data are credible, reliable, and aligns with international reporting standards such as the IPCC Guidelines.

- **Transparency:** All methodologies, assumptions, and data sources should be openly documented and accessible for independent review. This ensures trust in the processes used,

enhances credibility and facilitates effective communication that will enable an informed decision-making.

- **Accuracy:** Emissions data and estimates through scientifically robust tools and methods must be as precise as possible to minimize uncertainties and errors. High accuracy is essential for ensuring that reported data reflect actual conditions, strengthening policy responses and financial investments. Adjustments should be made to address identified inaccuracies promptly.
- **Consistency:** Data collection and reporting must use standardized methodologies across time periods. This ensures that trends and changes are comparable and interpretable over time. Consistency avoids discrepancies caused by methodological shifts, enabling meaningful analysis of progress toward climate goals.
- **Completeness:** MRV systems should include all significant emission sources (energy consumption) and other relevant data to provide a comprehensive picture. This includes:
    - **Scope 1 (Direct Emissions):** Emissions from on-site fuel combustion, such as diesel generators, which will be monitored through direct measurement using smart meters and IoT-enabled sensors.
    - **Scope 2 (Indirect Emissions):** Emissions from electricity consumption, which will be estimated using calculation methods in line with IPCC Guidelines or other recognized protocols.

Due to the complexity of accounting for Scope 3 emissions, we recommend that at this stage, Scope 1 and 2 should be covered.

- **Comparability:** Data and reports should adhere to internationally recognized standards (e.g IPCC Guidelines and GHG Protocol,) and methodologies for fair comparisons across different entities. This principle facilitates data harmonization, which is essential for global collaborations like those under the Paris Agreement.

3.1.4 Existing MRV Framework under the UNFCCC

The MRV framework under the UNFCCC has been enhanced to align with the requirements of the Enhanced Transparency Framework (ETF) established under Article 13 of the Paris Agreement. This framework provides common guidelines for all Parties to report on their GHG emissions, progress in implementing NDCs, and support provided/received. The Modalities, Procedures, and Guidelines

(MPGs) for the ETF are outlined in Decision 18/CMA.1, emphasizing transparency, accuracy, completeness, consistency, and comparability (TACCC principles)[78].

3.1.5 International MRV Framework under the ETF

Under the ETF, the key reporting requirements for all Parties, including developing countries, are as follows:

- Biennial Transparency Reports (BTRs):
    - All Parties are required to submit BTRs every two years, replacing the previous Biennial Update Reports (BURs) for developing countries.
    - BTRs must include comprehensive data on GHG inventories, progress in implementing NDCs, and support needed and received, using the common reporting tables (CRTs) and common tabular formats (CTFs) as specified in Decision 18/CMA.1.
    - Developing countries have flexibility provisions in areas such as reporting frequency, scope, and methodology based on their capacities.
- National Communications (NCs):
    - Submitted every four years, NCs provide additional context on national circumstances, GHG inventories, mitigation actions, and financial, technological, and capacity-building support.
- International Consultation and Analysis (ICA):
    - BTRs submitted by developing countries are subject to the ICA process, comprising a technical analysis and a facilitative sharing of views (FSV).
    - The ICA process ensures that BTRs adhere to the TACCC principles and identifies areas for capacity-building support.

3.1.6 Domestic MRV Framework for Developing Countries

At the national level, developing countries are expected to:

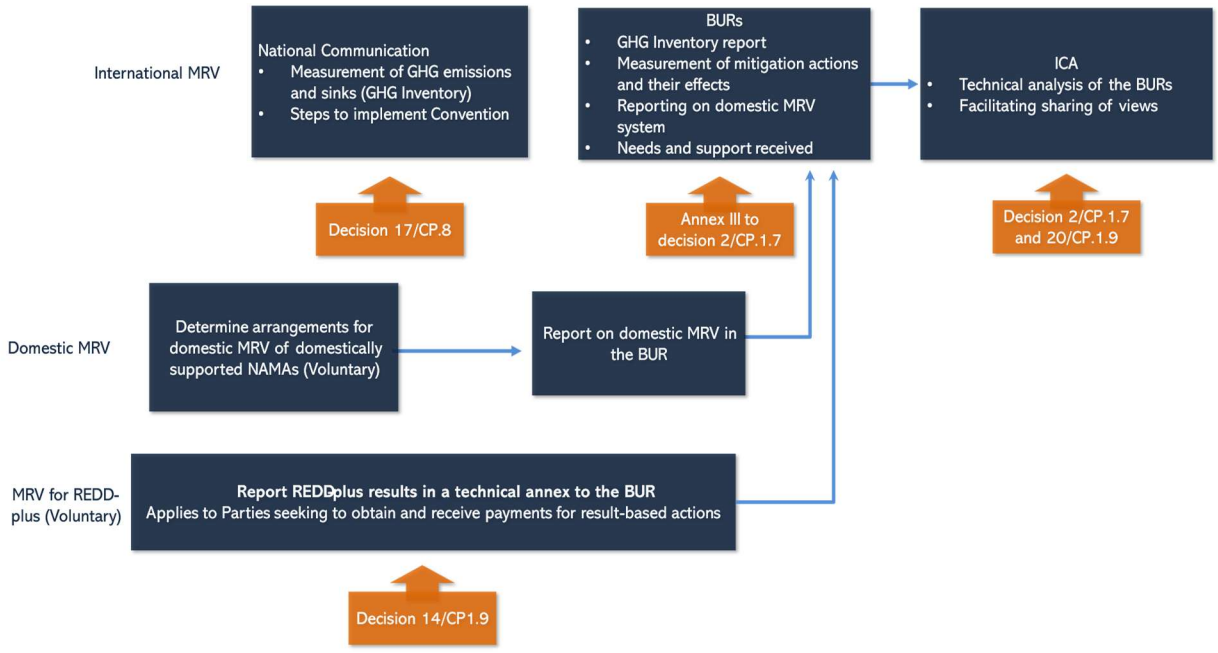
- Develop Domestic MRV Systems: Establish MRV frameworks to collect and report data on GHG emissions, NDC implementation, and support provided/received, in line with the MPGs.

[78] https://unfccc.int/documents/193408

- Implement Flexibility Provisions: Apply flexibility in reporting frequency, scope, and methodologies, as permitted under the MPGs, based on national capacities.
- Align with NDC Implementation: Ensure that the domestic MRV system is capable of tracking progress towards NDC targets using common guidelines and reporting templates.
- Integrate Scope 1, 2, and 3 Emission Sources: The MRV framework should encompass direct emissions (Scope 1), indirect emissions (Scope 2), and relevant indirect emissions (Scope 3), aligning with international guidelines.

This structured approach ensures that the MRV framework under the ETF effectively captures all relevant data while accommodating the specific circumstances of developing countries.

Figure 10: UNFCCC Existing MRV Framework



Source: Energy Sector Report

N.B: The Biennial Transparency Report (BTR) replaces the Biennial Update Report (BUR) as part of the ETF under the Paris Agreement, ensuring improved reporting on climate actions and support. Countries are now required to submit BTRs instead of BURs, starting from 2024, in line with UNFCCC guidelines.

3.1.7 Existing MRV Practices in the Telecommunication Sector

The Monitoring, Reporting and Verification processes in the telecommunications sector in Nigeria is still in its infancy when it comes to implementing measuring, tracking and reporting emissions. While some monitoring practices are in place, they are mostly focused on operational metrics such as subscriber data, internet data usage, etc. There is, however, no direct focus on climate impact or a coordinated approach to tracking energy consumption or GHG emissions. The table below presents some monitored operational metrics and the current practices.

Table 12: Monitored Operational Metrics and Current Practices.

Monitored Operational Metrics	Current Practice
Subscriber Data	The NCC and telecom operators collect data on the number of subscribers and active SIM cards, which helps monitor market penetration. As of early 2024, an infographic from DataLeum indicated that as of Q4 2023, the total number of active mobile subscribers in Nigeria has over 387 million[79] based on data from the National Bureau of Statistics (NBS), making it one of the most vibrant telecom markets globally.
Internet Data Usage	Data usage in Nigeria has grown exponentially, surpassing 500,000 terabytes (TB) in 2023 due to the proliferation of smartphones and high-speed internet services. According to the NCC, the country's internet data usage surged to a record 753,388.77 terabytes (TB) in March 2024[80]. (Telecom companies track data usage to optimize network performance).
Energy Monitoring	Energy consumption is one of the telecom sector's major cost drivers, particularly in areas where power is supplied primarily by diesel generators due to the national grid's unreliability. While some telecom operators monitor energy consumption at their facilities, this is done inconsistently and often lacks a focus on emissions reduction. Furthermore, the heavy reliance on diesel generators exacerbates GHG emissions but, it is not systematically tracked as part of an MRV framework.
Infrastructure Operations	Telecom infrastructure providers like IHS Towers and Helios Towers monitor the performance of telecom towers, but their environmental metrics, including energy use and emissions from diesel generators, are fragmented and not integrated into national climate reporting systems.

[79] Infographics from DataLeum indicates that the total number of subscribers in Nigeria was 387.8 million as of Q4 2023, based on data from the National Bureau of Statistics (NBS).
[80] https://businessday.ng/technology/article/nigerias-internet-usage-hits-record-high-on-rising-5g-subscriptions/

3.1.8 Challenges and Gaps

Despite the growth of the telecom sector, several challenges hinder the development of an effective MRV system in Nigeria's telecommunications industry. The table below shows some of these challenges and gaps.

Table 13: Challenges, Gaps and Descriptions

Challenges/Gaps	Descriptions
Lack of Climate-relevant Activity Data	While telecom companies track operational data such as subscriber numbers and internet usage, publicly available energy consumption or emissions intensity data is limited. Data collection for climate-relevant activities, such as tracking GHG emissions from diesel generators or grid electricity usage, is incomplete or inconsistent. There is no formal data collection and reporting system currently available.
Lack of Standardized Measurement Tools	The absence of standardized measurement tools or methodologies for measuring emissions in the sector is a significant challenge. Different telecom operators monitor energy consumption and emissions in various ways, leading to inconsistencies and difficulty in aggregating data at the national level.
Verification Process	Verification by independent third parties is necessary to ensure the accuracy and credibility of emissions data. However, there is currently no formal verification process for the telecom sector's GHG emissions data, which challenges the credibility of reported figures and makes it difficult to track progress towards climate targets.
Fragmented Data Collection	The data collected by telecommunications companies and infrastructure providers is often incomplete making it challenging to understand the impact of emissions on the sector. While companies may collect energy data at specific sites, this information is not aggregated into a coherent national MRV framework.
Resource and Capacity Constraints	Implementing an MRV system requires substantial investment in technology, infrastructure, and human capacity. The telecommunications sector, which is primarily focused on service delivery, often lacks the resources or technical expertise required to develop robust MRV systems.
Regulatory Gaps	The existing regulatory framework does not mandate that the telecommunications sector report emissions or energy consumption. This lack of regulatory alignment with Nigeria's climate commitments hinders the sector's ability to contribute effectively to national climate goals.

3.2 Institutional Framework

3.2.1 Overview

An institutional framework is critical for ensuring that all relevant parties are involved in measuring, reporting, and verifying GHG emissions within the telecommunications sector. This arrangement outlines how data should be gathered, reviewed, and verified, ensuring transparency, credibility and accountability. To effectively operationalize a robust and effective MRV system in the telecommunications sector, it is essential that the responsibilities of each stakeholder are clearly defined, and regulatory mechanisms are put in place to mandate compliance.

This chapter will provide an overview of the existing regulatory landscape, propose an institutional arrangement for the MRV system, and outline the specific roles and responsibilities of stakeholders involved in the process.

3.2.2 Regulatory and Institutional Landscape

The telecommunications sector in Nigeria is primarily regulated by the NCC. The NCC oversees all telecom companies' operations. However, there are limited formal mechanisms that specifically target emissions monitoring and sustainability reporting.

Currently, the following elements comprise the institutional landscape for MRV within the sector:

- **Regulatory Frameworks:** While the NCC mandates telecom operators to adhere to specific operational standards, these regulations primarily focus on service delivery, market competition, and consumer protection rather than environmental impacts. There are no explicit regulations requiring operators to monitor, report, and verify their GHG emissions.
- **Existing Reporting Practices:** Telecom operators collect operational data such as subscriber numbers and internet and data usage; however, these reporting practices do not in most cases include energy consumption or emissions data. Reports submitted to the NCC focus on financial and market metrics, with little or no emphasis on environmental sustainability.
- **Collaboration with Environmental Agencies:** Some telecom companies have voluntarily partnered with environmental organizations to promote sustainability. These collaborations aim to raise awareness about climate change and encourage the adoption of greener technologies, but they lack the institutional backing necessary for widespread implementation.
- **International Commitments:** Nigeria's commitments under the Paris Agreement and its NDCs provide a framework for integrating sustainability into the telecommunications sector. However, there is a gap between these international commitments and local regulatory enforcement, leading to inconsistencies in how telecom operators address climate change.

Overall, the current regulatory and institutional landscape presents significant gaps that must be addressed to facilitate the implementation of an effective MRV system in Nigeria's telecommunications sector. However, an existing legal framework can be significantly leveraged to enhance the development of a robust MRV system within the telecommunications sector.

- **Legal Framework**

Development and implementation of MRV systems in Nigeria's telecommunication sector require a robust legal framework. Such framework ensures compliance, accountability, and alignment with national climate objectives and international commitments. Existing laws and regulations in the telecommunication and environmental sectors provide a foundation for developing MRV systems for the sector.

Nigeria's Nigerian Communications Act (2003) empowers the NCC to regulate technical standards and ensure accountability among telecommunication operators. This Act can be expanded to include mandatory reporting of GHG emissions and energy use from infrastructure such as base transceiver stations, data centres, and backup power systems. In October 2024, the NCC announced an initiative to revise and update the 2016 Nigeria National Code of Corporate Governance to focus on introducing mandatory sustainability reporting for operators in the telecommunication sector. The initiative aims to promote transparency and align the global ESG standards with the telecommunications sector, supporting sustainable development goals. Similarly, the Climate Change Act (2021) creates a legal foundation for climate action in Nigeria and establishes the NCCC. The Act mandates the NCCC to ensure compliance with national climate commitments. It backs the Commission to request reporting obligations from all sectors, including telecommunications, hence requiring operators to implement effective MRV systems to track their GHG emissions accurately.

Additionally, existing frameworks, such as the Environmental Impact Assessment (EIA) Act (1992) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act (2007), provide opportunities to embed MRV requirements into environmental compliance standards. The EIA Act already mandates businesses to assess and report environmental impacts, which can be expanded to include emissions reporting in telecom operations. NESREA, on the other hand, enforces environmental standards but currently lacks sector-specific guidelines for emissions verification within the telecommunications sector.

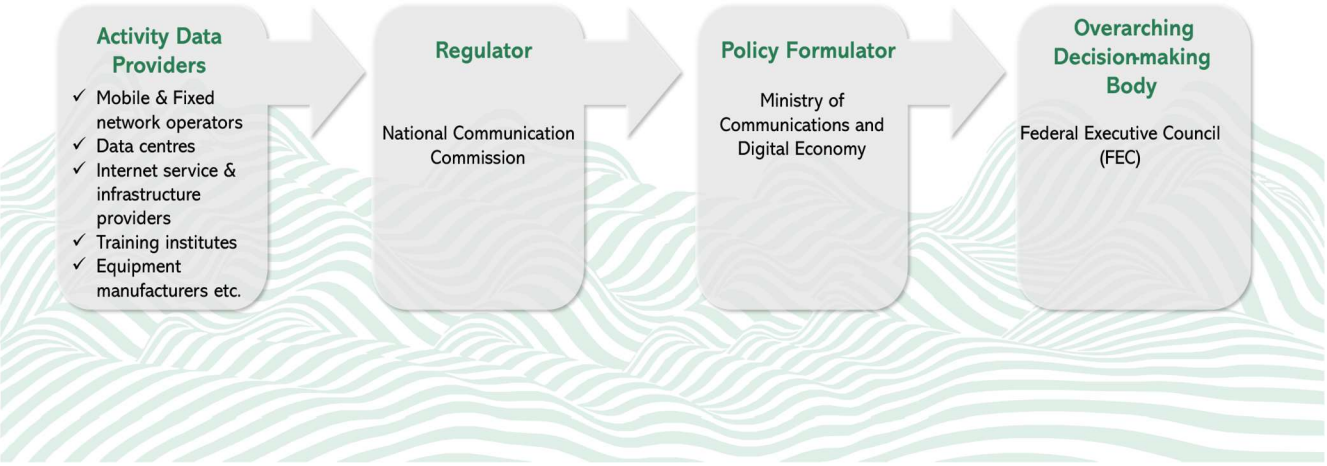
On an international level, Nigeria's commitments (conditional and unconditional NDC targets mentioned above) under the Paris Agreement (2015) are significant drivers for developing MRV systems. A functional MRV system in the telecommunication sector would contribute to achieving this goal while enhancing transparency and accountability in emissions reporting. Furthermore, under Article 6 of the Paris Agreement, verifiable emissions data is crucial for participating in carbon markets;

- **Existing Institutional Arrangement in the Nigerian Telecom Sector**

The NCC oversees and regulates the telecom operations across the country. Entities such as telecom operators, infrastructure providers, internet service providers, equipment manufacturers, etc, need to report operational, compliance, and performance data to the NCC.

This reporting process ensures that the sector adheres to national standards, facilitates transparent operations, and drives continuous improvement in service delivery. The NCC, in turn, reports to the Ministry of Communications and Digital Economy, which oversees the implementation of national telecommunications policies and strategies. The Ministry then reports to the Federal Executive Council (FEC), ensuring that telecom policies align with broader national development goals. The figure below highlights the existing institutional arrangement within the sector.

Figure 11: Existing Institutional Arrangement



Source: Designed by Carbon-Limits Nigeria

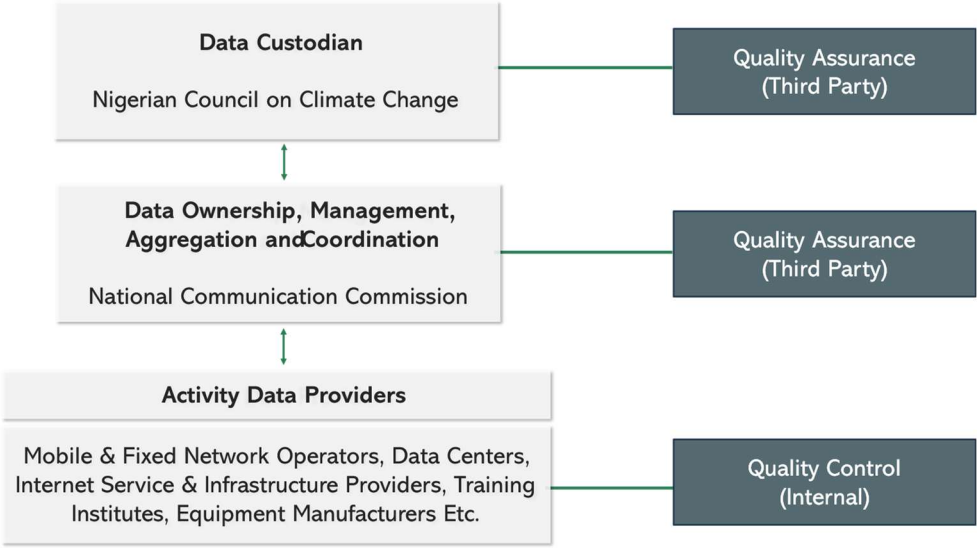
3.2.3 Proposed Institutional Arrangement for MRV

The successful implementation of an MRV system in the telecommunications sector will largely depend on a well-organized institutional arrangement where all key players are assigned roles and responsibilities. Highlighted below is a proposed arrangement for implementing MRV in the telecom sector.

- **Desk Officer for Sustainability (Telecom Operators):** Each telecommunications company should appoint a Sustainability Desk Officer responsible for gathering energy consumption (electricity, fuel etc.), emissions (scopes 1,2,3), and other climate-related data. This role will ensure accurate data collection and submission to the relevant authorities.

- **Internal Review (Quality Control/Quality Assurance):** Companies will need to implement internal procedures for data quality assurance (QA) The internal review process should ensure that energy use, waste management, sustainability measures and emissions data are accurately measured and compliant with national and international MRV standards. QA will be performed by the third-party auditor engaged by NCC and NCCC.
- **External Verification:** To maintain the MRV system's integrity, independent third-party auditors should subject telecom operators' data to external verification and validation. The NCCC and NCC should hire third-party auditors to ensure the reported data's accuracy, credibility, and transparency.
- **Nigerian Communications Commission (NCC) as Data Custodian:** The NCC will serve as the national data custodian for all MRV-related submissions. In this role, the NCC will request and collect, climate-related data from telecommunications operators. The commission will also conduct quality control (QC). Data will then be sent to NCCC who also will quality control the data received before using the data for climate/emission reduction reports.

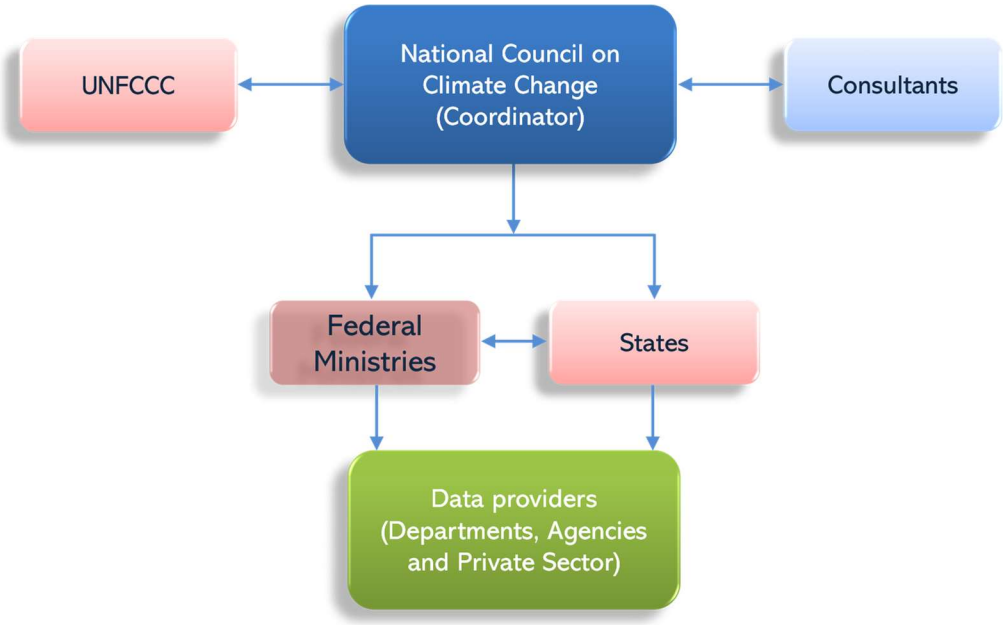
Figure 12: Proposed Institutional Arrangement



Source: Designed by CLN

The proposed institutional arrangement is designed to fit into the existing overarching national institutional arrangement. See the overarching institutional arrangement in
Figure 13 *below.*

Figure 13: Institutional arrangement for inventory and emissions reduction.



Source: Industry Report

3.2.4 Roles and Responsibilities of Key Stakeholders

The successful implementation of the MRV system will require clear roles and responsibilities for all stakeholders involved:

- **Telecommunications Operators[81]:** Responsible for collecting and reporting accurate emissions and energy consumption data, implementing internal review processes, and collaborating with regulatory bodies.
- **Nigerian Communications Commission (NCC):** NCC would oversee compliance with reporting requirements, provide guidelines for emissions monitoring, and facilitate coordination among stakeholders. NCC would also perform QA functions and work with third-party auditors to verify and validate the submitted data.
    - NCC should spearhead the collection of data from the Telecoms sector and then disseminate it to the NCCC.
    - NCC should ensure quality assurance and quality control of the telecoms data in the National Climate data, Integrate an MRV into the telecom's operations and standardize operators' data.

[81] Telecom Operators include Mobile and Fixed Network Operators, Data Centers, Internet Service Providers, Internet Service Providers, Infrastructure Providers, Training Institute, Equipment Manufacturer etc.

- **Nigeria Climate Change Commission (NCCC):** This commission is the custodian of emissions data, ensuring that the data collected by telecom operators is aggregated and used for national climate reporting.
- **Technical Experts and Consultants:** Provide guidance and support to telecom operators in establishing effective MRV systems, including developing standardised measurement tools and methodologies.

In line with the successful implementation of the MRV system, it is essential to integrate the TACCC principles across all stakeholder roles.

I. Telecommunications operators must ensure transparent and accurate data collection and reporting, implementing internal review processes to guarantee the reliability of the data.
II. The NCC will oversee the consistency of data reporting, enforcing standardized frameworks and conducting audits to ensure accuracy.
III. The NCCC will aggregate emissions data from telecom operators, ensuring completeness and alignment with national climate reporting requirements.
IV. Technical experts and consultants will provide guidance on standardized measurement tools and methodologies, facilitating comparability with global emissions data while ensuring that all relevant emissions and energy consumption data are captured.

3.3 MRV Requirements for the Telecommunication Sector

This chapter explores the MRV requirements specifically for the telecommunications sector. It highlights the specific data requirements, methodologies, and performance metrics essential for tracking energy consumption, quantifying emissions, and enhancing accountability among all relevant stakeholders.

Furthermore, the chapter highlights key performance indicators (KPIs) to evaluate the effectiveness of the MRV, ensuring alignment with Nigeria's overarching commitments as stated in the NDC.

3.3.1 Data Requirements

The success of the MRV system for the telecommunications sector relies on a comprehensive collection of data across key energy, emissions, and operational metrics. Given Nigeria's telecommunications industry's unique challenges and characteristics including extensive reliance on diesel generators and unreliable grid electricity data must be tailored to reflect the national context. Key data requirements include:

Energy Consumption Data: The Nigerian telecommunications sector is one of the largest energy consumers in the country due to the high number of cell towers, base stations, and data centres, many of which are powered by off-grid energy sources. To properly monitor the amount of energy consumed, the following data should be collected; however, this would depend on the energy source.

1. **Grid Electricity:** Telecoms companies should collect data on electricity consumption from load centres in regions with grid access. The information to be collected would include the total kilowatt-hours (kWh) consumed per telecom facility.
2. **Diesel and Backup Generators:** Many telecommunications sites rely heavily on diesel generators due to unreliable grid power. The amount of diesel consumed (in litres) and the generators' operational hours of each generator. The data be should reported using the reporting template provided by the regulators which is in line with the IPCC Guidelines, ensuring that information on fuel type, fuel consumption rate, and emission factors are clearly documented.
3. **Renewable Energy:** Data on solar power usage or other renewable energy sources, including the amount of energy generated and consumed (kWh), will be crucial to understand the energy mix of the companies.
4. **Greenhouse Gas (GHG) Emissions Data** ($KgCO_2e$)**:** GHG emissions data will be derived from the energy consumption figures, aligning with the Tier methodologies outlined in the IPCC Guidelines. The MRV system will track emissions across:

- **Scope 1 Emissions:** Direct emissions from on-site diesel generators, calculated using Tier 1 or Tier 2 methodologies based on available data. Tier 1 applies default emission factors, while Tier 2 incorporates sector-specific or country-specific data for more accurate calculations.
- **Scope 2 Emissions:** Indirect emissions from purchased grid electricity, assessed using Tier 1 or Tier 2 methods depending on data availability and quality.
- **Scope 3 Emissions:** While Scope 3 emissions provide a more comprehensive overview of an organization's carbon footprint, their inclusion at this stage presents significant challenges in terms of data availability, accuracy, and reporting consistency. Unlike Scope 1 and Scope 2 emissions, which can be directly monitored and quantified using measurable energy consumption data, Scope 3 emissions involve indirect sources such as supply chain activities, employee commuting, and product lifecycle impacts.

In the context of the Nigerian telecommunications sector, several factors make it impractical to include Scope 3 emissions at this stage:

- **Data Availability:** Obtaining accurate and consistent data for Scope 3 emissions is complex, as it requires collaboration with third-party suppliers, service providers, and other external stakeholders who may not have established data monitoring and reporting systems.
- **Capacity Constraints:** The current focus is on establishing robust systems for monitoring Scope 1 and Scope 2 emissions, which are already resource-intensive. Including Scope 3 emissions would require significant capacity building, technical support, and financial investment to implement standardized data collection frameworks across multiple external entities.
- **Implementation Phases:** Introducing Scope 3 emissions at the initial phase could overburden telecom operators and regulators, diverting resources from effectively operationalizing the MRV system for direct and indirect emissions. A phased approach, starting with Scope 1 and Scope 2 emissions, allows for capacity building, data system strengthening, and gradual scaling to include Scope 3 emissions in subsequent phases.

Therefore, the current focus will remain on Scope 1 and Scope 2 emissions to ensure data integrity, consistency, and alignment with Tier 1 and Tier 2 methodologies under the IPCC guidelines.

5. **Operational Data:** The operational efficiency of telecommunications infrastructure, such as the number of active cell towers, base transceiver stations (BTS), data centres, and transmission equipment, will be monitored. The infrastructure will be monitored based on their energy sources as follows:

    I. Grid-Powered Infrastructure: Data centres and BTS located in areas with grid access.
    II. Diesel-Powered Infrastructure: BTS and cell towers relying on diesel generators due to unreliable grid power.
    III. Hybrid Systems (Solar-Diesel Hybrids): Telecom sites with integrated solar-diesel systems or solar installations with battery storage.
    IV. Renewable-Powered Infrastructure: Off-grid BTS powered solely by solar or other renewable energy sources.
    V. Energy Efficiency and Smart Systems: Facilities with low-power BTS, smart metering systems, and energy-efficient data centre equipment.

The data to be collected would include data on:

- Total number of telecom sites: A count of active BTS and other regional infrastructure components.
- Operational characteristics: Power usage effectiveness (PUE) for data centres, energy load per tower, and any energy-saving technologies implemented.
- Sustainability Initiatives: Information on specific measures to improve energy efficiency, increase renewables, or otherwise reduce emissions will be tracked. This may include adopting hybrid power systems (e.g., solar-diesel hybrids) or installing energy-efficient equipment (e.g., low-power BTS, smart metering systems).

Accurate and timely collection of this data from all relevant stakeholders (telecom operators, service providers, and infrastructure companies) is critical to the MRV's success. Aggregating and analysing this data will provide insights into the sector's carbon footprint, environmental impacts and contribution to achieving Nigeria's climate targets.

3.3.2 Methodological Approach

The telecommunications MRV system's methodological approach must align with international standards, such as the IPCC Guidelines for National Greenhouse Gas Inventories, the GHG Protocol or any other recognized standard; as well as national policies, including the Nigeria Climate Change Act and the NDC.

The methodological approach includes:

1. **Data Collection and Reporting Framework:** Telecom operators will be required to report their energy consumption and GHG emissions annually. The MRV system will be designed to allow seamless data submission through a central platform managed by the NCC.

The system will:

- Standardize data formats to ensure consistent reporting across all operators.
- Develop clear guidelines for data collection, detailing how energy consumption (from grid, diesel, and renewable sources) and GHG emissions should be calculated.

2. **Emission Factors:** Emission factors (EF) tailored to Nigeria's energy mix will be applied to convert energy consumption into GHG emissions. This includes:

- Grid Electricity Emission Factor: Reflecting the carbon intensity of the Nigerian electricity grid, which depends largely on fossil fuels (e.g., natural gas).
- Diesel Generator Emission Factor: Emission factors for diesel will be based on the specific carbon content and density of the fuel consumed, as outlined in the IPCC Guidelines. Where national data is unavailable, IPCC 2006 default values will be applied[82].
- Renewable Energy Factor: Zero or low emissions will be applied for energy sourced from renewables such as solar.

3. **Verification Procedures:** After submission, the data will undergo:

- **Internal Quality Control (QC):** Carried out by the telecom operators themselves to ensure the accuracy of their submissions before being reported to the NCC.
- **External Quality Assurance (QA):** Independent third-party verifiers will be engaged to validate the data reported by telecom operators. This step ensures that reported emissions are accurate and consistent with international standards.

4. **Emission Calculation Methodology:** A straightforward calculation will be employed to determine total emissions for each operator.

The total emissions for each operator will be calculated using the formula outlined in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy.

$$\textit{Total Emissions } (CO2_e) = \textit{Energy Consumption (in appropriate units)} \times \textit{Emission Factor (kg CO2e/unit of energy consumed)}$$

[82] https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

Where:

- Energy Consumption refers to the total amount of energy used (e.g., in kWh, GJ, or other relevant units).
- Emission Factor is a standardized value indicating the amount of CO_2e emitted per unit of energy consumed, based on the energy source.

This approach ensures consistent and accurate emissions estimates.

5. **Uncertainty Analysis:** An uncertainty analysis will be included to address any discrepancies in the data or assumptions made. This involves calculating the potential margin of error in the data and adjusting to improve future reporting accuracy.

6. **Capacity Building:** Telecom operators will receive training on the MRV system, including data collection protocols, emission factor application, and report submission procedures. The NCC and environmental agencies will provide the training, ensuring operators have the tools and knowledge to meet reporting requirements.

In addition, capacity building will be organized for NCC and the telecoms sector to help with the basic calculation of emissions, so that only the refined data is shared with NCCC in line with the quality control framework for development.

3.3.3 Key Performance Indicators (KPIs)

The MRV system is developed to effectively monitor and evaluate performance within a set of KPIs. These KPIs provide a clear framework for tracking progress in reducing GHG emissions, improving energy efficiency, and transitioning to cleaner energy sources. They are designed to be practical, measurable, and relevant to Nigeria's unique energy and infrastructure challenges.

The KPIs will help:

I. Assess energy consumption and emissions performance across the sector.
II. Identify areas for improvement, such as reliance on diesel and adoption of renewable energy.
III. Ensure compliance with reporting standards and improve transparency.
IV. Highlight the sector's contribution to Nigeria's climate goals, including the NDCs.

The data collected will be reported annually to the NCC to serve as benchmarks for measuring progress and guiding strategic decisions. See the table below for KPIs.

Table 14: KPIs for Monitoring MRV System in Nigeria's Telecommunications Sector

S/N	KPI	Definition	Purpose
1	Total Energy Consumption	Total energy used (MWh) for operations aggregated for the year (grid, diesel, renewables).	It shows how much energy the sector uses and what its energy sources are.
2	GHG Emissions per Service Unit	Carbon emissions per unit of service (e.g., per GB of data measured in $kgCO_2e/GB$).	Measures how efficiently services are delivered with less carbon.
3	Renewable Energy Utilization (%)	Percentage of energy sourced from renewables (e.g., solar.	Tracks progress in adopting clean energy.
4	Emission Intensity of Sites	Emissions per telecom site in $KgCO_2e$ (BTS or data center).	Compares emissions between regions and operators.
5	Compliance Rate	Percentage of operators meeting MRV reporting requirements.	Reflects commitment to transparency and accuracy.
6	Number of Verified Reports	Number of MRV reports verified by third-party auditors.	Ensures data quality and accountability.
7	Total GHG Emissions Reduction	Overall reduction in emissions per operator in $kgCO_2e$	Shows progress toward Nigeria's climate goals.
8	Energy Efficiency Improvements	Reduction in energy used per service unit (e.g., kWh per GB).	Tracks improvements in using less energy for the same output.
9	Hybrid/Renewable Power for Sites (%)	Percentage of telecom sites using hybrid or renewable systems.	Measures the shift from diesel to clean energy solutions.
10	Grid Power Reliability	Share of energy coming from unreliable grid sources.	Identifies areas where diesel is used due to poor grid supply.
11	Scope 1 and 2 Emissions	Direct (Scope 1) and indirect (Scope 2) emissions of operators.	Provides a clearer emissions profile for each operator.
12	Equipment Efficiency Upgrades	Adoption of energy-efficient telecom equipment.	Reduces energy use and emissions.
13	Waste Management (E-waste Recycling)	Recycling or reuse of old telecom equipment.	Reduces environmental impact and promotes sustainability.
14	Climate Investments	Money spent on renewable energy and carbon reduction projects.	Reflects operator commitment to green initiatives.

3.4 Steps to Operationalize the MRV System

This chapter lays out the step-by-step process for implementing the MRV system in the telecommunications sector. The successful rollout of this system relies on a strategic phased approach, ensuring that it aligns with existing practices and regulatory frameworks with consideration of Nigeria's telecommunication environment. The steps to operationalize the MRV system have been broken into three phases: short-term, medium-term, and long-term, with targeted actions and timeframes for each phase.

3.4.1 Awareness, Sensitization, and Initial Capacity Building

This shall be implemented within a short-term period (0 to 6 Months)

In the short-term phase, the primary focus will be on creating awareness about the MRV system and initiating capacity building for relevant stakeholders. For a successful start, key players in the Nigerian telecommunications industry such as telecom operators, infrastructure companies, and regulators need to be made aware of their roles in this system.

Key Activities:

- **Awareness Campaigns:** The NCC, in collaboration with NCCC and the Ministry of Communications, will lead public awareness campaigns across major cities (e.g., Lagos, Abuja, Port Harcourt). The campaign will aim to educate telecom operators like MTN, Airtel, Glo, and 9mobile and telecom infrastructure companies like IHS Towers about the importance of the MRV system. The campaign will leverage mass media channels, including newspapers, social media, and industry-specific events.
- **Stakeholder Sensitization Workshops:** A series of workshops will be held aimed at engaging telecom executives and engineers. These workshops will provide practical information on how to collect and submit energy usage and emissions data, addressing concerns related to data accuracy, cost, and reporting timelines. Practical sessions will also cover topics like energy efficiency and alternative energy sources, considering the high reliance on diesel generators by telecom operators in Nigeria due to grid unreliability.
- **Initial Capacity Building:** The short-term capacity building will involve training telecom engineers, facility managers, and sustainability officers on the basics of energy and emissions data collection using tools like smart meters and emissions calculators.

  Training will also be extended to the NCC staff, who will be managing data submissions from the telecom operators. The training will focus on:

  - Understanding data collection points (e.g., energy consumption at cell towers and base stations).

- Using IoT-enabled devices for real-time energy monitoring. NCCC in collaboration with NCC will outline the specific requirements for IoT devices, ensuring consistency in data collection and transmission across telecom operators. Telecom operators will be responsible for installing and maintaining these devices, while technical experts and consultants will provide training on device calibration, data extraction, and trouble-shooting to maintain data integrity.
- Reporting standards as per Nigerian regulations and international best practices (IPCC guidelines…).

Deliverables in 0-6 Months:

- Increased awareness of MRV requirements among key telecom stakeholders.
- NCC's data submission templates were designed and sent to major operators.
- Basic capacity building completed for initial stakeholders (e.g., MTN, Airtel, Glo, NCC staff)

3.4.2 Role Assignment and Expanded Capacity Building

This shall be implemented within the medium-term (6 Months to 2 Years)

The MRV system will move from awareness and preliminary data collection to the full operational phase in the medium term. The primary goal during this phase will be to assign specific roles within existing regulatory structures and to expand training efforts across the telecommunication industry.

Key Activities:

Role Assignment within Existing Structures: To ensure efficiency and avoid overlap, the MRV system will be integrated into Nigeria's existing telecom regulatory framework. Roles will be clearly assigned as follows:

- **Telecom Operators (e.g., MTN, Airtel, Glo, 9mobile):** They should be responsible for collecting and submitting energy and emissions data for their operations, including fuel use for base stations, power consumption at data centers, and any emissions from backup diesel generators.
- **NCC (Quality Control):** The NCC should be the regulator responsible for quality control (QC) of the submitted data. This will involve reviewing operator data for consistency and compliance with agreed-upon MRV guidelines. After the data has been checked and confirmed accurate, the NCC will share it with NCCC.
- **NCCC (Data Custodian):** The Nigerian Council on Climate Change will act as the national data custodian. This means they will house and aggregate the data for inclusion in national climate change reports, such as Nigeria's NDCs.

- **Third-Party Verifiers (Quality Assurance):** Independent auditors should be appointed by the NCC and NCCC to verify the submitted data (Quality Assurance – QA). They will check that the data is accurate and follows the correct methodologies (such as energy measurement and emissions factor calculations). These verifiers will be accredited by the NCCC.
- **Expanded Capacity Building:** By this phase, deeper capacity-building initiatives will target telecom operators' technical staff, including:
  - Advanced training on how to use energy efficiency and emissions reduction technologies like hybrid power solutions (solar-diesel systems) and lithium-ion battery storage.
  - Operators will also be trained on how to report Scope 1 and Scope 2 emissions from their operations, including the calculation of emissions factors based on fuel use.
  - Capacity building will also extend to the NCC and NCCC, ensuring they have the skills needed to manage the MRV system, audit data, and report on national emissions inventories.
- **Pilot Testing:** In collaboration with selected operators (e.g., MTN or Airtel), the MRV system will be pilot tested in certain regions of Nigeria, such as Lagos and Abuja, Port Harcourt etc where telecom operations are concentrated. The purpose of this pilot is to identify any data gaps or technical issues in data collection, and to refine the MRV process based on the feedback.

Deliverables in 6 Months to 2 Years:

- Fully assigned roles and responsibilities for MRV data collection and reporting across all stakeholders.
- More advanced capacity-building programs completed for operators and regulators.
- Completion of the pilot testing phase, with feedback used to improve the system.

3.4.3 Full Implementation of the MRV System:

This shall be implemented in a long-term period (3 to 4 Years)

The long-term phase focuses on the full-scale rollout of the MRV system across the entire Nigerian telecommunications sector. By this stage, the MRV system will be fully operational, and all stakeholders will be expected to comply with the established guidelines for data submission and verification.

Key Activities:

- **Full MRV System Implementation:** All telecommunication operators will be required to collect and submit energy usage and emissions data to the NCC as part of their annual reporting requirements. This will include:

- Data on electricity consumption from both grid and off-grid sources (especially diesel generators).
- Emissions from backup power systems, energy use in data centers, and carbon footprint assessments of telecom operations.
- The NCC will review and verify this data, before submitting it to the NCCC, which will integrate it into the country's GHG inventory and climate reporting obligations.

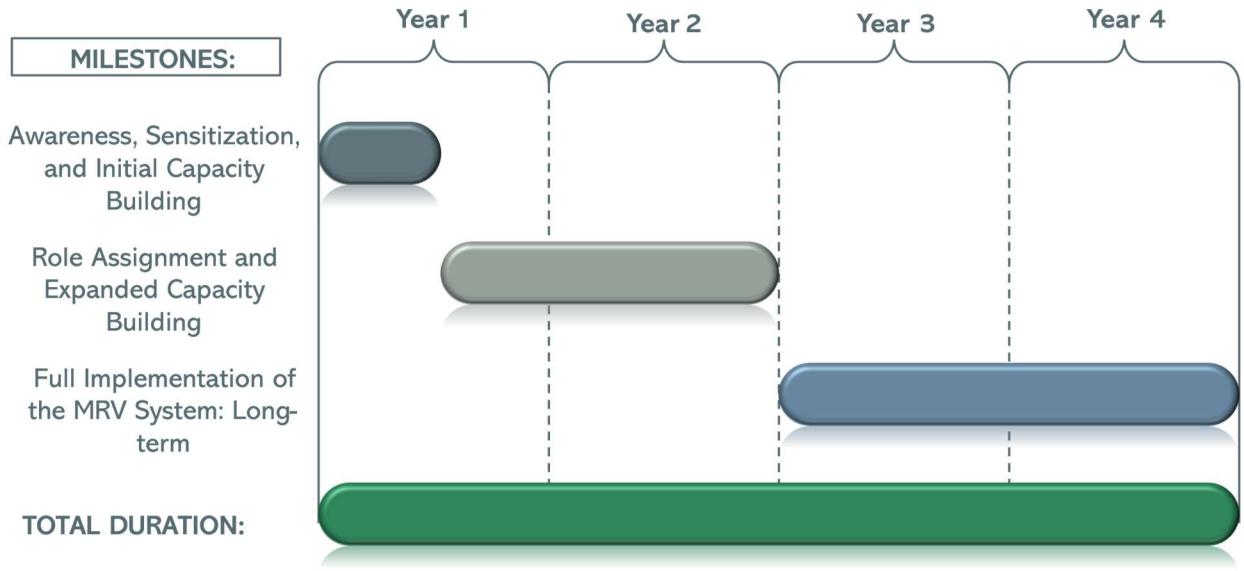
- **Annual Reporting and Verification:** Operators will submit their data annually for verification. Data will be checked by third-party auditors engaged by the NCCC. These audits will ensure that reported emissions and energy consumption data are accurate and meet international reporting standards. The audit results will be submitted to the NCCC for final approval.
- **System Improvements and Integration:** Based on feedback and evolving industry needs, the MRV system will undergo continuous improvements. It will also be updated to reflect changes in energy sources, such as a shift towards renewable energy or a reduction in diesel generator usage. Non-compliance may attract penalties especially for operations whose GHG emissions profile goes above the sector's threshold. Data from the telecom sector will also support Nigeria's broader national emissions reduction goals and climate policies.
- **Expansion to Other Sectors:** Once the MRV system is fully operational, lessons learned will enable the reproducibility of similar MRV systems in other sectors, such as the energy production and transport industries, further contributing to Nigeria's climate goals.

Deliverables in 3 to 4 Years:

- All telecom operators must comply fully with MRV system requirements.
- Verified data submissions feeding into Nigeria's national GHG inventory.
- Continuous improvements to MRV reporting tools and systems based on industry feedback.
- Expanded implementation of MRV systems into other key economic sectors in Nigeria.

The figure below presents a summary of the anticipated timeline for the proposed project's operationalization schedule.

Figure 14: Gantt Chart showing estimated schedule for project operationalization



3.5 Conclusion

The operationalization of a robust MRV system within Nigeria's telecommunications sector represents a critical step toward enhancing environmental accountability and promoting sustainable practices in the industry. As Nigeria faces pressing challenges related to climate change and energy consumption, implementing a practical MRV framework aligns with global climate commitments and positions the telecommunications sector as a proactive sector in the national sustainability agenda.

The phased approach outlined in this report from initial awareness and capacity building to full-scale implementation, ensures that stakeholders at all levels in the sector are equipped with the necessary knowledge, tools, and responsibilities to contribute meaningfully to the MRV process. Furthermore, the MRV system has the potential to create a ripple effect across other sectors of the Nigerian economy, serving as a pilot for similar initiatives in industries such as energy, transportation, and manufacturing.

The successful implementation of the MRV system in Nigeria's telecommunications sector will not just serve as a regulatory requirement; but would be an opportunity for the industry to embrace sustainability and drive innovation in addressing climate change.

SECTION 4: CARBON TAX OPERATIONAL GUIDE

4.1 Introduction

The imperative to address climate change has never been more urgent, particularly for countries like Nigeria that are highly vulnerable to its adverse impacts. In response to growing national and global concerns over GHG emissions, carbon pricing instruments (CPI) such as carbon taxes have emerged as effective policy tools for driving emissions reductions while promoting low-carbon economic growth. As part of Nigeria's broader climate action strategy and its commitments under the Paris Agreement, the introduction of a carbon tax presents a critical opportunity to align economic development with environmental sustainability.

Anchored in the Climate Change Act, 2021, this Carbon Tax Operational Guide has been developed under the leadership of the Nigerian Council on Climate Change (NCCC). The Act provides a comprehensive legal framework to support national climate policy, mandating the NCCC to ensure compliance with Nigeria's climate commitments. It empowers the Council to request emissions data and enforce reporting obligations across all sectors, including telecommunications—thereby reinforcing the requirement for effective Measurement, Reporting and Verification (MRV) systems to track GHG emissions accurately.

The initial focus on the telecommunications sector is driven by its potential to serve as a high-impact, scalable pilot for carbon pricing in Nigeria. The sector's centralized operations, significant diesel dependency, and increasing energy demands make it well-suited for early implementation. A carbon tax in this context offers dual incentives: encouraging a transition to cleaner, renewable energy sources while discouraging continued reliance on high-emission fuels. Moreover, the sector's capacity to enable broader digital infrastructure positions it to influence climate action beyond its own operations—amplifying its contribution to achieving Nigeria's Nationally Determined Contributions (NDCs).

The **Carbon Tax Operational Guide** aims to provide practical direction for the design, implementation, and administration of a carbon tax framework in Nigeria. The guide outlines key operational components, including sectoral coverage, MRV systems, compliance mechanisms, institutional roles, and revenue utilization strategies.

This document seeks to ensure that the carbon tax is not only effective in reducing emissions but also equitable, transparent, and conducive to long-term sustainable development.

4.1.1 Background and Context

The Nigerian government, through the National Council for Climate Change Secretariat (NCCCS), is working towards implementing carbon pricing mechanisms as part of its commitment to reducing national emissions. The telecommunications sector has been selected for the pilot because of its relatively easy-to-define size of stakeholders and its mode of operation. The telecommunications sector in Nigeria operates through a structured and relatively centralized framework involving MNOs, infrastructure service providers, and regulatory oversight from the Nigerian Communications Commission (NCC). Core operations in the sector are driven by a network of Base Transceiver Stations (BTS), data centres, switching systems, and transmission infrastructure. These facilities are typically powered by electricity sourced from the national grid, captive diesel generators, or hybrid energy systems such as solar-diesel configurations, particularly in off-grid locations. Because each BTS site consumes a measurable amount of energy, the sector's emissions footprint can be accurately quantified, making it suitable for carbon pricing interventions. The sector is characterized by centralized corporate operations. Major service providers such as MTN, Airtel, Globacom, and 9mobile manage their infrastructure and activities through integrated systems that maintain detailed records of energy consumption, asset deployment, and site operations. These companies often use enterprise resource planning (ERP) platforms and network monitoring tools that streamline data collection and performance management. This structure provides a strong foundation for implementing MRV systems necessary for carbon pricing mechanisms. Service delivery in the telecom sector is heavily dependent on a reliable power supply to maintain network uptime and quality. Telecommunication services including voice, data, and SMS are delivered through energy-intensive systems. Additionally, many operators outsource tower maintenance and power supply services to infrastructure providers such as IHS Towers and Helios Towers, who also maintain granular energy usage data. This adds another layer of accountability and transparency in energy reporting. One of the sector's strengths is its high level of digital maturity. Many companies already operate automated reporting and monitoring systems capable of capturing real-time energy consumption and facilitating emissions calculations based on the type of energy source used. These systems can be integrated with national MRV frameworks, allowing for seamless reporting and compliance with carbon pricing regulations.

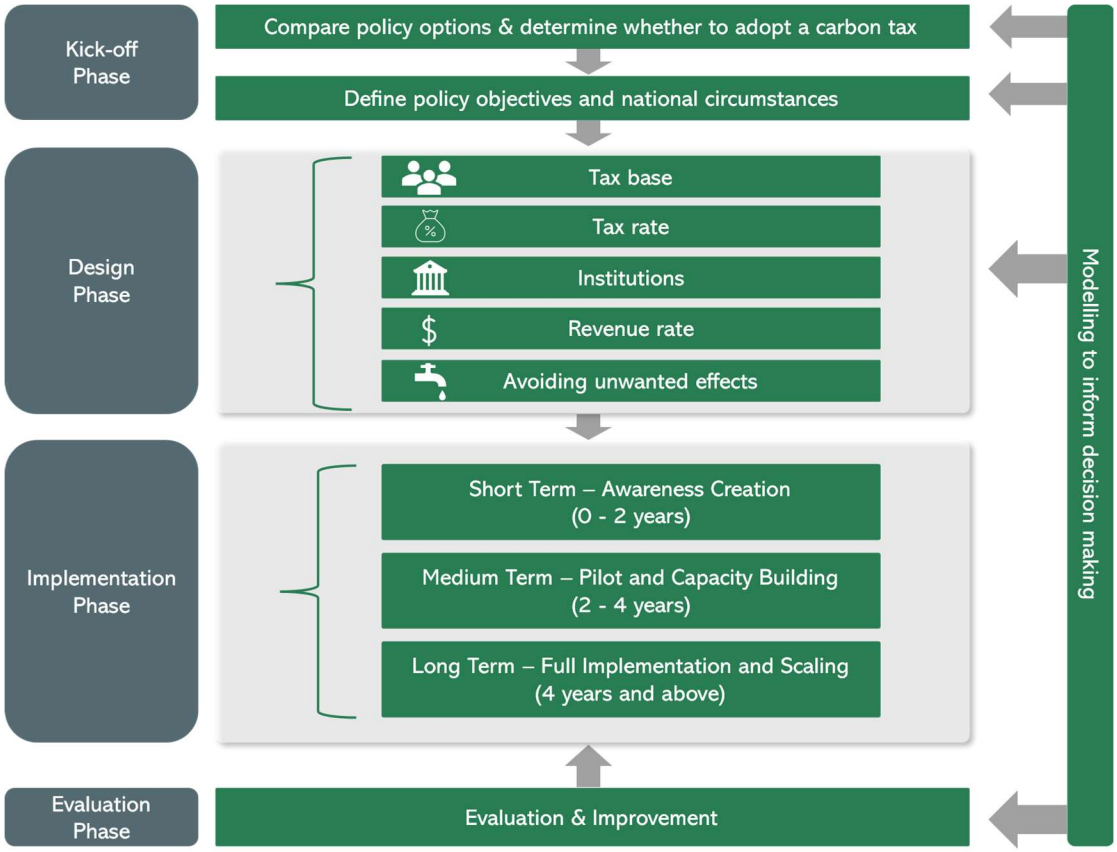
In summary, the telecommunications sector's structured operations, strong data systems, and existing regulatory mechanisms make it a viable sector for piloting carbon pricing in Nigeria. Providing clarity on how the sector functions helps stakeholders understand that the pilot is both technically feasible and relatively easy to implement, thereby reducing concerns and encouraging cooperation.

The pilot carbon tax initiative in the telecommunications sector also represents a strategic approach to addressing emissions, promoting energy efficiency and adopting renewable energy technologies.

Implementing the carbon tax in the telecommunications sector is expected to drive behavioural and operational changes by incentivising telecommunications operators to invest in cleaner energy alternatives, such as solar-powered base stations, energy-efficient network infrastructure, energy storage and grid technologies. Furthermore, the carbon tax aligns with Nigeria's broader climate objectives, including its NDCs[83] under the Paris Agreement and its ambition to achieve net-zero emissions by 2060.

While not traditionally seen as a major emissions contributor, the telecommunications sector is rapidly expanding and consuming increasing volumes of energy, particularly through BTS powered by diesel generators. With the right design, a CPI such as the carbon tax can incentivize the sector to transition to cleaner energy sources, promote energy efficiency, and stimulate green innovation.

Figure 15: Stages of Carbon Tax Design and Interlinkages between Implementation Phase



Source: Carbon Tax Guide _A Handbook for Policy Makers. (Adapted by Carbon-Limits Nigeria)

[83] Nigeria's First NDC (INDC 2015) and Updated NDC (2021) both recognize the importance of market-based mechanisms, including carbon pricing and emissions trading, as viable tools to meet national emissions reduction targets. The 2021 NDC specifically outlines the country's intention to explore carbon markets and establish enabling conditions for innovative climate finance solutions.

4.1.2 Strategic Implementation Highlights

The successful operationalization of the carbon tax in the telecommunications sector would depend on the critical points highlighted below:

I. **Establishing a Fit-for-Purpose MRV System:** A telecommunications-specific MRV process needs to be designed with phased deployment approach; data reporting processes, and seamless integration with the national GHG inventory system. This will improve data quality and build investor and public trust (An MRV design, including an MRV data collection template, has been developed under this study)

II. **Introducing a Tiered Carbon Tax Structure:** To ensure fairness and effectiveness, a tiered tax system should be implemented. For example, lower emission thresholds could attract minimal tax rates to encourage early compliance, while higher emitters face stronger signals to decarbonize. This structure also allows small players to adapt without undue financial burden. As explained in the carbon tax design document, operators would be classified into high-carbon and low-carbon emitters depending on their operations or by their inventory data. Companies with lower emissions intensity, particularly those using renewable energy solutions or energy-efficient technologies, could qualify for discounted tax rates compared to higher-emitting counterparts. This sector-specific discount would serve as an incentive for cleaner operations and reward proactive investment in low-carbon technologies. New and emerging telecom businesses may receive temporary exemptions but must demonstrate a transition plan toward low-carbon operations. This ensures that exemptions are not arbitrary but instead support emission reductions while fostering industry growth. Exemption and Discounts would include lowering the tax rate based on criteria such as revenue, number of subscribers, or operational scale

III. **Transparent Use of Carbon Tax Revenues:** A portion of the tax revenue should be allocated to support telecommunications sector decarbonization such as subsidies for solar BTS retrofits, battery storage investments or any other green initiatives that can enhance acceptability and long-term impact. The revenue generated can be used to remediate environmental damage or invest in cleaner generation technologies.

4.1.3 Scale-Up and Replication

The telecommunications sector presents a viable starting point for a carbon tax pilot in Nigeria, given its technological maturity, structured corporate framework, centralized operations, and increasing emissions footprint resulting from the heavy reliance on diesel generators for electricity. The carbon tax when fully implemented and operational, will achieve the following:

a) Serve as a replicable model for other sectors such as Oil and Gas, Manufacturing, Power etc., where energy use is also rapidly growing.
b) Position the telecommunications sector as a climate leader, especially in aligning with the global push toward emissions disclosures.
c) Create foundational systems (MRV systems) that will enable the implementation of a more complex pricing instruments, such as emissions trading schemes (ETS) or offset-based compliance mechanisms.

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The successful operationalization of the carbon tax in the telecommunications sector would depend on the critical points highlighted below:

I. Establishing a Fit-for-Purpose MRV System: A telecommunications-specific MRV process needs to be designed with phased deployment approach; data reporting processes, and seamless integration with the national GHG inventory system. This will improve data quality and build investor and public trust *(An MRV design, including an MRV data collection template, has been developed under this study)*.

II. Introducing a Tiered Carbon Tax Structure: To ensure fairness and effectiveness, a tiered tax system should be implemented. For example, lower emission thresholds could attract minimal tax rates to encourage early compliance, while higher emitters face stronger signals to decarbonize. This structure also allows small players to adapt without undue financial burden. As explained in the carbon tax design document, operators would be classified into high-carbon and low-carbon emitters depending on their operations or by their inventory data. Companies with lower emissions intensity, particularly those using renewable energy solutions or energy-efficient technologies, could qualify for discounted tax rates compared to higher-emitting counterparts. This sector-specific discount would serve as an incentive for cleaner operations and reward proactive investment in low-carbon technologies. New and emerging telecom businesses may receive temporary exemptions but must demonstrate a transition plan toward low-carbon operations. This ensures that exemptions are not arbitrary but instead support emission reductions while fostering industry growth. Exemption and Discounts would include lowering the tax rate based on criteria such as revenue, number of subscribers, or operational scale.

III. Transparent Use of Carbon Tax Revenues: A portion of the tax revenue should be allocated to support telecommunications sector decarbonization such as subsidies for solar BTS retrofits, battery storage investments or any other green initiatives that can enhance acceptability

and long-term impact. The revenue generated can be used to remediate environmental damage or invest in cleaner generation technologies.

4.1.5 Scale-Up and Replication

The telecommunications sector presents a viable starting point for a carbon tax pilot in Nigeria, given its technological maturity, structured corporate framework, centralized operations, and increasing emissions footprint resulting from the heavy reliance on diesel generators for electricity. The carbon tax when fully implemented and operational, will achieve the following:

a) Serve as a replicable model for other sectors such as Oil and Gas, Manufacturing, Power etc., where energy use is also rapidly growing.
b) Position the telecommunications sector as a climate leader, especially in aligning with the global push toward emissions disclosures.
c) Create foundational systems (MRV systems) that will enable the implementation of a more complex pricing instruments, such as ETS or offset-based compliance mechanism.

4.2 Institutional and Governance Framework for Implementation

As earlier defined in the Stakeholders Identification and Mapping Report, the telecommunications sector comprises various institutions that can be grouped into public and private sector institutions. The public sector institutions vary from Ministries, Departments, and Agencies (MDAs). These institutions play important roles in regulating, developing, and promoting telecommunications infrastructure, policies, training, Research and Development (R&D), and services. On the other hand, Private Sector Institutions carry out the key business and commercial aspects of the telecommunications industry. They include service providers such as Mobile network operators, Mobile network Infrastructure providers (TowerCos), Data centers, End User Consumers etc.

4.2.1 Responsibilities of Stakeholders

To implement and operationalize the carbon tax in the telecommunications sector requires a multi-stakeholder approach to ensure compliance, transparency, and efficiency. The roles of all the relevant stakeholders have been highlighted in the table below.

Table 15: Agencies and their Responsibilities

Agencies	General Responsibilities	Specific Role in Carbon Tax Implementation
National Council on Climate Change Secretariat (NCCCS)	Serves as the apex inter-ministerial body for co-ordinating climate action and strategic decision-making on climate policies and interfacing with the UNFCCC.	Leads the overall design, policy direction, and oversight of the carbon tax framework in alignment with Nigeria's NDCs and net-zero ambition. It provides high-level coordination across sectors and ensures cross-ministerial alignment. NCCC will interface with the NCC for cordination and other necessary interventions.
Federal Ministry of Environment (FMEnv)	Responsible for planning and implementing national environmental policies, including climate change strategies.	Acts as the technical lead ministry for implementing climate initiatives. Oversees the integration of the carbon tax into national environmental planning, supports NCCCS in policy execution, and provides technical guidance on emissions accounting and MRV standards.
Nigerian Communications Commission (NCC)	Regulates the telecommunications sector and enforces compliance with industry standards and government policies.	Works under the policy framework set by NCCCS and FMEnv to ensure sector-level compliance with MRV and reporting requirements. Facilitates cooperation from telecom operators and integrates carbon reporting into existing regulatory obligations. This agency will be the primary interface with the Operators.
Telecommunications Operators	Provide telecommunications services; responsible for emissions generated by operations.	Calculate, report, and pay applicable carbon taxes based on verified emissions.
Independent Auditors/Third-Party Verifiers	Provide objective verification and validation of emissions data	Verify emission reports submitted by telecommunications operators to ensure transparency and accuracy
Federal Inland Revenue Service	Collects taxes and enforces compliance with tax laws	Administers carbon tax collection and ensures fiscal compliance by liable entities. The agency will equally ensure that IFRS standards are adopted to ensure transparency.

Ministry of Finance	Oversees national budgeting, taxation policy, and fiscal planning.	Integrates carbon tax revenue into the national fiscal strategy and allocates funds. This will be inline with IFRS standards.
Non-Governmental Organizations (NGOs) and Environmental Advocates	Promote environmental awareness and policy advocacy	Monitor policy implementation, raise public awareness, and advocate for climate justice

Governance Hierarchy and Coordination

In the Nigerian context, governance of climate policy follows a structured hierarchy:

- The National Council on Climate Change Secretariat (NCCCS), chaired by the President, is the highest-level decision-making and coordinating body for climate action. It sets policy direction and oversees cross-sector alignment, including carbon pricing instruments.
- The Federal Ministry of Environment (FMEnv) functions as the primary implementing agency under the NCCCS's guidance. It is responsible for operationalizing policies, developing technical standards (e.g., MRV methodologies).
- The Nigerian Communications Commission (NCC) operates as a sectoral regulator, working within the framework established by the NCCCS and FMEnv. It ensures that operators in the telecommunications sector comply with carbon tax-related requirements, including emissions reporting and data management, using its existing regulatory mechanisms.

This governance structure ensures a top-down alignment of climate strategy (via NCCCS) with technical execution (via FMEnv) and sectoral enforcement (via NCC), fostering effective implementation of the carbon tax.

4.2.2 Compliance Responsibilities for Telecommunications Operators

The carbon tax framework presents a transformative opportunity for the Nigerian telecommunications sector, compelling operators to align their business models with sustainability goals. Given the sector's heavy reliance on fossil fuels, particularly diesel-powered base stations, a structured carbon tax regime is expected to drive significant operational shifts toward cleaner energy alternatives. However, the success of this initiative is contingent on strict compliance with established regulations. As key industry stakeholders, telecommunications operators must integrate emission monitoring, accurate data reporting, and timely tax payments into their corporate strategies. The effectiveness of the carbon tax scheme will largely depend on their commitment to transparently report emissions data, adhering to compliance regulations, and proactively investing in energy efficiency measures. While Section 4 broadly focuses on compliance management by the regulatory agencies, the requirements for mandatory and long-term compliance for the operators are highlighted below.

Mandatory Compliance Requirements

To facilitate a smooth transition into the carbon tax framework, telecommunications operators must adhere to the following:

I. **Emission Monitoring and Reporting:** Operators must continuously track and document their GHG emissions using the reporting templates provided by the regulators. Reported data must

include energy consumption at base stations, data centers, and other telecommunications infrastructure to quantify CO_2 emissions. Data reporting must align with the MRV framework to ensure accuracy and consistency in emissions records.

II. **Submission of Verified Data:** Telecommunications operators will be required to submit annual emissions data to regulatory bodies for assessment. Independent third-party verifiers will validate these reports to prevent misreporting and discrepancies. Digital reporting systems will be encouraged to streamline the data submission process and enhance transparency.

III. **Timely Tax Payments:** Operators must remit their carbon tax levies within stipulated deadlines. The tax structure will impose penalties for late or non-payment.

Beyond compliance, telecommunications operators are encouraged to proactively adopt energy-efficient technologies and integrate renewable energy solutions into their operations. Transitioning from diesel generators to solar or hybrid power systems would reduce exposure to tax liabilities and would lead to long-term cost savings and significant environmental benefits.

Regular engagement with key regulatory agencies, including the NCCCS, NCC, the Federal Ministry of Environment (FMEnv), and the FIRS, is as well essential. Telecommunications operators should actively participate in policy discussions, attend workshops, and provide feedback on the tax framework to support continuous improvement and ensure practical implementation.

Long-Term Compliance

For sustained adherence to carbon tax regulations, telecommunications operators must embed environmental sustainability into their corporate governance structures. The following strategic measures will enhance compliance efficiency and long-term commitments:

I. **Establishment of Sustainability Teams:** Companies should create dedicated environmental and sustainability teams responsible for overseeing emissions tracking, reporting, verification and tax payments. These units will also explore innovative energy-saving strategies and sustainability initiatives to reduce operational carbon footprints.

II. **Internal Audit Mechanisms:** Regular internal audits will help assess compliance levels, identify reporting gaps, and address any inaccuracies in emissions data. Operators must adopt robust data management systems to track emissions trends over time and adjust mitigation strategies accordingly.

III. **Capacity Building and Training:** Continuous training for technical staff and management teams is necessary to enhance understanding of the carbon tax framework and its implications. Capacity-building workshops should be established to educate stakeholders on best practices for emissions reduction and regulatory compliance.

IV. **Collaboration with Government and Industry Players:** Partnering with government agencies, international organizations, and industry associations will provide telecommunications operators access to resources, technical assistance, and financial support for clean energy investments. Engaging in collaborative initiatives would also facilitate knowledge exchange and the adoption of global best practices.

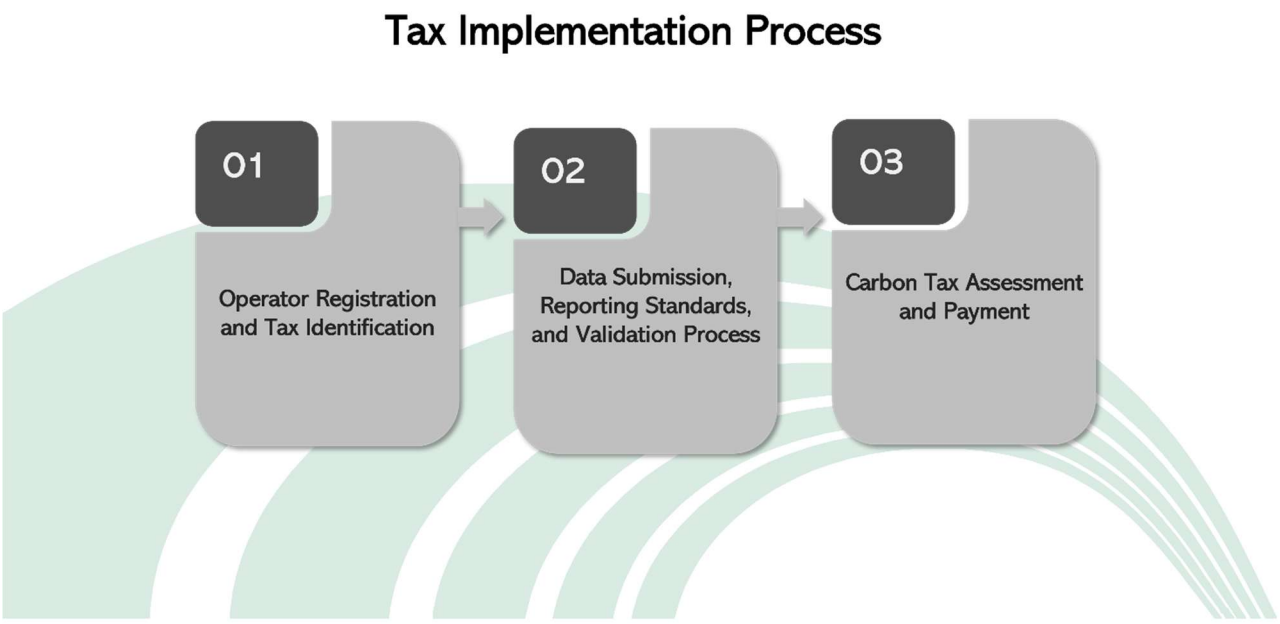
4.3 Tax Implementation Process

The tax process is designed to be accessible, enforceable, and transparent. The implementation process comprises three significant steps:

i. Operator Registration and Tax Identification
ii. Data Submission, Reporting Standards, and Validation Process
iii. Carbon Tax Assessment and Payment

These steps provide clarity for both regulators and operators, enabling a comprehensive and all-encompassing approach.

Figure 16: Snapshot of tax implementation process



Source: Designed by Carbon–Limits Nigeria

Institutional Roles for the Tax Implementation Process

The specific actions taken by each institutional actor is clearly defined in alignment with their general responsibilities and carbon tax roles

Table 16: Institutional Roles for the Tax Implementation Process

Step	Timeline	Stakeholder	Specific Actions
1. Operator Registration and Tax Identification	One-time; updated annually as needed	Telecommunication Operators	- Register with the carbon tax compliance platform - Obtain a Tax Identification Number (TIN)
		NCC	Ensure operator compliance with registration and reporting obligations
		NCCCS	- Lead high-level coordination of the carbon tax framework - Manage national registry and set registration requirements
		FIRS	- Assign carbon tax-specific TINs - Prepare operators for fiscal compliance
Data Submission, Reporting Standards, and Validation Process	Monitoring: Conducted daily/monthly/ annually as applicable Reporting/Submission: Due by the end of January of the following year Verification: Completed by the end of the first quarter post-submission (i.e., February – March)	Telecommunication Operators	- Monitor and calculate GHG emissions per MRV standards - Submit annual emissions reports via NCCCS/NCC platform
		NCC	- Support monitoring and reporting by demanding compliance from the operators - Integrate reporting into regulatory compliance tools
		FMEnv	- Provide technical guidance on GHG accounting and MRV standards
		NCCCS	Oversee MRV system quality and ensure transparency
		Independent Auditors / Third-party Verifiers	- Validate emissions reports using approved standards - Submit verification results to NCCCS and NCC
Carbon Tax Assessment and Payment	Assessment: Conducted within the second quarter following	NCCCS	- Assess tax liability using approved rates - Issue tax notices to operators

	verification (i.e., April – May) Payment Deadline: By the end of the second quarter following verification (i.e., June)	FIRS	- Collect carbon tax payments - Enforce compliance and track tax receipts
		Telecommunication Operators	- Review and respond to tax notices
		Ministry of Finance	- Integrate revenue into national fiscal strategy - Allocate funds toward climate goals

4.3.1 Operator Registration and Tax Identification

Timeline: One-time; updated annually as needed

The first stage of implementing the carbon tax is the formal registration of all telecommunications' operators. All operators including MNOs, ISPs, tower infrastructure providers, and data centre operators must register with the regulatory authorities responsible for overseeing the carbon tax.

> Registrations would be with the NCCCS, in conjunction with NCC and FIRS.

Operators should submit a detailed profile of their operations and an inventory of assets contributing to emissions. This should include diesel generators, energy consumption from the national grid, and other fuel-based infrastructure. Following successful registration, each operator should be issued a Carbon Taxpayer Identification Number (CTIN), their unique identifier within the carbon tax system.

To ensure timely compliance, registration is required within 30 days of the official launch of the carbon tax policy. Regulatory agencies may deploy online platforms to facilitate digital registration, automate data collection, and streamline verification.

1Beyond initial registration, the system should include periodic updates to operator profiles, especially following significant operational changes such as expanding to new regions, acquiring new emission sources, or adopting low-carbon technologies. These updates will enable dynamic tracking of each operator's emissions profile and ensure the accuracy of carbon tax assessments.

This process ensures that all telecommunications operators are adequately documented, and emissions data is accurately recorded.

> The registration process also ensures that all telecommunications operators participate in the scheme and sets the foundation for transparent carbon taxation.

4.3.2 Data Submission, Reporting Standards, and Validation Process

Timeline and deadlines will be as follows:

- **Monitoring:** Conducted daily, monthly or annually as applicable
- **Reporting/Submission:** Due by the end of January of the following year
- **Verification:** Completed by the end of the first quarter post-submission (i.e., Feb – March)

Once registered, operators are required to submit accurate and verifiable emissions data on an annual basis.

> The data submission must cover direct (Scope 1) emissions from fuel combustion and indirect (Scope 2) emissions from electricity use.

Operators must report the types and volumes of fuels consumed, total electricity used from the grid, generator operational hours, and the number of active base stations or data centres.

> To ensure consistency, operators should use standardized emissions calculation methods based on Intergovernmental Panel on Climate Change (IPCC) guidelines and national emission factors in their reporting. Emissions from diesel, petrol, and grid electricity must be calculated using defined formulas and verified conversion factors. Emissions from grid electricity will be estimated using country-specific emission factors derived from the Nigerian energy mix, as provided by the Nigerian Electricity Regulatory Commission (NERC).

Further, regulators will provide a standard emissions reporting template to ensure all operators present data in a uniform format.

To maintain credibility, all data submitted will undergo a third-party verification and validation process. The NCCCS and NCC should engage independent accredited verifiers to conduct third-party audits, including on-site inspections where applicable, cross-checking fuel purchase receipts and electricity bills and benchmarking them against industry best practices.

4.3.3 Carbon Tax Assessment and Payment

Timeline will be as follows:

- **Assessment:** Conducted within the second quarter following verification (i.e..., April – May)
- **Payment Deadline:** By the end of the second quarter following verification (i.e., June)

After data submission and validation, the NCCCS will collaborate with the FIRS and NCC to compute each operator's carbon tax liability. The tax will be levied at the determined rate, expressed per tonne of CO_2 equivalent (tCO_2e)

A key recommendation is to link carbon tax payments with broader fiscal reporting systems. Companies should report and pay their carbon tax obligations as part of their regular tax filings, just like they do for income or corporate taxes. However, provisions should be made for instalment-based payments to cushion the financial burden on smaller operators or emerging telecommunications startups.

Also, tax rates should be reviewed periodically to assess their impact and adjusted where necessary to ensure the tax reflects current realities.

We recommend developing an online tax portal to facilitate seamless payment processing, allow operators to track their tax obligations, and submit compliance reports.

The carbon tax liability is computed using the formula:

Tax Liability = Total Annual Emissions (tCO_2e) x Carbon Tax Rate ($/$tCO_2e$).

For instance, assuming a telecommunications' operator emits 5,000 tCO_2e in a fiscal year, its carbon tax would be $10,000 (equivalent to ₦16,000,000 at an exchange rate of ₦1,600 to $1) if the carbon tax rate is set at $2 per tCO_2e.

Once assessed, operators should receive a tax notification and a payment invoice. Payment should be made to the accounts provided by the regulatory authorities. After full payment, operators should be issued a Carbon Tax Clearance Certificate for the reporting year.

A formal review process should be available in cases where operators dispute the tax assessment. They may submit evidence and request a reassessment within 14 working days of receiving the tax notice. The regulatory body is mandated to complete the review within 30 working days.

Enforcement and Compliance Management

This section outlines an integrated enforcement strategy to ensure telecommunication operators meet their obligations under the carbon tax program. Key to this strategy is a comprehensive monitoring system that combines sector-wide performance assessments and physical audits (where applicable) to track emissions and tax compliance in real time. For the carbon tax program to achieve its objectives, regulators and policymakers must recognise that compliance monitoring should not be a reactive process but a proactive and ongoing process that anticipates and addresses potential concerns before they escalate.

Beyond monitoring, enforcement mechanisms are equally important. The penalty structure outlined in Section 4.2 serves as a preventive measure to non-compliance.

This section emphasises to regulators and other policymakers that effective carbon tax enforcement requires a balanced approach that integrates monitoring, penalties, and incentives within a framework that supports long-term compliance. By doing so, the regulatory authorities can ensure that the carbon tax program is both impactful and equitable, encouraging sustainable practices across the telecommunications industry while providing the government with a precise mechanism to track and reduce emissions.

4.4 Compliance Monitoring Procedures

A comprehensive compliance process is needed to ensure telecommunications operators meet their registration, reporting, and payment obligations.

> Monitoring should be conducted through digital tools, physical audits (where applicable), and sector-wide performance assessments.
>
> A dedicated compliance portal should be developed to serve as the central hub for all carbon tax-related activities.

Operators will upload their emissions reports, tax receipts, and supporting documentation. The portal will enable operators to monitor submission and compliance deadlines and flag inconsistencies or non-compliance. The portal will also allow regulatory agencies to assess the profiles of telecommunications companies, identify operators with unusually low emissions declarations, late submissions, or inconsistencies in operational data to determine the status profiles of telecommunications companies. This will enable targeted inspections and resource-efficient enforcement.

Additionally, sector-wide benchmarking should be conducted to determine average emissions per base station or data centre, which would help detect anomalies and guide enforcement priorities.

Periodic audits (random or scheduled), which may include physical visits to assets in cases where applicable, should be conducted to cross-reference the submitted data. (for instance, reported fuel consumption etc., against actual field realities).

> We recommend that the audits be undertaken by trained staff or contracted third-party verifiers accredited by the NCCCS or a relevant national accreditation body.

4.4.1 Flexibility Measures

To enhance compliance and cost-effectiveness within the carbon tax framework, flexibility mechanisms can be introduced that allow telecommunication operators to partially meet their tax obligations using approved emissions offsets. These measures are particularly useful for operators who

may face short-term constraints in adopting cleaner technologies or reducing emissions within their operational footprint.

Under such a mechanism, a defined portion of taxable emissions typically up to a set percentage can be offset using verified carbon credits from projects that meet national eligibility criteria. These projects may include renewable energy generation or energy efficiency improvements, among others. The offsets must be certified under recognized standards and approved by the designated national authority to ensure environmental integrity and alignment with Nigeria's broader climate goals.

For example, South Africa's carbon tax framework allows companies to offset up to 10% of their taxable emissions using eligible credits from domestic mitigation projects. This approach provides regulated entities with a cost-containment option while simultaneously promoting investment in local emissions reduction initiatives.

In the Nigerian context, incorporating a similar provision could encourage private sector participation in voluntary carbon markets, stimulate domestic offset project development, and provide regulated entities with greater compliance flexibility while ensuring the environmental objectives of the carbon tax remain intact. To operationalize this, clear rules on offset eligibility, certification standards, maximum allowable offset limits, and submission procedures would need to be established and administered by the NCCCS in collaboration with relevant regulatory bodies.

4.4.2 Non-Compliance Penalties

The carbon tax regulation should penalise defaulters to manage non-compliance, overreporting or underreporting. These penalties should be proportionate to the severity of the violation while ensuring that they are effective enough to encourage compliance.

Regulatory penalties may involve the suspension of operational licenses, denial of permit renewals, and disqualification from government-led green incentives or grants. Non-compliant entities may also be listed and publicly named on the regulator's website or publications.

Repeat offenders may face stricter penalties, such as a ban from participating in public procurement, license revocation, or any other penalties considered applicable by the regulating authorities.

4.4.3 Conflict Resolution

Disputes between telecommunications operators and regulatory authorities regarding tax assessments, penalties, or the interpretation of the carbon tax policy should be addressed through a transparent and efficient conflict resolution mechanism.

Operators may file appeals within 14 days of receiving a disputed tax notice. The appeal must include documentation supporting their claims, such as corrected data, third-party audit reports, or evidence of investment in emissions-reducing infrastructure. The regulatory authority should resolve the appeal within 30 business days.

4.4.4 Incentives for Compliance and Green Investments

Recognising that enforcement alone may not drive the desired behavioural change, the carbon tax program should be complemented with green incentives to encourage voluntary compliance and investment in sustainable technologies.

These incentives may include:

- Tax Credits: Operators investing in renewable energy solutions, such as solar-powered base stations or energy-efficient cooling systems, can apply for tax credits that reduce their carbon tax liability. Tax credits serve as a vital incentive for operators to invest in renewable energy technologies such as solar-powered base stations and energy-efficient systems, thereby reducing their carbon tax liability while promoting environmental sustainability. To assess the effectiveness of such credits, key indicators such as the rate of renewable energy adoption, emissions reductions directly attributable to credited investments, the volume of capital mobilized, the uptake rate of the credits, and overall cost-effectiveness measured per tonne of CO_2 abated. Additionally, changes in the sector's energy mix and the speed of technology adoption offer useful insights. Methodologies for evaluating these impacts include regression models, marginal abatement cost analysis, stakeholder surveys etc.
- Recognition Programs: Annual awards such as "Green Telecommunications Operator of the Year" may be instituted to publicly recognize carbon compliance and sustainability leaders.
- Technical Assistance: The government, in collaboration with development partners, will offer capacity building, training programs, and technology transfer initiatives to help operators decarbonise their operations.

- Access to Finance: Compliant operators may be prioritized for concessional green financing through national climate funds, the Central Bank of Nigeria's green financing schemes, or international climate finance mechanisms.

4.4.5 Revenue Utilization Strategies

As stated in the Carbon Tax Design Document, the revenues generated from the carbon tax should be reinvested in ways that support consumers, telecom operators, and the broader digital economy, ensuring that the tax does not stifle sectoral growth or consumer access. The expected revenue from the carbon tax will depend on several factors, including the tax rate, the emissions levels and the size of the taxable base (i.e., the number of companies or facilities subject to the tax). The actual revenue generated would need to be estimated through a model that factors in these variables. However, the exact proportion to be used as for offsets would need to be aligned with national priorities and fiscal capacity, ensuring a balance between revenue generation and social equity goals.

Revenue Recycling Measures

A. Direct Rebates & Cost Offsets for Consumers

I. Lower Tariffs for Low-Income Users: Use a portion of tax revenues to offset network infrastructure in low-income and rural users to prevent digital exclusion. Low-income and rural users can be identified based on geographic location, income thresholds, participation in social programs, limited access to digital services, and data from telecom operators regarding low-revenue subscribers.

II. Provide shared infrastructure in rural areas.

III. Green Energy Access Support: Fund telecom-led initiatives that provide solar-powered charging stations in underserved areas, reducing reliance on diesel generators.

B. Support for Telecom Operators & Businesses

I. Renewable Energy Transition Grants: Provide tax rebates or subsidies for telecom companies investing in renewable energy solutions like solar-powered base stations.

II. Energy Efficiency Incentives: This form of support is a financial or policy-based reward such as a tax break, rebate, grant, or low-interest loan offered to encourage businesses or individuals to adopt technologies or practices that reduce energy consumption and improve efficiency. In the telecom sector, this could include support for upgrading to low-power equipment, smart cooling systems, or advanced energy management tools.

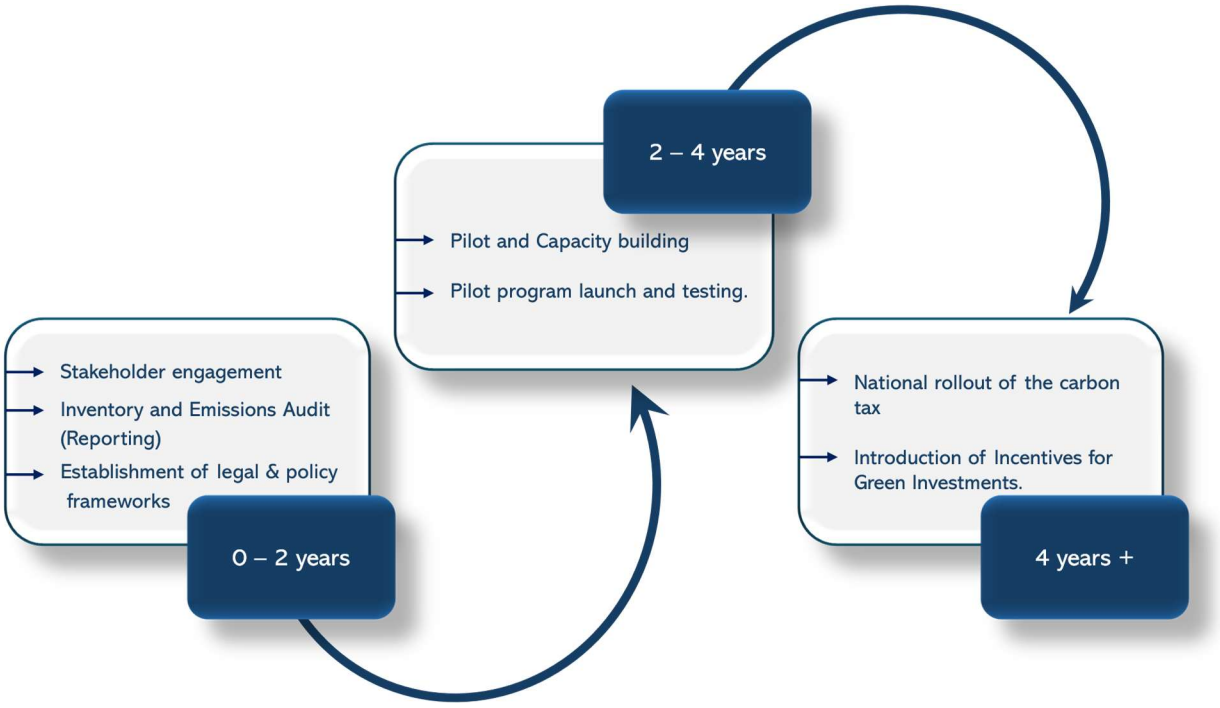
III. Infrastructure Expansion Support: Use revenues to co-fund telecom infrastructure expansion in off-grid and rural areas, reducing reliance on fossil-fuel-powered generators.

To ensure that recycled revenues deliver intended outcomes, the following governance mechanisms should be established:

I. Stakeholder Engagement: Regular consultation with telecom operators, consumer groups, and industry regulators to optimize revenue recycling effectiveness.
II. Periodic Audits & Reporting: Public disclosure on how revenue is recycled to benefit stakeholders.
III. Performance Metrics: Establish measurable KPIs (e.g., reduction in carbon emissions per telecom site, increase in renewable-powered sites, lower consumer costs).

It should be mentioned that currently, Nigeria lacks specific legislative measures for the collection, management, and recycling of carbon tax revenues, particularly within the telecom sector. However, to ensure effective and efficient use of these funds, there is a need to introduce new legislation or amend existing laws to establish a clear legal framework. This should include the creation of a dedicated fund, define institutional roles, mandate transparent reporting and stakeholder engagement, and incorporate safeguards against mismanagement. Such legal backing would strengthen governance, align with international best practices, and build public and investor confidence in the carbon pricing initiative.

Implementation Roadmap



4.5 Conclusions & Recommendations

4.5.1 Overview of the Validation Workshop

The validation workshop featured a seminar presentation summarizing the evaluation, assessment, and recommended implementation pathway for introducing a Carbon Tax in Nigeria's telecommunications sector. The workshop aimed to formally present, review, and validate the outcomes of the stakeholder consultations and technical analyses undertaken during the development of the pilot carbon tax design.

Participants included the RCC team from Lomé, members of the National Council on Climate Change (NCCC) Secretariat, the Carbon Limits team (project consultants), and a range of stakeholders from the telecommunications sector, as detailed in the table below.

Table 17: List Of Organisations that Attended the Validation Workshop

S/N	Organizations	No of Representatives
1	Africa Carbon Partner/Nigerian Carbon Market Community of Practice	1
2	Authority Newspaper	2
3	Carbon Limits Nigeria Limited	3
4	Carbonex	1
5	Ceesolar Energy Limited	2
6	Centreville	1
7	Delight ENT (Centre for E- Learning)	1
8	Federal Ministry of Budget and Economic Planning Peoples	1
9	Federal Ministry of Communications, Innovation and Digital Economy.	5
10	Federal Ministry of Environment (DCC)	3
11	Federal Ministry of Transport	1
12	Federal Ministry of Agriculture and Food Security	1
13	Federal Ministry of Housing and Urban Development	1
14	Haven Books Limited	1
15	Heaven Brooks Ltd	1
16	Initiative for Climate Action Transparency (ICAT) and the Climate and Clean Air Coalition (CCAC)	1
17	IHS	2
18	Jama Africa	3

19	MCAN	1
20	Media Hub	1
21	Ministry of Labour	1
22	Ministry of Petroleum Resources	2
23	National Bureau of Statistics (NBS)	1
24	National Council on Climate Change (NCCC)	21
25	NDC-Partnership/NCCC	1
26	NEC	1
27	Nigerian Electricity Regulatory Commission (NERC)	1
28	National Environmental Standards and Regulations Enforcement Agency	1
29	Nigeria Communication Commission	1
30	Nigeria Conservation Foundation	1
31	Nigeria Environmental Society	1
32	Nigerian National Petroleum Corporation Limited (NNPC)	1
33	National Oil Spill Detection and Response Agency (NOSDRA)	1
34	Nigerian Television Authority (NTA)	1
35	People's Delight Ent	1
36	Rural Electrification Agency -Nigeria Electrification Project (REA-NEP)	1
37	Spectranet	1
38	Standard Organization of Nigeria	1
39	Thisday Media	1
40	Tizeti Network Ltd	1
41	Two& Two Legacy	1
42	UNFCCC/RCC	2
Total no of organizations that attended		**77**

4.5.2 Recommendations

The table below highlights the recommendations from the break-up sessions of the validation workshop, and these have been integrated into the relevant documents.

Table 18: Summary of Group discussions and Recommendations outcome from Validation Workshop

	Group Discussion Points	Recommendations
1.	Institutional & Governance Arrangements for Operationalizing the Carbon Tax	The NCC role should include. • Ensuring quality assurance and control of the telecoms data in the National Climate data. • Integrating an MRV into the telecom's operations. • Standardizing operators' data. In the Short-Term Action: • MRV directive and templates should be developed. • Training for operators and regulators should be conducted.
2.	Tax Design, Implementation Pathway & Compliance Mechanisms	• The group agreed that the tax rate proposed in the study is fair for now, but this should be increased with time to encourage adoption. • Suggestions were made that the telecoms companies should adopt renewable energy technology(solar). **Compliance** • Incentives like tax breaks and credits should be adopted to encourage compliance. **Alignment of the MRV and the fiscal system for efficient tax collection and tracking.** • NCCC should be the custodian of data to reduce conflict of interest and promote Transparency. • NCC should spearhead the collection of data from the Telecoms sector and then disseminate it to the NCCC. • Capacity building should be organized for NCC and the telecoms sector to help with the basic calculation of emissions.
3.	Revenue Utilization, Incentives & Replicability to Other Sectors	• There should be an allocation of a share of tax revenue to the Climate Change fund. • Renewable energy technology should be adopted to replace fuel such as diesel, which emits over 60% of emissions. • Research and development should be made a priority to enhance. o Better technology adoption o Improve operations within the value chain. o To collate data for investment opportunities • Incentive programs for early compliance and green technology adoption should include. o Progressive tax systems o Carbon credit generation

		○ Certification ○ Access forex at a good rate • Telecom pilot can inform carbon pricing expansion to the energy and industrial sectors by ○ Adopting what works since the concept and principles are almost the same. ○ Strengthening the institutional framework. ○ Adoption of an incentive-based compliance and punitive taxing. ○ Phased implementation to build trust.
4.	Stakeholder Engagement, Communication, & Capacity Building	• The approaches to enhance awareness and understanding of the carbon tax framework should include. ○ SMS from NCC ○ Townhall meetings ○ Monitoring by NCC • Training and capacity-building for regulators and industry actors would be based on a framework for the Carbon instrument. The expected output would include. ○ Exploring partnership ○ Conducting stakeholder engagement ○ Identifying indicators that show compliance. ○ Operationalization of MRV in the telecoms sector.

4.5.3 Next Steps

From the validation workshop, the next few steps would be taken to progress the project as outlined and presented by the NCCC.

Governance & Institutional Framework

- Develop a governance framework defining institutional roles, coordination, and reporting lines (NCCC, NCC, FIRS, FMF, etc.)
- Establish permanent coordination mechanisms for continuous dialogue and feedback.
- Ensure inter-agency alignment for effective implementation.

Data Collection & MRV Framework

- Finalize and validate data collection templates with NCC.
- Conduct technical demonstrations on MRV data flow and reporting.

- Initiate data gathering and verification from telecom operators.
- Strengthen data management capacity across key institutions.

Pilot Implementation Roadmap

- Launch pilot implementation of the telecom carbon tax framework.
- Include incentive mechanisms (tax credits, recognition for compliance).
- Define milestones for design, testing, and scale-up.
- Document and disseminate lessons learned for replication in other sectors.

Stakeholder Engagement & Sensitization

- Develop a structured engagement plan with NCC, telecom associations, FIRS, FMF, SON, and others.
- Convene sectoral dialogues to harmonize policies and frameworks.
- Produce communication materials for awareness and stakeholder buy-in.

Capacity Building

- Organize targeted trainings for NCC, telecom operators, and data managers.
- Focus on MRV, data reporting, and carbon pricing principles.
- Integrate modules on climate finance and technology access.
- Build sector readiness for transition to low-carbon operations.

Legal and Policy Alignment

- Align framework with Nigerian Communications Act (2003) and Climate Change Act (2021).
- Engage Attorney General's Office for legal validation.
- Ensure coherence with national climate policy instruments and fiscal measures.

Coordination with UNFCCC RCC WAC Africa and Partners

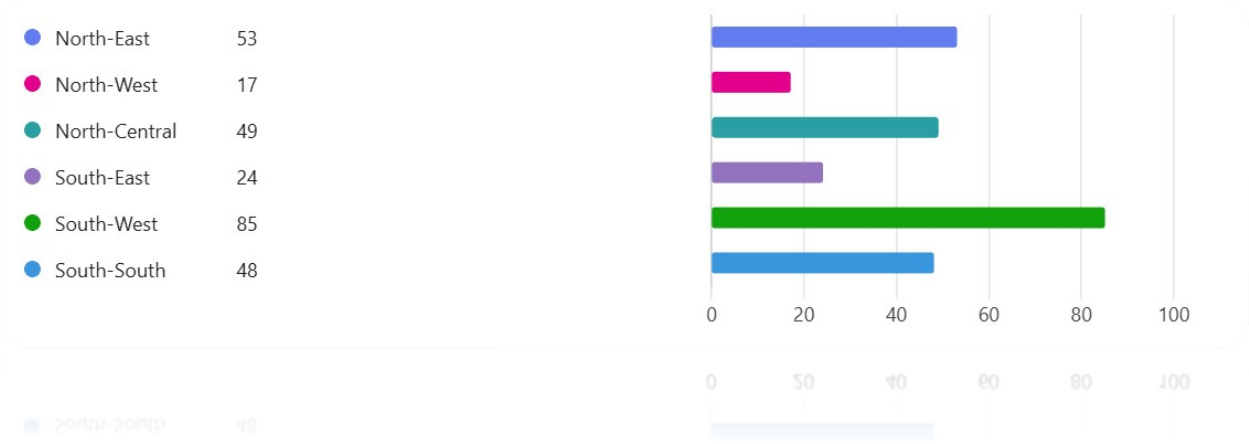
- Collaborate with UNFCCC RCC WAC Africa and CiACA for support and guidance.
- Facilitate technical and financial assistance for pilot activities.
- Establish progress reporting channels to highlight achievements at COP30 and global forums.

ANNEXES

Annex 1: Outcome of Regional Consultation Survey

The survey titled "Introduction of Carbon Tax in Nigeria's Telecom Sector – Service Users' Perception'' was launched on the 14th of March 2025 and ran for three months. It aimed to assess public perception and gather insights on the proposed implementation of a carbon tax. The primary objective was to gauge public awareness of carbon emissions, explore support for a carbon tax as a mechanism to incentivize cleaner energy adoption, and understand potential consumer reactions to cost implications arising from such a tax. Additionally, the survey sought to assess public opinion on revenue allocation priorities, tax differentiation based on pollution levels, and the importance of transparency in reporting environmental initiatives by telecom operators. The findings provide a comprehensive overview of public sentiment, serving as a crucial input in shaping effective carbon pricing policies within Nigeria's telecom sector.

Figure 17: Respondents Per Region



Summary of Findings

The survey was conducted using a structured online questionnaire distributed through stakeholder networks, digital platforms, and telecommunications user groups across Nigeria. Participation was voluntary, and as such the sample represents a geographically diverse but non-random group of respondents which comprised of active telecom service users from diverse professional and demographic backgrounds.

The rationale behind the survey distribution was to ensure broad national representation by taking into cognisance a range of states across all six geopolitical zones of the country, thereby capturing

diverse regional perspectives on the proposed carbon tax in the telecommunications sector – such that the survey captured views from both informed and general telecom service users.

The survey received 276 responses, distributed across Nigeria's six geopolitical zones as follows: South-West (30.8%), North-East (19.2%), North-Central (17.8%), South-South (17.4%), South-East (8.7%), and North-West (6.2%). Lagos state had the highest number of respondents (46), accounting for about 17% of the sample. The gender distribution was 55% male and 45% female, maintaining a balanced perspective. Awareness of environmental issues remained high, with 62% of respondents very familiar with the concept of carbon emissions. This familiarity translated into 70% supporting the idea of a carbon tax as a mechanism to encourage telecom operators to transition to cleaner energy sources like solar power. Environmental concerns were the dominant factor, with 192 mentions regarding the negative impact of diesel usage, followed by generator noise (152 mentions) and network outages (80 mentions).

In terms of policy fairness, 85% of respondents advocated for a differentiated tax structure, where big polluters pay more, reflecting a strong consensus on equity and accountability. Additionally, 57% believe that telecom operators investing in rural areas should pay a lower tax, aligning with the need to balance environmental goals with infrastructure expansion.

Cost sensitivity remains a critical issue. Although 70% acknowledged that a carbon tax might increase telecom service costs, only 28% supported a small increase in their bills, with 1–5% being the most acceptable range (104 mentions). A significant 50% (138 respondents) opposed any increase, reinforcing the need for strategic communication and mitigation strategies to prevent consumer backlash.

The majority of respondents (94%) believe the government should incentivize eco-friendly telecom operators, and the use of carbon tax revenue should prioritize solarizing telecom towers (112 mentions), followed by network expansion in underserved areas (77 mentions) and reducing costs for low-income users (74 mentions). Transparency remains crucial, as 93% of respondents expressed interest in telecom companies reporting their environmental efforts. Additionally, 57% stated they would prefer a telecom provider using solar power, suggesting that green branding could enhance consumer loyalty.

Recommendations Based on the Survey

1. Adopt a Tiered Carbon Tax Structure: The percentage (85%) of respondents that supported the taxing of larger polluters more heavily underscores the need for a progressive tax system. This structure would not only align with equity principles but also incentivize major telecom operators to invest in cleaner technologies to reduce their tax burden.

2. Implement Targeted Incentives for Rural Investments: Given that 56% of respondents support tax relief for rural infrastructure investments, the government should develop a rebate system or tax credits for telecom operators expanding to underserved areas. This approach would help bridge connectivity gaps while maintaining environmental goals.

3. Cap Cost Increase and Communicate Benefits Clearly: Since consumer resistance to cost increases remains strong (50% against any rise), policymakers and telecom operators must adopt a phased or capped increase strategy (1–5%), coupled with transparent communication about how funds will be utilized to improve service reliability, reduce pollution, and enhance network coverage.

4. Allocate Carbon Tax Revenues Strategically: Revenue allocation should prioritize solarizing telecom towers (112 mentions) to directly reduce carbon emissions from diesel generators. Further investments should target network expansion in underserved areas and subsidizing telecom costs for low-income users, in line with respondents' preferences.

5. Enhance Environmental Reporting and Transparency: With 93% of respondents demanding environmental performance reports, telecom operators should be mandated to publish regular sustainability reports, detailing carbon reduction measures, renewable energy adoption, and other green initiatives. This transparency can foster consumer trust and align with global ESG reporting trends.

6. Promote Green Consumer Choice: Given that 57% of respondents indicated a preference for solar-powered telecom services, regulatory bodies should consider introducing a green certification program for telecom operators that meet specific environmental criteria, enabling consumers to make more sustainable choices.

Annex 2: Categorization of Stakeholders in the Telecommunication Sector

Stakeholder Category	Stakeholders
Mobile Network Operators	MTN Nigeria
	Airtel Nigeria
	Globacom Limited
	9Mobile (Emerging Markets Telecommunication Services Ltd)
Data Centres	Africa Data Centres (Cassava Technologies)
	Digital Realty
	WIOCC (Open Access Data Centres)
	Jovis Nigeria Limited
	Rack Centre
Internet Infrastructure	MainOne
Internet Services	Spectranet
	FiberOne Broadband Ltd
	Starlink Internet Services Nigeria Ltd
	Tizeti Network Ltd
	ipNX Nigeria Ltd
	Broad-based Communications Ltd
	VDT Communications Ltd
	Cobranet Ltd
	Radical Technology Network Ltd (Coollink.Ng)
	Cyberspace Network Ltd
Infrastructure Support/ TowerCos	IHS Towers
	American Tower Cooperation Nigeria (ATC)
	Pan African Towers (PAT)
	RAK Unity
	Africa Mobile Network (AMN)
Software and Hardware Services	Ericsson Nigeria
	Huawei Technologies Nigeria
	Nokia Networks Nigeria
	ZTE Corporation
	Cisco Systems
	Samsung Networks
Regulators	Nigerian Communications Commission (NCC)
	National Environmental Standards and Regulations Enforcement Agency (NESREA)

Stakeholder Category	Stakeholders
	Federal Competition and Consumer Protection Commission (FCCPC)
Policy Maker	Federal Ministry of Communications and Digital Economy
Revenue	Federal Inland Revenue Services (FIRS)
Training Institute	Digital Bridge Institute (DBI)
Research & Development	National Information Technology Development Agency (NITDA)
Consumers (End Users)	Individual Subscribers, Large companies using Internet services

Annex 3: Case Studies of Compliance Best Practices

Several countries have successfully implemented compliance frameworks for carbon taxation in energy-intensive industries. These frameworks provide valuable insights into best practices that can be adapted for Nigeria's telecommunications sector.

South Africa's Carbon Tax Model

South Africa introduced its Carbon Tax Act in 2019, mandating that all major industries, including the telecommunications sector, register under a centralized emissions monitoring system. This framework ensures that companies accurately measure, report, and verify their emissions to facilitate effective taxation and compliance. The tax is structured in a phased approach, starting with a low initial tax rate to ease businesses into the transition while providing incentives for emission reductions.[84]

A notable compliance mechanism in South Africa's model is the provision of tax rebates for companies investing in renewable energy solutions. Telecom operators that shift to solar-powered base stations or integrate hybrid energy systems benefit from reduced tax obligations, thereby encouraging industry-wide decarbonization. This approach has driven significant investments in clean energy within the sector.[85]

Canada's Greenhouse Gas Pollution Pricing Act

Canada implemented the Greenhouse Gas Pollution Pricing Act (GGPPA) in 2018, requiring businesses in high-emission sectors, including telecommunications, to submit annual emissions reports and pay a carbon price based on their CO_2 output. The compliance process is managed through a combination of federal and provincial programs, ensuring flexibility for businesses while maintaining strict oversight.[86]

One of the key compliance incentives under Canada's model is the reinvestment of a portion of the tax revenue into clean energy projects. Telecom operators that adopt energy-efficient technologies, such as low-power data centers and advanced cooling systems, can receive grants and subsidies. This strategy has resulted in a significant shift toward greener infrastructure within the industry.

[84] https://www.treasury.gov.za/comm_media/press/2019/2019052701%20Media%20statement%20-%20Carbon%20Tax%20Act.pdf
[85] https://www.dffe.gov.za/ccaq_research
[86] https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/greenhouse-gas-annual-report-2020.html

Additionally, companies that exceed their emissions limits can purchase carbon credits through a regulated cap-and-trade system, providing flexibility in meeting compliance obligations.[87]

United Kingdom's Climate Change Levy

The United Kingdom's Climate Change Levy (CCL) is a tax on energy usage designed to incentivize businesses, including telecom operators, to reduce their carbon footprint. The levy is applied to electricity, gas, and solid fuels consumed by non-domestic users, with varying rates depending on energy efficiency measures adopted by the company.[88]

A key compliance mechanism within the CCL framework is the Climate Change Agreements (CCAs), which allow businesses to negotiate lower tax rates in exchange for meeting specific energy efficiency targets. Telecom companies that upgrade their network infrastructure, implement smart grid technologies, or switch to energy-efficient transmission equipment qualify for reduced tax rates. This system has led to substantial improvements in energy efficiency across the UK telecom sector, demonstrating the effectiveness of regulatory flexibility combined with financial incentives.[89]

[87] https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-_work/greenhouse-gas-annual-report-2021.html
[88] https://www.gov.uk/green-taxes-and-reliefs/climate-change-levy
[89] https://www.gov.uk/guidance/climate-change-levy-rates

Annex 4: Telecom Sensitivity Analysis for Carbon Tax

Initial case (2 USD/tonne) and after Initial case ($5/tonne) Scenario

Assuming that:

- Total telecom company revenue: N2 billion
- Energy cost: 50 million (2.5% of the revenue)
- Carbon emissions: 150,000 tonnes of CO2

- Initial Case: Carbon tax at $2
- Additional cost $= \$2\ x\ 150{,}000$
  $= \$300{,}000$

- If Carbon tax rate = $5 per tonne of CO2
- Additional cost $= \$5\ x\ 15000$
  $= \$750{,}000$

Example of Telecom Sensitivity Analysis for Carbon Tax

Assumptions:

- Telecom company revenue: $10 billion
- Energy costs: $500 million (5% of revenue)
- Carbon tax rate: $30 per tonne of CO2
- Carbon emissions: 200,000 tonnes per year
- Telecom company plans to reduce emissions by 20% over 5 years by investing in renewable energy infrastructure.

Scenario Analysis:

- Base Case: No carbon tax.
- Moderate Case: Carbon tax of $30/tonne (total tax liability = $6 million).
- High Case: Carbon tax of $50/tonne (total tax liability = $10 million).

Results:

- Base Case: Profit margin remains unchanged at 10%.
- Moderate Case: Profit margin decreases by 0.5%, resulting in a $50 million reduction in profitability due to additional energy costs and carbon taxes.
- High Case: Profit margin decreases by 1%, resulting in a $100 million reduction

Sample Question to Calculate GHG Inventory for Telecoms

A telecommunication company runs on 50 diesel generators at its cell towers across the country, and each generator consumes 5000 litres of diesel annually. The company's office buildings and data centres consume 2,000,000kWh of electricity annually. The company purchased 10,000 smartphones for resale and the carbon footprint of each smartphone is 100kgCO_2e (based on the supplier's data). The company has a bus that commutes all staff and drives a total of 1,000,000Km annually. Calculate

a) The total GHG emissions for Scope 1, 2, and 3
b) Determine the company's total GHG emissions for the year.
c) Calculate how much emission will be saved if all the cell towers run on solar.
d) If the company invests in a nature-based solution to offset its emissions and grows 5000 trees each on a 10-hectare land with each tree sequestering 50 kgCO2 per annum, how much emissions will be offset?

($EF_{diesel} = 2.67kgCO_2/L, EF_{grid} = 0.5kgCO_2/kWh, EF_{bus}a = 0.2kgCO_2/km, 1000Kg = 1t$)

Solution

a) **Scope 1(Direct) emission** = Emission from diesel consumption from cell towers

$$= Total\ Volume\ of\ Diesel\ x\ Emission\ Factor\ of\ Diesel$$
$$= (50\ X\ 5000)\ l\ x\ 2.67KgCO2/l$$
$$= \mathbf{667,500kgCO_2}\ (\mathbf{667.5tCO2e})$$

Scope 2 (Indirect) Emission = Purchased Electricity

$$= Volume\ of\ Power\ consumed\ x\ Grid\ emission\ Factor$$
$$= 2{,}000{,}000kWh\ x\ 0.5KgCO2/kWh$$
$$= \mathbf{1,000,000kgCO_2e}\ (\mathbf{1000tCO2e})$$

Scope 3 (Indirect) Emission = Emissions from purchased goods, services, and employee commuting

Emission from Purchased Smartphone $= Total\ number\ of\ smart-phones\ x\ Emission\ Factor$

$$= 10{,}000\ x\ 100kgCO_2$$
$$= 1{,}000{,}000kgCO_2(1000tCO_2)$$

Emission from Employee Commuting $= Total\ Distance\ covered\ by\ bus\ x\ Bus\ Emission\ Facto$

$$= 1{,}000{,}000\ x\ 0.2kgCO_2$$
$$= 200{,}000kgCO_2(200tCO_2e)$$

Scope 3 (Indirect) Emission $= 1{,}000{,}00KgCO2 + 200{,}000KgCO2$

$$= \mathbf{1,200,000kgCO_2e}\ (\mathbf{1,200tCO_2e})$$

b) Total Emission $= Scope\ 1 + Scope\ 2 + Scope\ 3\ Emission$

$$= 667{,}500KkgCO_2 + 1{,}000{,}000kgCO_2 + 1{,}200{,}000kgCO_2$$
$$= 2{,}867{,}500kgCO_2$$

c) Emission Saved =Total Emission in (i) above – Total Emission If cell towers run on Solar

$$= 2{,}867{,}500kgCO_2 - (0 + 1{,}200{,}000kgCO_2)$$
$$= 2{,}867{,}500kgCO_2 - 1{,}200{,}000kgCO_2$$
$$= 1{,}667{,}500kgCO_2\ (1{,}667.5tCO_2)$$

d) Total sequestration from trees = Total Number of trees x Annual Sequestering

$$= (5000\ x\ 10)\ x\ 50kgCO_2$$
$$= 2{,}500{,}000kgCO_2(2{,}500tCO_2e)$$

Emissions left to be offset = Total Emissions – Total Sequestration from trees

$$= 2{,}867{,}500KgCO2 - 2{,}500{,}000kgCO_2$$
$$= \mathbf{367,500KgCO2}\ (\mathbf{367.5tCO_2e})$$