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CARBON OFFSET IN THE NIGER DELTA

CARBON OFFSET in the Niger Delta: SCOPING STUDY REPORT

IMPLEMENTING PARTNERS:





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CARBON OFFSET SCOPING STUDY: **PROJECT REPORT**

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ABBREVIATIONS

ACCF	Advisory Council on Carbon Finance
AFOLU	Agriculture, Forestry and Other Land Use
BAU	Business As Usual
BECCS	Bioenergy with carbon capture and storage
CBN	Central Bank of Nigeria
CCA	Climate Change Act
CDM	Clean Development Mechanism
CNG	Compressed Natural Gas
COP	Conference of the Parties
ETP	Nigeria Energy Transition Plan
ETP	Energy Transition Plan
FCO	Forest Carbon Offset
GDP	Gross Domestic Product
GGWI	Great Green Wall Initiative
GHG	Greenhouse gas
GIS	Geographic Information System
ICT	Information and Communication Technology
IOCs	International Oil Companies
IPCC	Intergovernmental panel on climate change
IPPU	Industrial Processes and Other Product Use
ITCP	Integrated Territorial Climate Plan
LEAP	Low Emission Analysis Platform
LMICs	Low and Medium-Income Countries
LT-LEDS	Nigeria's Long-Term Low-Emissions Development Strategy
MAP	Mass Agricultural Programme
MHP	Mass Housing Programme
MRV	Measurement, Reporting, and Verification
MSMEs	Micro, Small and Medium Enterprises
MWh	Megawatt-hour
NACGOND	National Coalition on Gas Flaring and Oil Spills in the Niger Delta
NCCC	National Council on Climate Change
NCDMB	Nigerian Content Development and Monitoring Board
NDC	Nigeria's Updated Nationally Determined Contribution
NDCMC	Niger Delta Carbon Market Consortium
NESP	Nigeria Economic Sustainability Plan
NESREA	National Environmental Standards and Regulations Enforcement Agency
NIIA	Nigerian Institute of International Affairs
NMDPRA	Nigerian Midstream and Downstream Petroleum Regulatory Authority
NNPCL	Nigerian National Petroleum Corporation Limited
NUPRC	Nigerian Upstream Petroleum Regulatory Commission
PACM	Paris Agreement Crediting Mechanism
PJ	Petajoules
PIA	Petroleum Industry Act
REDD	Reducing Emissions from Deforestation and Forest Degradation
SFCG	Search for Common Ground
TJ	Terajoules
VCM	Voluntary Carbon Markets



EXECUTIVE SUMMARY

Climate change has been identified as a conflict multiplier in the Niger Delta region because it is linked with the aggravation of the existing tension in the vulnerable communities in the region. Oil and gas production in the region has already pushed a majority of the oil and gas host communities into a disproportionate burden because of environmental degradation and loss of livelihoods. These challenges are worsened by climate change that has altered weather patterns, causing erratic rainfall, flooding, extreme winds, rising temperatures and drought. These environmental stresses induce unhealthy competition for scarce resources, such as arable land and clean water, thereby heightening tensions among local communities. The interplay between environmental degradation and climate change creates a complex web of challenges responsible for amplifying social and economic vulnerabilities, culminating in regional tension, conflicts and insecurity resulting from oil theft and artisanal oil refining. However, carbon offset has the potential to ensure social equity by ensuring that communities, especially local people, are empowered. The foregoing underscores the need for context-sensitive climate action and financing strategies (e.g. carbon offset) to alleviate the economic repercussions of climate extremes and ensure sustainable economic development in the Niger Delta region.

In this regard, a carbon offset scoping project was initiated to examine the potential impact of various approaches to carbon offset policies in the Niger Delta, as well as determine community perceptions and preferences. The study focused on Bayelsa, Delta, and Rivers States of the Niger Delta region of Nigeria. The following are the important findings that address the objectives of the study.

A. EXPLORE AND IDENTIFY SOURCES OF THE REGULATORY FRAMEWORK FOR CARBON OFFSETS AND CREDITS IN NIGERIA.

Nigeria has established several legislative and policy frameworks supporting energy development and environmental sustainability, including the Nationally Determined Contributions (NDC), Petroleum Industry Act (PIA), Climate Change Act (CCA), Energy Transition Plan (ETP), Long-term Low Emission Development Strategy (LT-LEDS), and a proposed Carbon Market Activation Policy. Some of these frameworks recognise carbon offset mechanisms as vital for achieving net-zero emissions by 2060 and unlocking climate finance for low-carbon investments. However, current policies lack coherence and effective implementation, particularly at the sub-national level, limiting the growth of carbon markets.

The Niger Delta, a region with significant potential for carbon offset projects, shows varied policy development. Delta State leads with an integrated climate policy framework and renewable energy roadmap, promoting carbon finance through Reducing Emissions from Deforestation and Forest Degradation (REDD+) and Clean Development Mechanism (CDM) approaches. Bayelsa and Rivers States show progress but remain constrained by policy and institutional gaps. Rivers State has a climate law and dedicated climate institutions, while Bayelsa lacks a comprehensive policy framework.

To activate a functional carbon offset market in Nigeria, particularly in the Niger Delta, targeted policy reforms are needed. These include strengthening institutional capacity, establishing robust Measurement, Reporting, and Verification (MRV) systems, enhancing private sector participation, and aligning state-level actions with national climate goals. A collaborative, inclusive approach involving government, the private sector, communities, and civil society will be essential to drive equitable, low-carbon development and environmental resilience across the region.

B. COLLECT, ANALYSE, AND PROVIDE DISAGGREGATED INFORMATION ON APPROACHES FOR ACHIEVING LOW CARBON DEVELOPMENT IN THE NIGER DELTA

The modelling and GIS mapping provide critical data for assessing carbon offsets in the Niger Delta region. In 2020, energy consumption in three focal states (Rivers, Bayelsa and Delta) was 310.23 PJ (21.45 GJ per capita), extrapolated to 881 PJ across the entire nine states. The residential and building sector dominated energy demand (59.4%), largely driven by inefficient firewood cookstoves, with fuelwood accounting for 57.9% of total energy sources, highlighting a key area for carbon offset interventions due to its link to deforestation and unsustainable biomass use.

GHG emissions in the base year totaled 52.00 mtCO₂e (3.59 tCO₂e per capita), which is 147.7 mtCO₂e across all nine states by extrapolation (see Figure E.1).

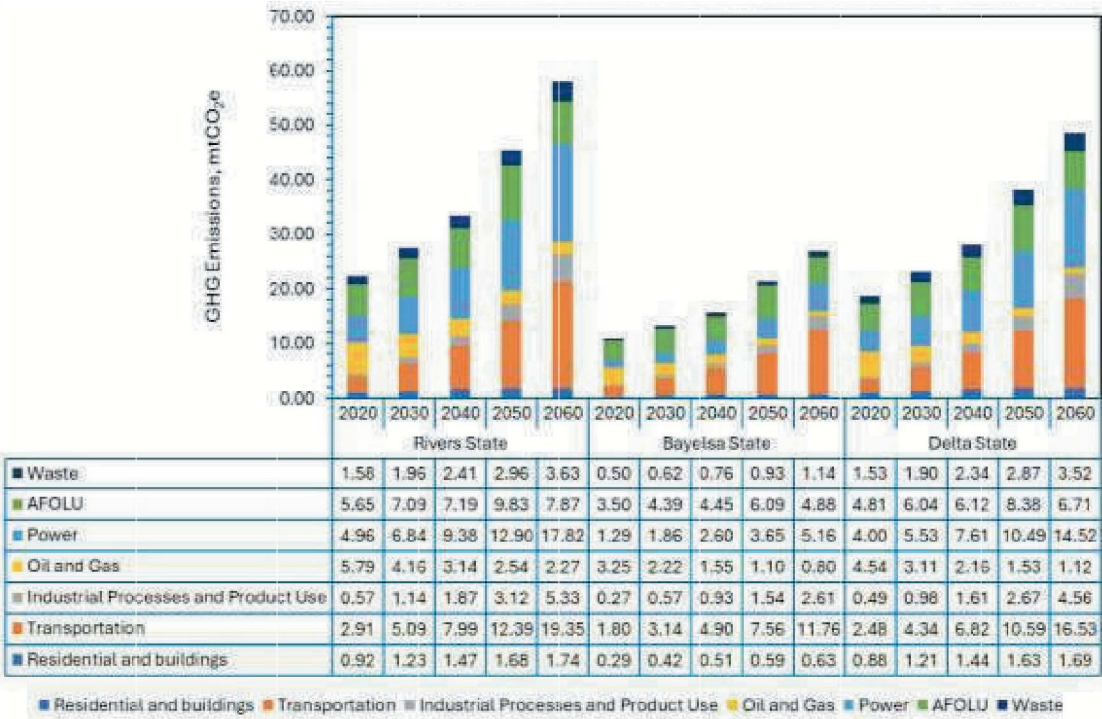
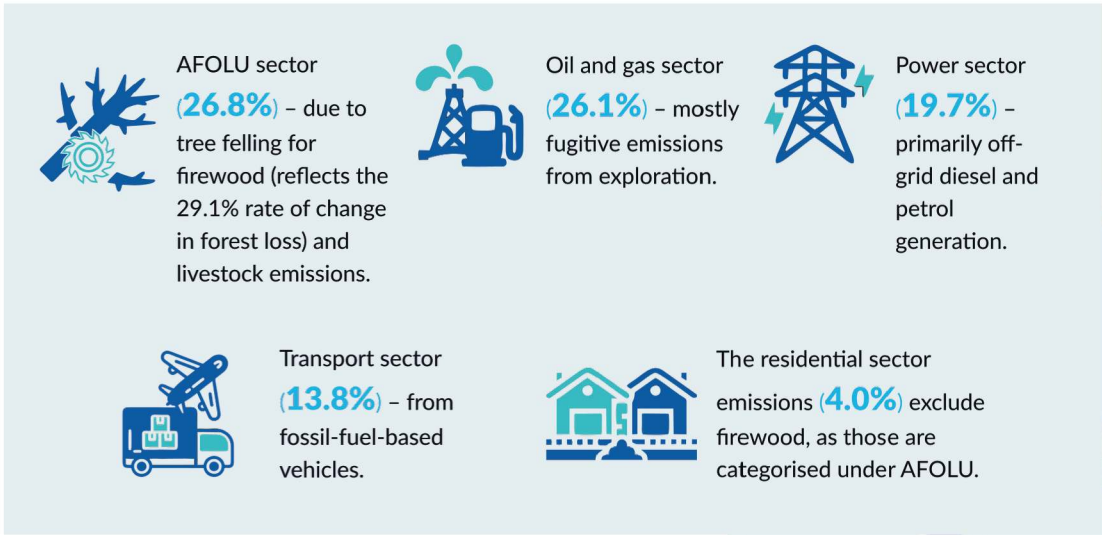


Figure E.1. GHG emissions

The energy emission intensity is about 167 tCO₂e/TJ, which is significantly higher than the global average (~56 tCO₂/TJ), reflecting the high carbon intensity of energy sources in the region (especially fuelwood and fossil fuels) and oil and gas production activities. The major contributions to the emissions are from:



Without mitigation, by 2060, total emissions could reach 379.8 mtCO₂e by linear extrapolation – a 156 % increase from 2020, with theoretical carbon credit potential of 319 mtCO₂e and 4758 mtCO₂e relative to 2020 by 2030 and 2060, respectively. The transport sector is expected to become the largest emitter (35.6%), underscoring the urgency of low-carbon transport strategies. Using Nigeria's updated Nationally Determined Contribution (NDC) targets for emission reduction, the country has set an unconditional target of 20% (equating to an annual rate of 1.67%) and a conditional target of 47% (with an annual rate of 3.9%). Based on these targets, the potential for carbon credits in the Niger Delta region ranges from 5.3 mtCO₂e to 12.4 mtCO₂e by the year 2030. By 2060, the range increases to between 79.5 mt CO₂e and 185.6 mtCO₂e.



Demographics and Socio-Economic Context: The communities exhibited a balanced gender and age spread, with the majority holding secondary education qualifications. Unemployment was widespread—most notably in Delta (67.3%)—highlighting significant economic vulnerability.



Livelihoods: Farming and fishing dominated in Bayelsa and Delta, while petty trading and fishing were common in Rivers. The strong reliance on natural resources positions these communities as suitable for land-based carbon offset projects. The prevalence of motorcycle-based transport further underlines the importance of designing locally relevant, livelihood-sensitive interventions.



Awareness and Knowledge: Awareness of carbon offsetting was low – as 66% in Bayelsa, 57.3% in Delta, and 55% in Rivers, were unaware of such projects. Knowledge was fragmented, reinforcing the urgent need for public education and sensitisation efforts ahead of project rollout.



Environmental Concerns: Communities expressed strong concerns over deforestation, air pollution, waste management, and water scarcity—especially in Bayelsa and Delta. These concerns can guide the design of locally responsive carbon offset interventions that align with environmental restoration and socio-economic upliftment.



Willingness to Participate: Despite limited awareness, over 98% of respondents across all states expressed a willingness to participate in carbon offset projects. State-specific preferences emerged: Bayelsa favoured tree planting and waste management; Delta leaned towards sustainable agriculture and clean energy; Rivers showed more moderate enthusiasm but emphasised conservation and biodiversity.



Perceived Benefits: Key expected benefits included job creation, skill development, improved health, and better access to clean energy—demonstrating strong alignment with the co-benefits of well-designed carbon programs. These aspirations underscore the opportunity for carbon offset projects to address existing inequalities, especially in rural oil-producing areas.



Risks of injustice and inequality from Energy Transition: The study identified 11 potential areas where the global energy transition could deepen injustice, ranging from job losses and skills mismatches to land grabbing and poor infrastructure. Carbon offset projects offer a chance to mitigate these risks, provided they are implemented equitably and inclusively.

This analysis highlights both the readiness and the pressing need for community-led, inclusive, and justice-centred carbon offset projects in the Niger Delta to support Nigeria's transition to net-zero emissions by 2060.

C. IDENTIFY CARBON OFFSET PROJECTS/INITIATIVES IN THE REGION AND INVESTIGATE ISSUES ASSOCIATED WITH THEIR OPERATIONS IN COMMUNITIES.

The identified registered carbon offset projects directly located in the Niger Delta region under the CDM are Afam Combined Cycle Gas Turbine Power Project with reduction capacity of about 0.6 mtCO₂e per annum and Pan Ocean Gas Utilization Project with a reduction capacity of about 2.6 mtCO₂e per annum. However, there are existing projects within the Niger Delta that could be aligned to carbon offset projects, namely; solar water system, solar street lights and renewable energy-based hybrid off-grid electrification. In the survey conducted among companies, the responses indicated a well-established understanding of climate change and the critical role of carbon offsetting in mitigating its effects. Also, the respondents reported that their organisations have initiated measures to reduce emissions, particularly through enhancements in energy efficiency, energy management, and the mitigation of methane leaks.

Potential carbon offset projects in the Niger Delta region are identified. Table E1 shows the ranking of the identified carbon offset projects in the Niger Delta.

Table E1. Ranked carbon offset projects

S/N		CLOSENESS TO AN IDEAL SOLUTION	RANK
1	Tree planting and reforestation	0.712	1
2	Conservation and biodiversity (including mangrove restoration)	0.662	2
3	Clean cooking solutions	0.622	3
4	Renewable energy (including electric vehicles/boats)	0.581	4
5	Sustainable agriculture (e.g. aquaponic)	0.561	5
6	Waste management and recycling	0.514	6

D. PROVIDE RECOMMENDATIONS FOR HOW CARBON OFFSET PROJECTS MIGHT BEST BE LEGISLATED AND IMPLEMENTED IN COMMUNITIES IN THE NIGER DELTA

The outlined strategic legislative, policy, and institutional pathways are designed to activate a robust carbon market in Nigeria, particularly within the Niger Delta region, while ensuring climate justice, community engagement, and alignment with international mechanisms.

 **Strengthening national-subnational integration:** National climate frameworks are not effectively implemented at state level. To align subnational actions with national policies, a coordination framework, policy toolkits, and fiscal incentives are proposed.

 **Subnational carbon market development:** Delta State is leading, but other states like Bayelsa and Rivers require clearer regulations. Model legislation, readiness programs, and climate funds with benefit-sharing mechanisms are recommended.

 **Mainstreaming climate justice:** Just transition clauses and community ownership models for offset projects should be legislated to prevent deepening inequalities.



Carbon market activation: Under Article 6, a National Carbon Market Authority should be established to oversee MRV, registry, and international trade. Pilot projects in key sectors and a tiered MRV system using digital tools are essential.



Mobilising private sector participation: Incentives such as credit guarantees, tax benefits, green bond linkages, and carbon auctions are needed to attract investors and de-risk participation.



Community engagement and capacity building: Public education through local campaigns and training models will increase awareness. Projects should be embedded in local development plans, prioritising those with high social and environmental co-benefits and ensuring local job creation.



Institutional collaboration: A Niger Delta Carbon Market Consortium (NDCMC) and an Advisory Council on Carbon Finance (ACCF) are recommended to foster cross-sectoral collaboration and enable regional project pooling, certification, and market access.



International linkages: Nigeria should leverage Paris Agreement's Article 6 mechanisms to secure bilateral trades and attract climate finance, positioning the Niger Delta as a hub for global carbon offset investments.



1.0 INTRODUCTION

1.1 BACKGROUND

The arcuate Niger Delta is situated between latitudes 4° and 6° north of the equator and longitudes 4° and 8° east of the Greenwich. The Niger Delta is the largest delta in Africa and the third largest in the world, with a total area of 112,106 km², which constitutes about 12% of the entire surface area of Nigeria. It is located within nine coastal southern Nigerian States, which include all six states from the south-south geopolitical zone Meridian[1]. The Niger Delta is a densely populated region sometimes called the Oil Rivers because it was once a major producer of palm oil. The geological Niger Delta is over 480 km wide, stretching from the Benin River in the west to the Imo River estuary in the east[2]. This vast area contains the largest mangrove forest in the world and serves as the spawning ground for 60% of the fish in the Gulf of Guinea[3].

The geographical area of the Niger Delta, covering some 38 km², is the receptacle of water and sediments from the vast catchment area of approximately 2 million km² of the Niger River system. The continuous deposition of sediments for several million years, together with other delta development processes, has resulted in the formation of a gently sloping prolific sedimentary basin characterised by a crisscrossing river and creek network. The fresh and saline water ecosystems which inhabit the channels maintain a dynamic equilibrium, thus making the ecosystem, which is rich in biodiversity, relatively fragile. At the same time, the interaction of the hydro-ecological processes with the environment has resulted in the development of different ecological zones whose boundaries are constantly adjusting to the balance of upstream discharge and tidal flows [4]. Rainfall Distribution in the Niger River Basin varies from as low as 300mm in the extreme north to 4000 mm in the Niger Delta. Rainfall in the Niger Delta typically varies from 2700 - 4000 mm per year as against an annual evaporation of about 1500 mm. By far, the rainiest part of the Basin is the coastal segment of the Niger Delta, where rainfall exhibits a bi-normal distribution and reaches about twice the amount of evaporation. Over 70% of the rainfall occurs between May and September.

The River Niger follows a relatively straight south-westerly trajectory after Onitsha. The main course of the Niger bifurcates into two (2) major courses at Asamabiri, namely; Forcados River and Nun River, as it enters the lower Niger Delta and discharges into the Gulf of Guinea[5]. From this point of bifurcation, the dry season riverbeds for both the Nun and Forcados Rivers are generally straight, but the rivers follow a strongly braided pattern. Along this stretch, the River Niger has a well-defined floodplain boundary due to the absence of backswamps. Further downstream of the Nun-Forcados bifurcation, the braided character of the river changes gradually into distinct meanders[6]. Many towns and settlements in this part of the delta are located along the riverbanks at the natural levees due to their relatively higher elevation, see Figure 1 for the geographical Niger Delta region.

The Niger Delta region is considered the live wire of Nigeria's economy because of the active oil and gas production activities in the region, making the country the 1st and 13th largest crude oil producer in Africa and the world, respectively[7]. The oil and gas production contributes about 65% of government revenue and over 85% of total exports[8]. According to a study conducted by the Central Bank of Nigeria (CBN) and the Nigerian Institute of International Affairs (NIIA), foreign direct investment in the oil and gas sector significantly impacts Nigeria's economic growth, which accounts for approximately 9% of Nigeria's GDP [7]. Crude oil was discovered in Nigeria about sixty-nine years ago. The country has proven oil and gas reserves of approximately 37.5 billion barrels of oil and 202 trillion cubic feet of natural gas[8]. Exploration and production activities in the oil and gas sector are driven by both international and local oil companies. Major International Oil Companies (IOCs) such as Shell, ExxonMobil, Chevron, Total, and Agip play significant roles in exploration and production activities. The state-owned Nigerian National Petroleum Corporation Limited (NNPCL) is pivotal, overseeing joint ventures with IOCs, providing regulatory functions, and supervising the downstream sector.



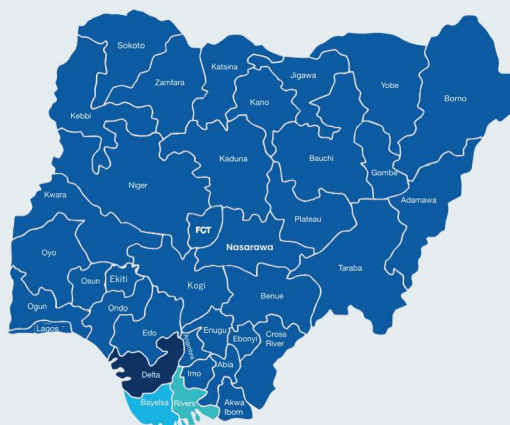
The oil and gas exploration and production activities in the Niger Delta region, which comprises nine states shown in Table 1, significantly contributed to the persistent tensions between oil companies and local communities over environmental damage, inadequate compensation, and insufficient developmental benefits, resulting in insecurity and violent conflicts[9]. The broader socioeconomic inequalities and social exclusion excited the “oil bunkering” and artisanal oil refining with profound implications on security and stability in the Niger Delta region. The practices are associated with environmental degradation in nearby communities, including reductions in water, air, and soil quality, which in turn negatively affect livelihoods for farmers and fishers.

Three (3) states, Bayelsa, Rivers, and Delta States, have experienced



77%

of all oil spills in Nigeria[10]. Environmental impacts are particularly damaging to women, whose livelihoods are more dependent on highly localised agricultural activities that are directly impacted by environmental degradation.



At a



2.38%

annual growth rate[11], the region's population is estimated at **45.12 million** people in 2024, scattered over **13,329** settlements, largely rural communities in dispersed settlements.



The combined population of Rivers, Bayelsa and Delta represents about **35%** of the region's population and contributed about **73%** of the region's **363,381,639** Bbls of crude oil/condensate production in 2023[12].

Figure 2 shows the locations of various oil wells in the Niger Delta region, including the identified communities for the study.

Table 1 Characteristics of the Nine States of the Niger Delta Region

STATE	LAND AREA (SQUARE KILOMETRES)	POPULATION	
		PROJECTED TO 2005*	PROJECTED TO 2024**
Abia	4,877	3,230,000	5,049,983
Akwa Ibom	6,806	3,343,000	5,226,654
Bayelsa	11,007	1,710,000	2,673,520
Cross River	21,930	2,736,000	4,277,633
Delta	17,163	3,594,000	5,619,083
Edo	19,698	3,018,000	4,718,529
Imo	5,165	3,342,000	5,225,091
Ondo	15,086	3,025,000	4,729,473
Rivers	10,378	4,858,000	7,595,299
Total	112,110	28,856,000	45,115,265

*GTZ population projection based on the 1991 census[13]

** Authors' projection of GTZ population at a 2.3% growth rate adapted from Statista[11]

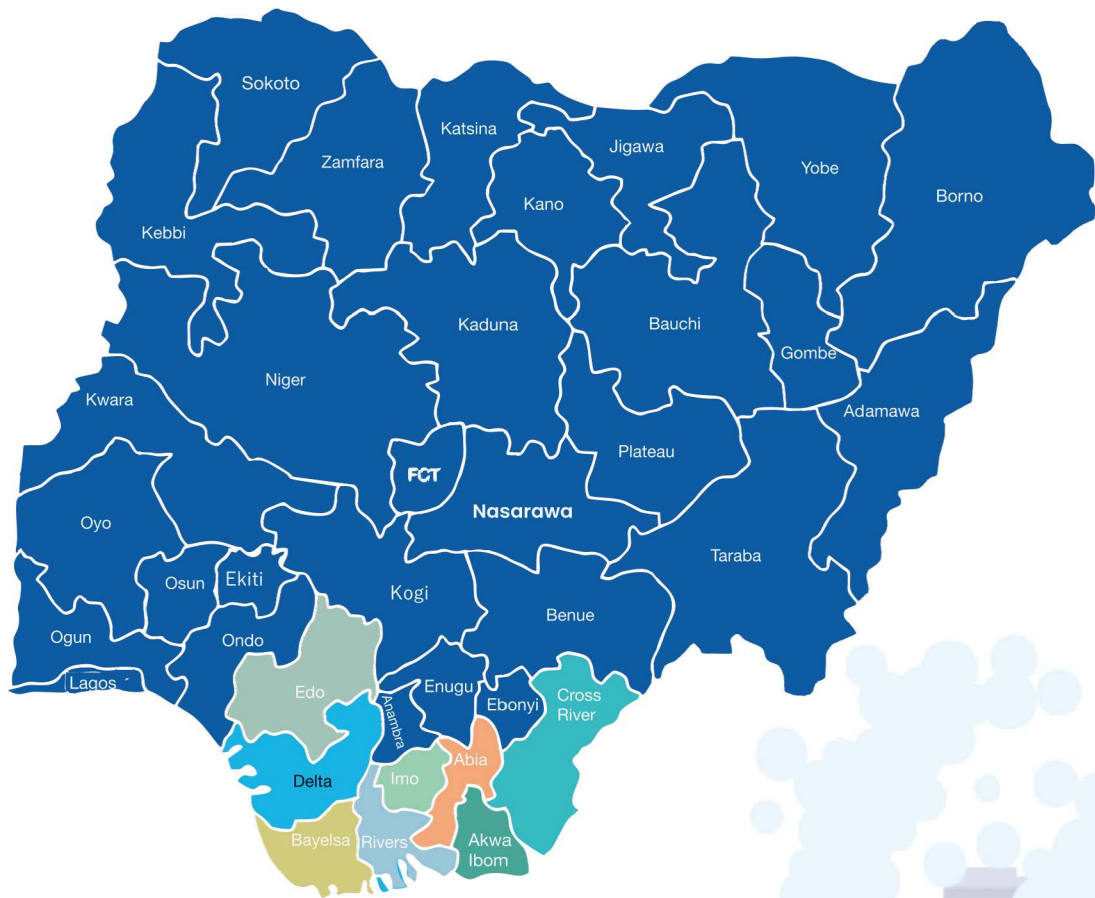


Figure 1. Map of Niger Delta Region Extruded from Nigeria's Map



Figure 2. Location of Oil Wells in Niger Delta (Source: Authors)



The oil and gas production activities in Nigeria are responsible for approximately

125 million

metric tons of carbon dioxide equivalent (mtCO₂e) emissions, which account for



54%

of the total **229.4** mtCO₂e emissions from the energy sector in 2018.

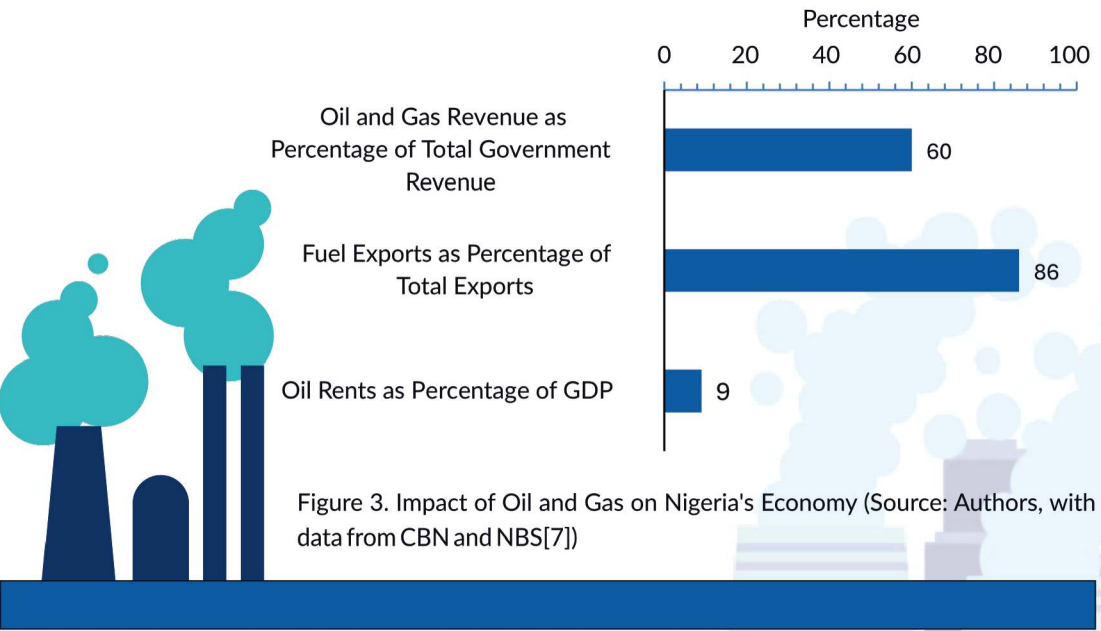
The emissions from the oil and gas sector are caused by gas flaring, ageing infrastructure, vandalism and fugitive emissions (methane leakage) [14], [15]. The contribution of the oil and gas sector to national GHG emissions will continue to be significant unless mitigation efforts are made. In addition, the 2018 emission figure suggests that the Agriculture, Forestry, and Other Land Use (AFOLU) sector had the highest source of greenhouse gas emissions (at 125.70 mtCO₂e) after the energy sector. Looking at the figures, it is no surprise that efforts to decarbonise the oil and gas sector and the AFOLU sector rank high in all the reports in the country.

Like many developing nations, Nigeria faces a complex challenge in balancing the need for improved socioeconomic development with the imperative to reduce greenhouse gas (GHG) emissions in response to the Paris Agreement through government policy. Over the last two decades, Nigeria has established several policies and policy documents (e.g., the 2018 Gas Flare Commercialisation Programme[16], 2020 Energy Transition Plan[18], 2021 Nationally Determined Contributions[19], 2024 Long-Term Low Emission Development Strategy(LT-LEDS)[15] intended to reduce GHG emissions and address poverty as its strong commitment to cooperative climate action under Article 6 of the Paris Agreement. The revised NDC commits Nigeria to unconditionally reduce GHG emissions by 20% below business-as-usual by 2030, whereas to conditionally reduce its GHG emissions by 47% below business-as-usual by 2030 through receiving appropriate international support[17].

1.2 OILAND GAS PRODUCTION IMPACTS

1.3.1 ECONOMIC

The oil and gas sector, comprising upstream, midstream, and downstream, is one of the primary drivers of Nigeria's economy, as illustrated in Figure 3. The oil and gas sector has contributed significantly to the total export revenue since the 1990s; for example, over 86% of the total export revenues in 2021[18]. The sector contributed 60% of Nigeria's total revenues over the last 5 years, making the sector the backbone of the national economy[7]. According to a study conducted by the Central Bank of Nigeria (CBN) and the Nigerian Institute of International Affairs (NIIA), foreign direct investment in the oil and gas sector significantly impacts Nigeria's economic growth, which accounts for approximately 9% of Nigeria's GDP [7]. Figure 4 shows the vulnerability of oil and gas-based economies (including Nigeria) to declining oil prices. Nigeria stands at a Tier 4 level of vulnerability to declining oil prices [19], [20]. The implication is that Nigeria's average annual revenues are expected to drop by 69 % over the next twenty years compared to 2015–19 [19].



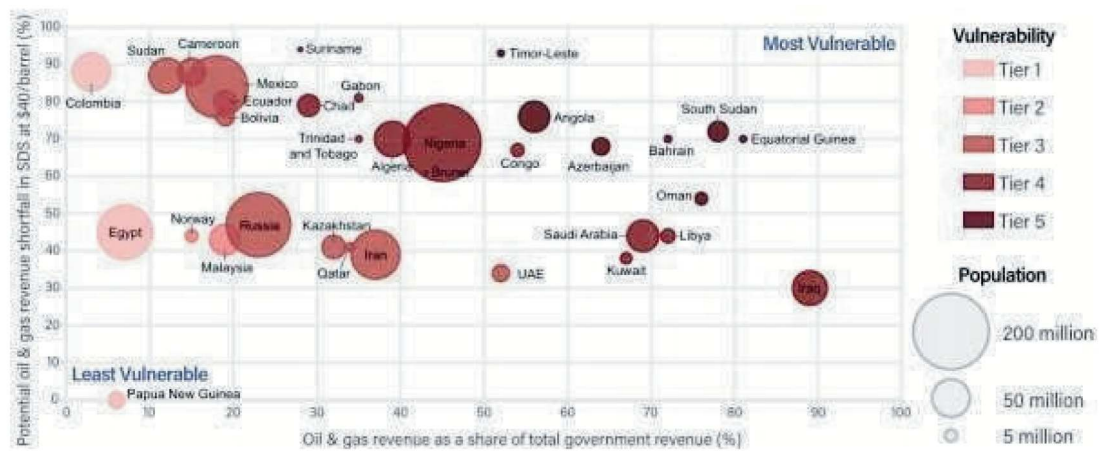


Figure 4. Vulnerability of oil and gas-producing countries to declining oil prices (adapted from[19])

The upstream segment of the oil and gas sector, encompassing both operating and service activities, has a combined staff strength of 39,152, as shown in Figure 5. The active operating companies had a staff strength of 11,057 (with a Nigerian-to-expatriate ratio of 94:6), whereas active service companies in the oil and gas sector had a combined staff strength of 28,095 (with a male-to-female ratio of 83:17) in 2019 based on an analysis of human capital development trends in the Nigerian oil and gas industry by the Nigerian Content Development and Monitoring Board (NCDMB) [21].

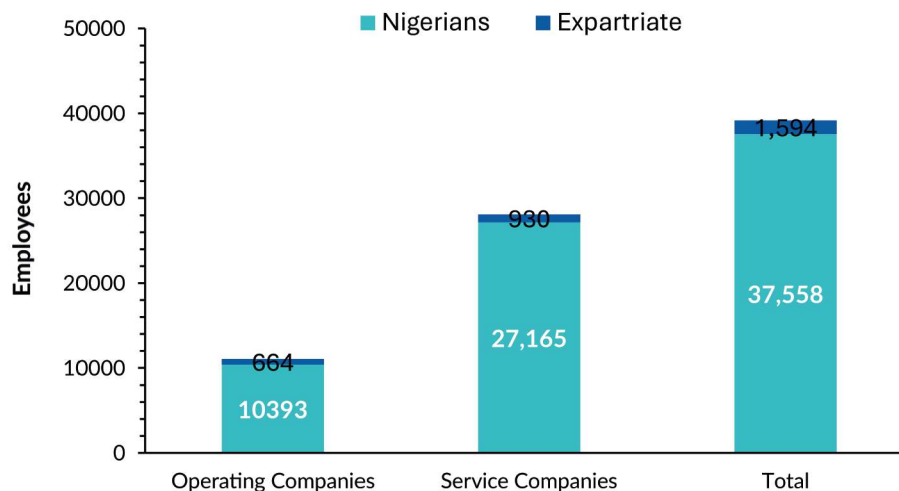


Figure 5. Staff Strength in Nigeria's Oil and Gas Upstream (Source: Authors with data from NCDMB[21])

1.2.2 ENVIRONMENTALAND SOCIAL

Besides the climate change impact of the oil and gas activities in Nigeria, oil and gas production is plagued with oil spills (from illegal bunkering, aged infrastructure and vandalism), gas flaring, and deforestation, which have severely impacted the local ecosystems and communities, leading to health issues and loss of livelihoods[22]. In addition, oil and gas exploration and production activities have significantly contributed to persistent tensions between oil companies and local communities, resulting in environmental damage, inadequate compensation, and insufficient developmental benefits, which have led to insecurity and violent conflicts [9]. Therefore, the existing structure of the Nigerian oil and gas sector introduces a level of injustice from the social and environmental dimensions.

1.2.3 CLIMATE CHANGE

Climate change is a pressing global challenge that impacts every country and continent, disrupting economies and lives worldwide. Without urgent action, it will have irreversible and catastrophic impacts on Nigeria's economy and citizens, especially the overburdened Niger Delta region of the country. Climate change is caused by global warming resulting from the accumulation of greenhouse gases (GHGs) in the atmosphere, primarily due to anthropogenic activities such as the burning of fossil fuels, deforestation, anaerobic waste decomposition, and agricultural practices. A study suggested that high greenhouse gas (GHG) emissions per oil production are a major driver of emissions in Nigeria's oil and gas sector [23].

The study examined



75

oil fields worldwide,

including three in Nigeria – **Nigeria Escravos Beach, Nigeria Obagi, and Nigeria Bonny** – which revealed that Nigeria currently has one of the highest GHG emissions per barrel of oil production

among the **75 oil fields**, ranging between **110 and 250 kg CO₂e/bbl.**



According to the scenario, an increase in unconventional oil exploitation could result in a 6-26% increase in CO₂e emissions over the baseline. Unconventional oil production in deep waters has increased CO₂e emissions per barrel of oil supplied; Nigeria's offshore production ranges from 12 to 250 kgCO₂e/bbl. The observation could be attributed to the government's enormous spending in the oil and gas sector and inefficient operations [24]. The literature suggests that various factors drive emissions in the oil and gas sector, including subsidies, climate policies, finance, declining performance of oil reservoirs, war and conflict, and technological advancements. However, there is a disagreement over the role of new technologies in driving emissions in the oil sector, which can be attributed to some macroeconomic implications [23], [25], [26], [27], [28].

1.3 CLIMATE CHANGE IMPACT IN THE NIGER DELTA REGION

The impact of climate change is evident in the oil and gas sector in the form of extreme weather conditions with more disruptive events putting the sector's operation, reliability, and growth at risk[29]. However, while climate change mitigation is talked up in Nigeria, a top priority action in the context of the global energy transition, there remains a widely acknowledged imperative to rapidly grow the Nigerian economy and increase the well-being of a rapidly growing population, especially the vulnerable population in the Niger delta[30]. Besides the climate change impact on the oil and gas activities in Nigeria, oil and gas production is plagued with oil spills, gas flaring, and deforestation, which have severely impacted the local ecosystems and communities, leading to health issues and loss of livelihoods[22].

Climate change has been identified as a conflict multiplier in the Niger Delta region because it is linked with the aggravation of the existing tension in the vulnerable communities in the region. Oil and gas production in the region has already placed a disproportionate burden on the majority of oil and gas host communities due to environmental degradation and loss of livelihoods. These challenges are exacerbated by climate change, which has altered weather patterns, causing erratic rainfall, flooding, extreme winds, and drought [31]. These environmental stresses induce unhealthy competition for scarce resources, such as arable land and clean water, thereby heightening tensions among local communities. The interplay between environmental degradation caused by oil activities and climate change creates a complex web of challenges that amplifies social and economic vulnerabilities, ultimately leading to regional tension and conflict.

Climate modelling by the World Bank's Climate Change Knowledge Portal (CCKP) indicates that the Niger Delta will likely experience a gradual rise in average temperatures by mid-century, as shown in Figure 6. From 1995 to 2014, annual average temperatures in the Niger Delta region ranged roughly from 26.4°C to 26.9°C. Projections show a consistent upward trend across all Shared Socioeconomic Pathways (SSPs). By 2060, the lower-emissions pathway (SSP1-1.9) still indicates an increase to around 27.5°C, while the higher-emissions scenario (SSP5-8.5) could exceed 29°C in the same timeframe. These data suggest that even under more ambitious mitigation efforts, temperatures are expected to be notably higher than the historical baseline. Warmer conditions can intensify heat-related challenges for agricultural activities and public health, especially in coastal and low-lying areas. Specifically, a significant portion of the population depends on crop farming and fishing for livelihood – about 60% of the population depends on farming[32]. Agriculture in the Niger Delta is heavily dependent on favourable climatic conditions, like rainfall. A study highlights the sensitivity of agricultural productivity to climatic variations, which have adverse impacts on livelihoods in the region [35]. Consequently, the increasing temperatures call for significant concern.

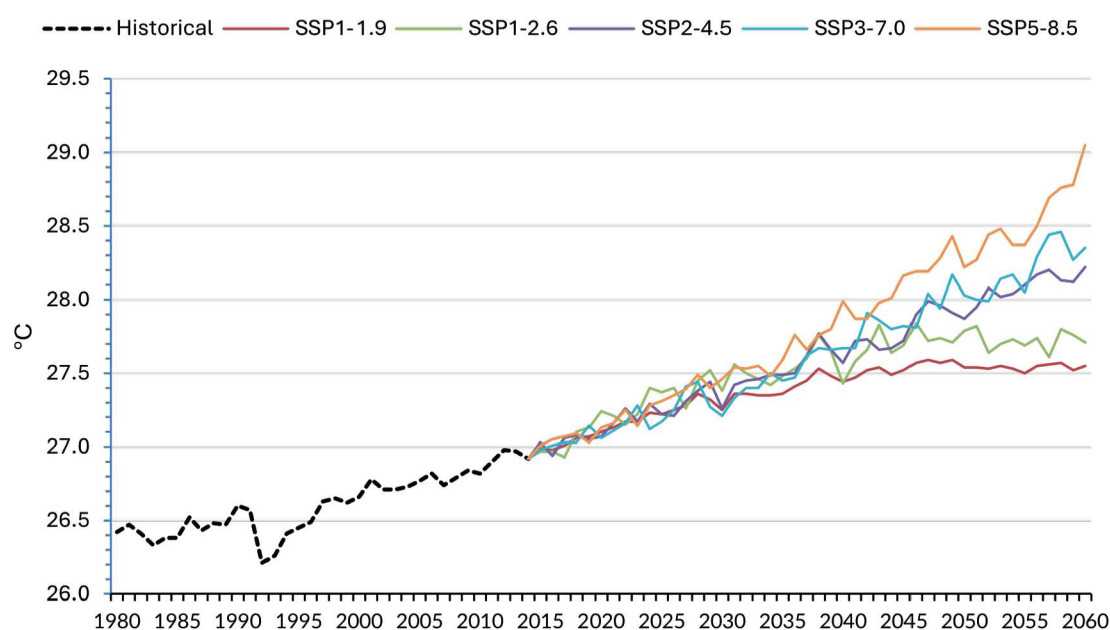


Figure 6. Average Mean Surface Air Temperature in the Niger Delta (Historical[33] and Projected) (Source: Authors)

On precipitation, projections often suggest altered rainfall patterns rather than a uniform increase or decrease. Historical annual precipitation (1995–2014) varies between about 2,800 mm and just over 2,900 mm, as shown in Figure 7. Looking ahead, projections under different scenarios fluctuate significantly: some show modest decreases relative to the baseline, while others indicate increases above 3,000 mm by 2060, notably under SSP5-8.5. This variability suggests that rainfall patterns may become more unpredictable, with possible implications for flood risk and water management in the region. Some scenarios suggest shorter, more intense rainfall seasons, which may lead to increased flood events and soil erosion. Moreover, coastal communities in the Niger Delta could see higher exposure to storm surges, exacerbated by sea-level rise. The observation will significantly disrupt fisheries because of the disruption in water bodies' temperature and chemistry, leading to the migration of fish species and reduced fishery yields, which will directly impact food security and the income of fishing communities in the Niger Delta region[34].

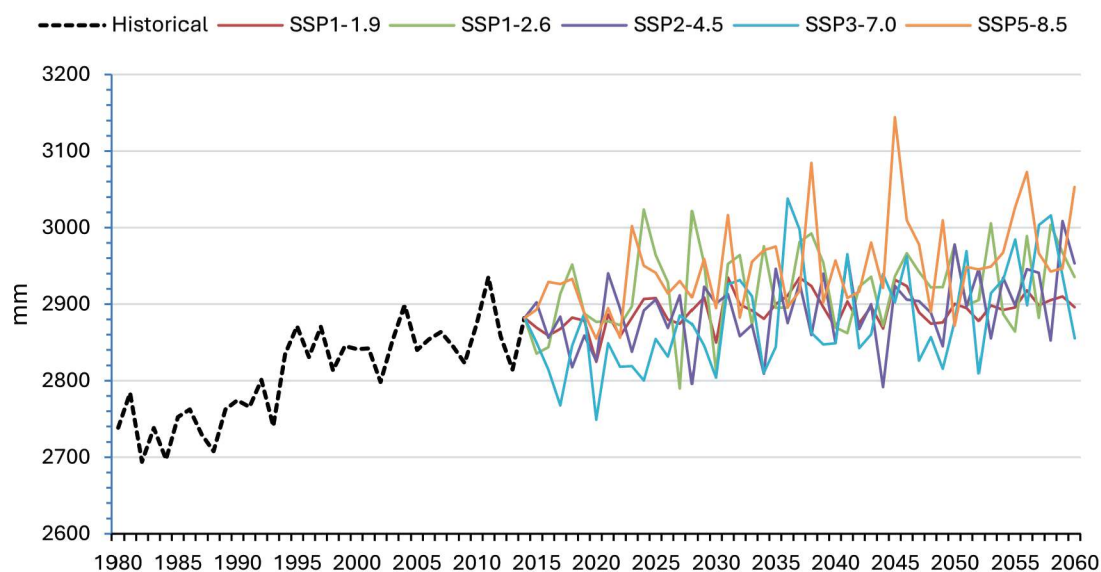


Figure 7. Precipitation in the Niger Delta (Historical[33] and Projected) (Source: Authors)

1.4 CARBON OFFSET

Specifically in Nigeria, the oil and gas sector creates significant indirect and consequential jobs largely geographically concentrated in the Niger Delta region[20]. At the same time, the region's abundant renewable[35] and other natural resources can be harnessed and utilised in ways that help to build climate resilience, create jobs, and address poverty and social inequality in the region through carbon offset instrumentality. The carbon offset has the potential to ensure social integrity by ensuring that communities, especially local people and communities, are empowered, according to the World Bank[36], [37]. The foregoing underscores the need for context-sensitive climate action and financing strategies (e.g. carbon offset) to alleviate the economic repercussions of climate extremes and ensure sustainable economic development in the Niger Delta region.

Carbon offset refer to mechanisms to reduce or sequester greenhouse emissions, such as carbon dioxide (CO₂) and methane, to compensate for GHG emissions produced elsewhere, aiming to achieve net zero emissions. The carbon offset could be anchored on afforestation and reforestation, renewable energy, carbon capture systems, and energy efficiency management. It is currently an important policy discussion in the climate change mitigation space, with a few African countries taking it on board through the carbon credit pricing and market[38]. The World Bank announced ambitious plans to support 15 countries in earning revenue of up to \$2.5 billion of carbon credits from the conservation of forests[36].

Note: Rivers State is currently used to proxy Niger Delta. Time period: 1950-2100 (historical scenario - 1950-2014, future scenarios - 2015-2100). Historical Reference Period: 1995-2014. Future projected Scenarios: SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5. Multi-Model Ensemble range: 50th (median), 10th, and 90th percentiles. Spatial resolution: 0.25° x 0.25° (1° x 1° for extreme precipitation events variables).

Note: Rivers State is currently used to proxy Niger Delta. Time period: 1950-2100 (historical scenario - 1950-2014, future scenarios - 2015-2100). Historical Reference Period: 1995-2014. Future projected Scenarios: SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5. Multi-Model Ensemble range: 50th (median), 10th, and 90th percentiles. Spatial resolution: 0.25° x 0.25° (1° x 1° for extreme precipitation events variables).

2.0 SCOPE, AIM AND OBJECTIVES OF THE PROJECT

The carbon offset scoping study targets the Niger Delta region of Nigeria, with a focus on Bayelsa, Delta and Rivers States. The project is part of a larger project entitled “A Community-Centred Approach to Transforming Criminality and Violence in the Niger Delta”.

The aim is to provide scoping study to examine the potential impact of various approaches to carbon offset policies in the Niger Delta, as well as determine community perceptions and preferences.

The specific objectives of the study are outlined as follows.

			
Explore and identify sources of the regulatory framework for carbon offsets and credits in Nigeria.	Collect, analyse, and provide disaggregated information on approaches for achieving low carbon development in the Niger Delta.	Identify Carbon offset projects/initiatives in the region and investigate issues associated with their operations in communities.	Provide recommendations for how carbon offset projects might best be legislated and implemented in communities in the Niger Delta.



3.0 METHODOLOGY AND ANALYTICAL FRAMEWORK

3.1 LITERATURE REVIEW



The study started by gathering granular data through a review of peer-reviewed publications, policies, regulations, and frameworks related to climate change, carbon offsets and credits in Nigeria, with a focus on the Niger Delta region. Additionally, an analysis of existing policy instruments that may likely support carbon offset mechanisms and carbon market regulations in Nigeria was conducted along with relevant government documents, reports, and data from ministries, departments, and agencies responsible for coordinating carbon offset initiatives.

3.2 DESKTOP ANALYSIS AND SIMULATION



The Low Emission Analysis Platform (LEAP) software was used to estimate the GHG emission profile and intensity in the studied area coarsely. LEAP is a bottom-up model originally developed at the Stockholm Environmental Institute and has been adopted by numerous organisations in almost 190 countries worldwide[39].

The LEAP model structure was designed to reflect the sector-tailored integrated scenarios. Consequently, the LEAP model offered quantitative information about the energy mix and emissions of the focused states. The LEAP model covers essential sectors, such as oil and gas, power, transport, building and residential, Agriculture, Forestry, and Other Land Use (AFOLU), industry and services, and waste. The LEAP model relies on key policy assumptions and bottom-up data reflecting the Niger Delta context-sensitive information. The modelling time horizon is 2060, with 2020 as the baseline year, aligning with the national climate vision enshrined in the Long-Term Low Emission Development Strategy (LT-LED).

In addition, the Geographic Information System (GIS) under ArcGIS were used to estimate the forestry and deforestation rates of the studied area. GIS is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface, enabling the analysis and visualisation of spatial data[40]. This study relies on remote sensing data and spatial analysis to assess deforestation trends in the Niger Delta region of Nigeria. The primary dataset used is the Global Forest Change v1.10, accessible through Google Earth Engine (GEE)[41]. This dataset provides annual global tree cover loss at a 30-meter spatial resolution from 2001 to 2022, making it particularly suitable for analysing long-term deforestation trends across the region. The Hansen dataset is widely recognised for its high temporal and spatial resolution, allowing for detailed and accurate monitoring of deforestation over extended periods[41]. One of its key benefits is the availability of annual tree cover loss data, which enables year-to-year analysis and quantification of deforestation rates with high precision. The Hansen dataset was used to identify tree cover loss by filtering the "lossyear" band to extract forest loss specific to 2021 and 2022. Each state's total deforested area was calculated using the `reduceRegion()` function, which summed up all pixels representing tree loss for the given years.



The total forest area in **2000** was extracted from the Hansen dataset to serve as the baseline for percentage loss calculations. This baseline was crucial in determining the relative extent of deforestation over time. To quantify deforestation, the total annual forest loss for 2021 and 2022 was computed in square meters for each state.

GDP source: <https://nigeria.opendataforafrica.org/qxjbkc/states-nominal-gross-domestic-product-2013-2017?state=1000030-delta>

3.3 STAKEHOLDER MAPPING AND ENGAGEMENT

This phase identified nine communities (three from each state) on the triangulation theory [42], and complimented by a Geographic Information System (GIS) tool appropriate for the study; see Table 2 for the characteristics of the selected communities.

Table 2. Selected communities for engagement

STATES	LGAS	COMMUNITIES	GEOLOCATION	POPULATION*
Rivers	Ahoda West	Oshika	5.0732,6.5623	1,602
	Akuku-Toru	Obonoma	4.7110,6.7918	2,344
	Gokana	Kpor	4.6523,7.2852	19,117
Bayelsa	Nembe	Boluorua	5.1077,6.1213	14,056
	Ogbia	Imiringi/ Elebele	4.8537,6.3663/ 4.8553,6.3453	11,330/ 9,352
	Sagbama	Ogbolomabiri	4.5339,6.4002	11,065
Delta	Ndokwa West	Umutesi	5.6830,6.4218	30,775
	Ughelli North	Omavovwe	5.5480,6.0550	12,202
	Warri South	Omadino	5.6295,5.6502	6,856

Estimated population from [43]

Stakeholder mapping and analysis were conducted based on existing relationships, different spheres of interest, and the influence of key players in achieving the project's objectives, as illustrated in Figure 8. The activity identified and mapped the major players contributing to carbon emissions in the target states of the Niger Delta region, including industries, oil and gas companies, and other relevant sectors.

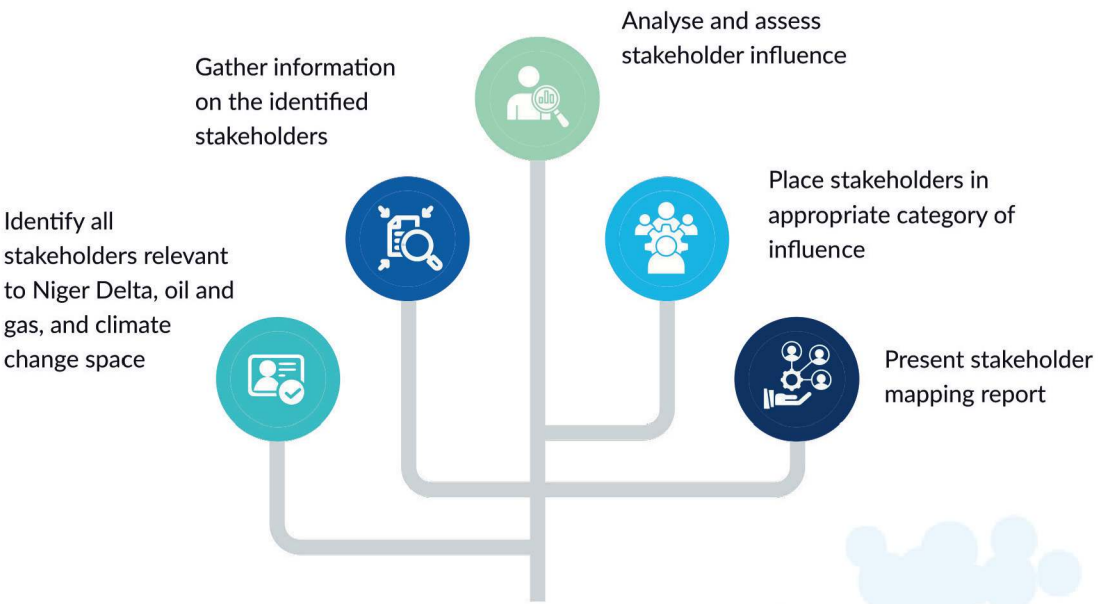


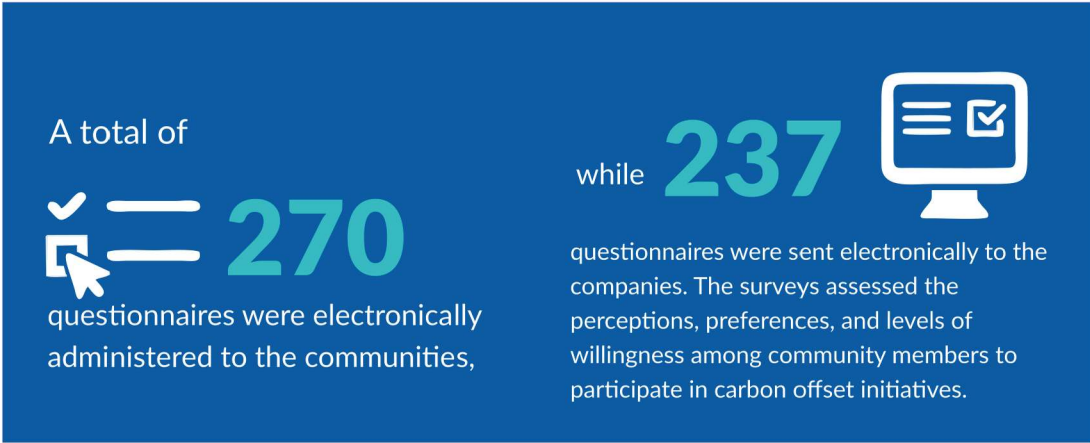
Figure 8. Stakeholder Mapping Steps

The exercise's outcomes identified the priorities, roles, interests, and influence of various stakeholders in the Niger Delta to contribute to implementation of a policy framework for carbon offset projects in the Niger Delta. A multi-stakeholder approach was employed to identify relevant stakeholders, including community leaders, government agencies, businesses, civil society organisations, academic institutions, local communities, vulnerable and marginalised groups, and international organisations, to ensure that the carbon offset policy framework and action plans are inclusive and implementable.

The stakeholder engagement employed semi-structured interviews, meetings and workshops, and focus groups to gather insights and ensure buy-in. The meetings, workshops, and focus groups discussed the potential impacts and benefits of the carbon offset project, addressing any concerns that arose. In this regard, on-site enumerators were trained on the nuances of the methodology and the focused communities. The stakeholder engagement involved a validation workshop used to validate data obtained from desktop analysis, literature review and field data through questionnaires and focus group discussions. The information from the literature review, desktop analysis, and stakeholder engagement was used to conduct a critical analysis of the existing policies, regulations, and institutional frameworks related to climate change administration and carbon offsets in Nigeria. Gaps, challenges, and potential areas for improvement in the effective implementation of a carbon offset framework in the Niger Delta region were specifically identified.

3.4 KEY INFORMANT INTERVIEWS, QUESTIONNAIRES AND FOCUS GROUP DISCUSSIONS

The project involved in-depth, semi-structured interviews with key stakeholders, including government officials, industry representatives, community leaders, and field experts, to gain valuable insights into carbon offsets and climate change mitigation. The questionnaires, segmented to focus on communities and industries, were implemented using the kobotoolbox software, which allows for central coordination and control of field data to eliminate human errors.



The questionnaires were supplemented by focus group discussions to collect qualitative data, enabling a deeper understanding of community members' experiences, concerns, and suggestions regarding carbon offset methods.

3.5 CASE STUDIES

Existing and potential carbon offset projects, including afforestation and reforestation, renewable energy, carbon capture systems, and energy-efficient technologies, were identified during the community visit and through government and credible open-sourced databases (e.g., NCCCC, Gold Standard). Mapping of carbon offset projects using GIS and other technologies was conducted to identify renewable energy, afforestation/reforestation, and carbon capture and sequestration (e.g., Bioenergy with Carbon Capture and Storage—BECCS) potentials across various regions. An in-depth examination of successful carbon offsetting initiatives from similar contexts, both within Nigeria and internationally, was done. The analysis focused on identifying effective approaches and strategies utilised in these case studies. Lessons learnt was evaluated to gain valuable insights to help in the development of a carbon offset framework tailored to the Niger Delta region.

4.0 RESULTS

4.1 RECENT NATIONAL CLIMATE CHANGE RELATED POLICY AND DOCUMENTS

4.1.1 THE NIGERIAN ECONOMIC SUSTAINABILITY PLAN

The Nigeria Economic Sustainability Plan (NESP)[44], approved by the Federal Government in June 2020, presents a pathway to bail out the economy after the COVID-19 pandemic. The NESP aims to stimulate and diversify the economy, retaining and creating jobs and protecting the economically vulnerable groups, with a target to lift 100 million Nigerians out of poverty over the next 10 years. The key interventions outlined in the plan focus on 10 core projects, including a Mass Agricultural Programme (MAP), an Extensive Public Works and Road Construction Programme, and a Mass Housing Programme (MHP). Others include installing solar home systems, strengthening the social safety net, supporting micro, small, and medium enterprises, creating survival funds, promoting domestic gas utilisation, and using digital technology. The installation of solar home systems, domestic gas utilisation and digital technology are critical climate actions to support environmental sustainability.

4.1.2 NIGERIA'S NATIONALLY DETERMINED CONTRIBUTIONS (NDC)

Nigeria submitted its Nationally Determined Contributions (NDC) to the UNFCCC in 2015 and updated it in 2021[17]. The updated NDC provided the GHG emission profile of Nigeria, estimated at 347 mtCO₂e in 2018. The updated NDC featured the Energy, Agriculture, Forestry, and Other Land Use (AFOLU) sector, as well as the Waste and Industrial Processes and Other Product Use (IPPU) sector. The Energy, AFOLU, Waste and IPPU sectors contributed approximately 60 % (208.2 mtCO₂e), 25 % (86.8 mtCO₂e), 9 % (31.2 mtCO₂e) and 5 % (17.4 mtCO₂e), respectively. The NDC posits that the country's emissions are expected to reach 452.7 mtCO₂e by 2030 if no mitigation action is taken, which corresponds to the Business as Usual (BAU) emissions scenario. However, the NDC targets committed to reduce the emissions under the BAU by 20 % under the "Unconditional NDC" scenario – if no external support is received. Furthermore, the NDC commits to reducing the BAU emissions by 47% with the intervention of international assistance by 2030.

Strategic measures enshrined in the updated NDC to reduce the emissions include: (i) enforcing stringent measures to eliminate gas flaring by 2030, (ii) elimination of fossil-based liquid fuels powered generators by 2030, (iii) effectively implement the gas flare commercialisation programme by ensuring 48 % penetration of LPG cookstoves coupled with 13 % penetration of improved cookstoves, (iv) 2.5 % annual reduction in energy intensity in all the productive sectors, (v) achieve 30 % of renewable energy in the grid-connected electricity generation from renewable energy, (vi) installation of 13GW of off-grid electricity generation mix, (vii) 100% electrification of lighting by 2030, (viii) achieve at most 8% transmission and distribution losses by 2030, (ix) all vehicles to meet EURO IV emission limits by 2030, and (x) achieve 22.1% of passenger-km through Bus Rapid Transport by 2035, and 25% of trucks and buses to use CNG by 2030.

The updated NDC also aligns with the NESP plan and some of the actions specifically targeted to the plan.

For example, the installation of Solar Home Systems targets



5 million
households,

serving about



25 million

individual Nigerians who are currently not connected to the national grid.

4.1.3 PETROLEUM INDUSTRY ACT

The recent oil and gas sector policy development is the Petroleum Industry Act (PIA), signed into law in August 2021[45]. This act aimed to comprehensively overhaul the oil and gas sector. The PIA aims to enhance transparency by promoting effective governance, efficient fiscal management, and a positive social impact on the host communities of oil and gas companies. The PIA established two new regulatory organs: the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA). Both agencies ensure better regulatory oversight and compliance in their respective sub-sectors. The PIA transformed the Nigerian National Petroleum Corporation (NNPC) into a commercially independent company that was no longer reliant on government funding. The commercialisation of NNPC mandates increased oil and gas exploration investment which may further undermine the conflicts and insecurity in the Niger Delta and the global commitment to energy transition[46].

However, the PIA created a Host Community Development Trust Fund to improve the social impact of oil and gas companies on the host communities. In addition, the initiative aims to promote the economic development of the host communities and mitigate conflicts between oil companies and host communities. Despite the positive intent of the PIA, challenges (e.g., lack of confidence, political and industry buy-in) could potentially cause disputes and inconsistencies in the implementation of the act[47]. The Nigerian government is keen on diversifying the economy into agriculture, technology, and renewable energy[48], [49]. The PIA empowers the Nigerian Upstream Petroleum Regulatory Commission to enforce low carbon emissions compliance for oil and gas license and permit applications. However, the PIA does not provide clear strategies for incorporating low-carbon emissions into the oil and gas sector, particularly due to the limited provision for renewable energy in the energy mix. In addition, the PIA offers an inadequate framework for engaging host communities in decision-making regarding low-carbon emission development.

4.1.4 NIGERIA'S CLIMATE CHANGE ACT (CCA)

The Climate Change Act 2021, grounded in prior climate change policies, establishes an ambitious legal framework for achieving a net-zero emissions target by 2050-2070, encompassing green growth and sustainable economic development [50]. The Act establishes a detailed regulatory framework designed to achieve long-term climate objectives, including a net-zero target, funding provisions, environmental and economic accountability, and the promotion of climate initiatives. It mandates implementing programmes to meet long-term climate change mitigation and adaptation goals. The Act aligns well with Nigeria's international climate action commitments, especially at COP26 in Glasgow. Notably, the Act features the establishment of the National Council on Climate Change, the creation of a Climate Change Fund, the provision of a carbon budget and a national climate change action plan, and the execution of vulnerability and risk assessments. The National Council on Climate Change (NCCC) is the designated sole national authority responsible for coordinating climate change activities in Nigeria.

4.1.5 NIGERIA'S ENERGY TRANSITION PLAN (ETP)



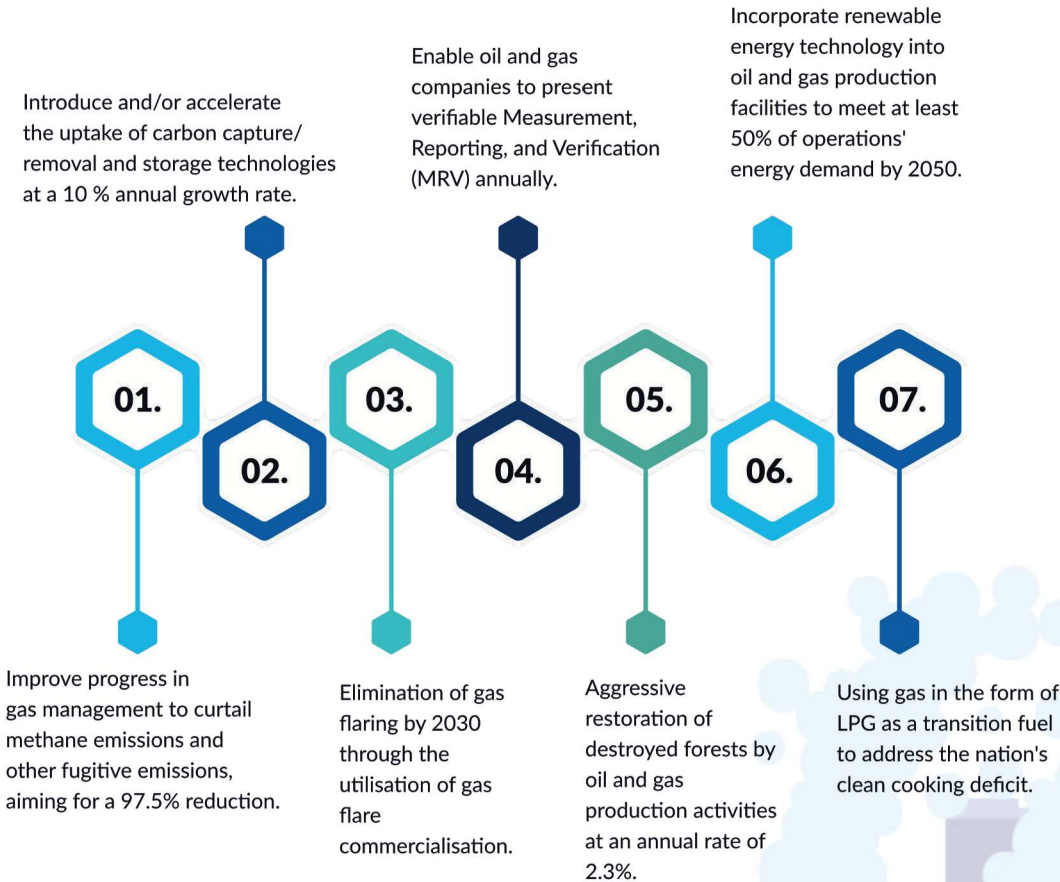
The Energy Transition Plan (ETP) that was launched on 24 August 2022 provides development pathways (NDC-guided and net-zero scenarios) for Nigeria to achieve a low-emission economy by 2050[51]. The ETP estimates that the country had 275 mtCO₂e (without the AFOLU contribution) of GHG emissions in 2020, with energy consumption and processing contributing to about **65%** (179 mtCO₂e) of the GHG emissions.

The ETP document indicates that the country could hit 216 mtCO₂e and 322 mtCO₂e GHG emission levels by 2030 and 2050, respectively, without any emissions mitigation interventions. The emissions estimates in the ETP only focus on energy consumption sectors (e.g., power, transport, building, and industry), excluding AFOLU and the waste sector, which results in substantially lower emissions estimates compared to those in the NDC. The ETP provides a development pathway to achieving net-zero emissions by 2060, unlike NDC's short-term (2030) emission reduction without a net-zero target. The net-zero development scenario commits to 80 % of vehicle fleets coming from electric vehicles and 80% of households switching to clean cooking services energy (electric and LPG) by 2050. In addition, 90% of the 250 GW electricity generation capacity is expected to come from renewable energy sources by 2050.

4.1.6 LONG-TERM LOW EMISSION DEVELOPMENT STRATEGY (LT-LEDS)

Nigeria developed a comprehensive Long Term-Low Emission Development Strategy (LT-LEDS) and submitted it to UNFCCC on 25 April 2024 [15]. The LT-LEDS is the most recent quantitative policy document in the country, inspired by existing policy documents and Act, such as NDC, ETP, and the Climate Change Act. The LT-LEDS aim to advance the country's efforts towards achieving global commitments following the first submission of the Long-Term Vision 2050 in 2021 at COP26 in Glasgow, as part of its commitment to the Paris Agreement (PA). The LT-LEDS addresses the gaps and shortfalls of the updated 2021 NDC. It serves as a long-term strategy and as a vehicle for transitioning Nigeria to a Net-zero Pathway by 2060. Nigeria's LT-LEDS promotes sustainable development and ensures a climate-resilient economy through multi-stakeholder climate action across multiple sectors, aiming to end poverty, provide access to affordable energy, and achieve zero hunger. The LT-LEDS presented four development scenarios – Business As Usual (BAU), Current Policy Scenario (CPS), Gas Economy Scenario (GES), and Renewable Energy Scenario (RES). RES emphasised massive renewable energy penetration (up to 98% by 2060), deployment of electric vehicles and modern transport infrastructure, rapid deployment of clean and improved cookstoves, smart agriculture (including massive ranches), reforestation at the rate of 2.3% annually, deployment of carbon capture and sequestration technologies, and support nature-based carbon sinks, relying on REDD+. These decarbonisation strategies will guarantee a net-zero economy by the end of 2060.

Specifically, the LT-LEDS provides strategic measures to reduce emissions in the oil and gas sector by over 96% in 2060, outlined as follows:



The Nigeria LT-LEDs have recognised the carbon offset mechanism as one of the key strategies for achieving the country's goal of reaching net-zero emissions by 2060 by exploring the best alternatives for participating in the carbon market[15].

4.1.7 PROPOSED NIGERIA'S CARBON MARKET ACTIVATION POLICY(CMAP)

Nigeria's Carbon Market Activation Policy is currently being finalised for release by the third quarter of 2025 by the National Council on Climate Change Secretariat. This development is a response to the Climate Change Act, which establishes a regulatory framework to drive a low-carbon, climate-resilient economy, aligning climate action with national development strategies.

The policy will support Nigeria in achieving its climate change mitigation commitments through market-based mechanisms, such as those outlined in Article 6.4 of the Paris Agreement, also known as the Paris Agreement Crediting Mechanism (PACM) and Voluntary Carbon Markets (VCM). The policy will encourage active participation from the government, businesses, project developers, validation and verification bodies, startups and universities, credit buyers, non-governmental organisations, and local communities in the carbon markets. The proposed policy's core objective is to create a transparent and credible system that significantly contributes to Nigeria's Nationally Determined Contributions (NDC) and Net Zero targets, positioning the country as the leading African hub for high-integrity carbon market investments while also promoting climate resilience and socioeconomic development. It provides a framework for carbon trading and climate finance to encourage climate financial mobilisation for zero- or low-carbon emission projects, thereby reducing emissions and motivating businesses to adopt sustainable practices and innovative technologies [52].

However, the granularisation of the carbon market to the sub-national level is lacking, especially in the Niger Delta region of the country, where it has the potential to support just energy transition and to solve other oil and gas-based related challenges (e.g. livelihood, insecurity and violent conflicts).

4.2 RELATED SUBNATIONAL CLIMATE CHANGE POLICY – DELTA, BAYELSA AND RIVERS STATES

4.2.1 DELTA STATE

The Delta State Climate Change Policy and Integrated Territorial Climate Change Plan were launched on 28 October 2013 by the Delta State Government, making the state the first subnational in Nigeria to have a climate change policy[53]. The policy, grounded in Nigeria's National Policy on Climate Change, aims to create an enabling environment for the formulation and implementation of environmental sustainability interventions, promoting sustainable socio-economic development.

The policy outlines the following key objectives:



The Delta State Ministry of Environment, in collaboration with other ministries, is responsible for operationalising the policy's implementation through the Integrated Territorial Climate Plan (ITCP). This plan serves as a roadmap for future climate-related activities, encompassing both greenhouse gas mitigation and adaptation strategies. The policy aims to promote the use of suitable carbon offset methodologies to finance afforestation projects. Specifically, the carbon offset finance through the REDD+ methodologies under the Clean Development Mechanism (CDM) is identified for damage prevention and restoration schemes in mangrove areas of the state.

In addition to the climate change policy, Clean Technology Hub and the Heinrich Böll Stiftung Foundation launched a Renewable Energy Policy Roadmap in August 2022 to improve access to climate-compatible energy for its residents, focusing on off-grid renewable energy technologies[54]. The policy roadmap will commit Delta State to addressing climate change challenges by fostering sustainable development and enhancing resilience. The policy document stresses intervention strategies and key sectors, namely agriculture, micro, small and medium enterprises (MSMEs), education, health, ICT and security, and transportation. The five-year (2023-2028) policy roadmap specifies targets and outlines measures for short-, medium-, and long-term implementation.

4.2.2 BAYELSA STATE

Bayelsa State is particularly endangered by environmental challenges induced by climate change in the form of rising temperatures, sea-level rise, and increased frequency of extreme weather events. The Government of Bayelsa State recognises the risks posed by climate variabilities to coastal communities, agriculture, and infrastructure. In this regard, the state conducted climate screening assessments for various projects, particularly in agriculture[55]. The assessments aimed to align projects with the National Climate Change Policy Response and Strategy, focusing on reducing greenhouse gas emissions and enhancing climate resilience. The assessment identified critical measures to reduce GHG emissions, with a carbon offset mechanism recommended for some of the assessed projects.

The Bayelsa State Government recently engaged with the National Council on Climate Change to craft collaborative opportunities towards ensuring a climate action plan[56]. While these initiatives demonstrate progress, it seems Bayelsa State lacks a formal climate change policy and action plan. Therefore, Bayelsa State must develop and implement a comprehensive Climate Change Policy and Action Plan. Such a policy and plan would provide a structured framework to address climate challenges, promote sustainable development, and protect the livelihoods of its residents.

4.2.3 RIVERS STATE

After the National Climate Change Act was enacted in 2021, Rivers State enacted the Rivers State Climate Change Law on 12 December 2022[57]. The Rivers State Climate Change law domesticated the National Climate Change Act 2021, with adjustments to capture Local Government Areas and state-specific issues, becoming the first subnational to domesticate the National Climate Change Act of 2021[58].

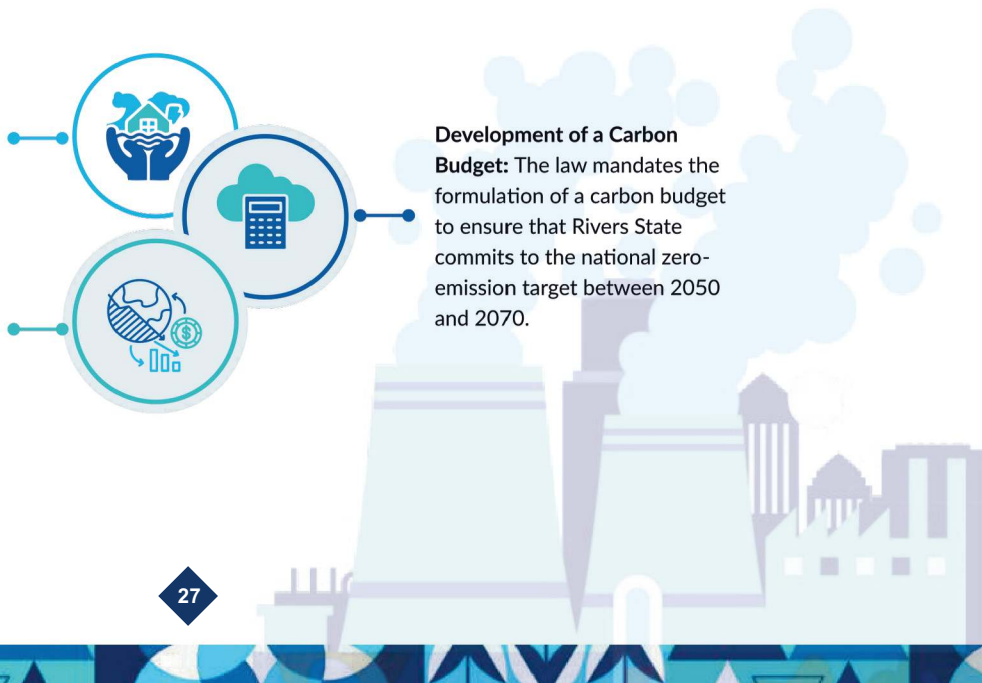
The key aspects of the law are as follows.

Establishment of a Climate Change

Secretariat: In alignment with the National Climate Change Act 2021, the Rivers State Climate Change law facilitates the creation of a secretariat to support the National Council on Climate Change.

Creation of a Climate Change Fund:

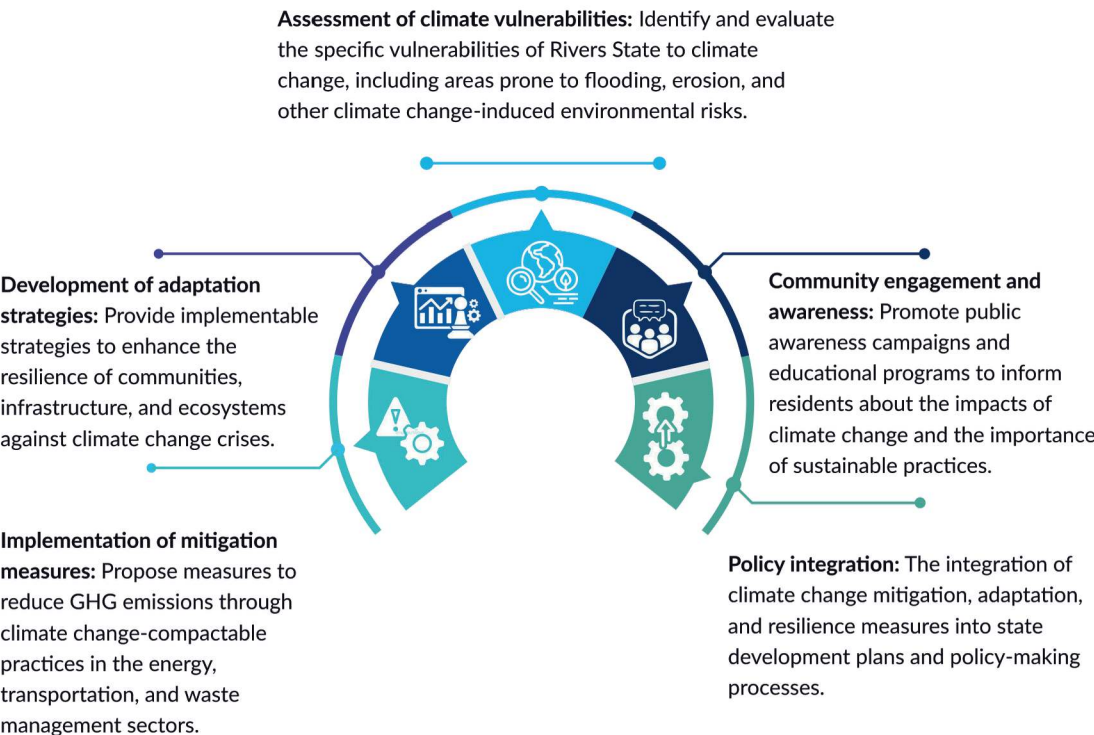
A dedicated fund is established to finance activities and initiatives that fulfil national climate change obligations.



Development of a Carbon Budget: The law mandates the formulation of a carbon budget to ensure that Rivers State commits to the national zero-emission target between 2050 and 2070.

The Rivers State Climate Change law highlights Rivers State's leadership in environmental stewardship and its dedication to addressing climate change through legally structured frameworks.

National Coalition on Gas Flaring and Oil Spills in the Niger Delta (NACGOND) developed a Climate Change Adaptation and Mitigation Plan for Rivers State[59]The plan presents strategies to address the unique environmental challenges faced by Rivers State, focusing on both the adaptation and mitigation aspects of climate change. The strategic plan spans five years and aims to effectively respond to climate change, reduce human-induced climate change factors, and help the state achieve a prosperous, low-carbon economy. The key objectives of the plan are as follows.



The plan emphasises the importance of a collaborative approach involving government agencies, non-governmental organisations, local communities, and other stakeholders in its implementation. However, it is unclear whether the Climate Change Adaptation and Mitigation Plan for Rivers State has been operationalised in the state.

4.3 CLIMATE CHANGE MITIGATION, CARBON MARKET AND CARBON OFFSET

The Paris Agreement stipulates a collective climate action to reduce greenhouse gases (GHGs) and keep global warming well below 2.0 °C above the pre-industrial period, with a goal of limiting it to 1.5 °C. To achieve GHG reduction, countries and organisations devise strategies and mechanisms to equitably and justly finance climate mitigation projects. One of the growing mechanisms is the carbon credit, which is traded in the carbon market. It is a critical mechanism in climate change mitigation, especially for developing low and medium-income countries (LMICs) like Nigeria, as a means to finance low-emission development projects[37].

The carbon market is growing rapidly, with the value of traded global carbon dioxide (CO₂) permits reaching a record high of \$948.75 billion in 2023, a 2% increase from 2022[58]. This growth is projected to continue, with an estimated value of \$967.73 billion in 2024, based on a linear growth rate. Africa's carbon market value is estimated at approximately 48.12 billion (approximately 2,400 mtCO₂e) in 2030[37], whereas the cumulative carbon market value of Nigeria by 2030 is estimated to be between 736 million and 2.5 billion[50], which corresponds to 87.2 to 124.7 mtCO₂e for removal or reduction projects. The carbon market mechanism is guided by two provisions in Article 6 of the Paris Agreement – Article 6.2 allows countries to bilaterally exchange mitigation outcomes (carbon reduction and carbon credit), and Article 6.4 provides high-quality carbon credits from approved projects through the Paris Agreement Crediting Mechanism (PACM)[60].

Globally, organisations are progressively deploying carbon credits in their mainstream plans – by avoidance of carbon dioxide equivalent (CO₂e) emissions or the removal of CO₂e from the atmosphere – to achieve net-zero emissions[37]. In this regard, efforts are intensifying to establish a robust and credible framework for generating and trading carbon credits. The idea behind carbon trading is to incentivise companies to emit less CO₂e and to encourage carbon projects such as clean cookstoves.

Carbon offsets are the instruments that supply carbon markets with tradable credits. Carbon offset is the reduction or removal of GHG emissions to compensate for emissions produced elsewhere. In this mechanism, entities purchase these credits to compensate for their emissions voluntarily or to comply with regulatory requirements. This system incentivises the development of projects that reduce GHG emissions, thereby contributing to global climate change mitigation efforts. The carbon credit from carbon offsets is supplied into the carbon market by two main channels[61]: regulatory compliance and voluntary programs. The regulatory compliance carbon markets are created by government legislatures at the national and sub-national levels or regional and international agreements, which include the Clean Development Mechanism (CDM) of the Kyoto Protocol, the Joint Implementation (JI) mechanism and the European Emissions Trading Scheme (or EU ETS). On the other hand, Voluntary Carbon Markets (VCM) are created by independent crediting mechanisms of non-governmental entities (e.g. Verified Carbon Standard and Gold Standard) that allow businesses and individuals to offset the emissions they create[62].

According to Nigeria's carbon market activation policy, the country's current carbon market is primarily driven by VCM projects focused on household and community, forestry, and other land-use and renewable energy initiatives. The policy aims to expand the VCM projects to include energy, agriculture, and industrial processes and product use. In addition, over the next two years, the policy stipulates that Nigeria will continue to actively participate in the VCM and work toward introducing a carbon tax, followed by a cap-and-trade system within the next five years. Project developers and Investors in Nigeria have taken advantage of the VCM, having registered a total of 57 projects valued at 5.8 mtCO₂e (with 2.7 mtCO₂e of credit retired and 3.1 mtCO₂e of credit remaining), as of December 2023. The projects focus mainly on the household and community sector (91% share of registered projects), followed by the renewable energy sector and the forest and other land use sector, with percentage contributions of 7% and approximately 2%, respectively. Proportionately, the household and community sector has the highest credits issued (at 98% of the total credit issued), followed by renewable energy at less than 2%[52].

However, the effectiveness of carbon offsets and markets depends on rigorous standards to ensure that the emission reductions are real, additional (i.e., the project is expected to reduce emissions below the business-as-usual level with CDM financing), and verifiable. Challenges such as the lack of regulatory frameworks and questionable credits have led to scrutiny and concerns over greenwashing. For instance, some carbon offset projects have been criticised for overstating their ability to sequester carbon, with some projects being shown to increase overall emissions[63].

4.4 CARBON OFFSET PROJECTS

4.4.1 TYPES OF CARBON OFFSET

The carbon offset project comes in the forms of avoidance or reduction offsets, removal offsets and community-based offsets. The avoidance offsets involve preventing emissions that would have otherwise occurred, such as transitioning from fossil fuels to renewable energy or improving energy efficiency and carbon capture technologies, while the removal offsets involve actively removing CO₂ from the atmosphere, typically through afforestation, reforestation, direct air capture, or soil carbon sequestration. In addition, the community-based offsets focus on projects that provide both environmental and social benefits, such as improved cookstove programs that reduce deforestation while improving public health[64].

4.4.2 CARBON OFFSET MECHANISM

Carbon offset projects are important in reducing GHGs and tackling the catastrophic global challenges associated with climate change. These carbon offset projects are framed, designed and implemented to reduce GHGs in one location by encouraging biodiversity, clean energy, and environmental sustainability while offsetting the carbon emissions in another area [65]. Carbon offset projects include afforestation, reforestation, renewable energy projects, zero or low-carbon energy systems, and agricultural carbon sequestration. These projects are integral to achieving a net-zero world that aligns with global climate goals.

AFFORESTATION AND REFORESTATION PROJECTS



Afforestation and reforestation projects, also known as forest carbon offset (FCO), are increasingly implemented globally as a strategic approach to GHG emissions removal. Forest carbon offsets have consistently been a significant nature-based mechanism for capturing carbon dioxide from the atmosphere and offering additional benefits of ecosystem services and functions, which include biodiversity and the conservation of soil and water[66]The prospect and potential of FCO projects are anchored on a well-designed and properly regulated carbon market.

In this regard, an increasing number of countries have provided frameworks to ensure high-quality offset standards and platforms. However, as the FCO projects progress, challenges and barriers have emerged, namely issues related to additionality, permanence, leakage, and monitoring, reporting, and verification (MRV).

Broadly, the challenges and barriers associated with FCO projects can be classified into methodological, socio-economic, and implementation. Carbon pricing, social, and opportunity costs fall under the socio-economic challenges, while leakage, monitoring, reporting, and verification (MRV) fall into the implementation challenges. The methodological challenges are mainly related to the heterogeneous frameworks (in the sense of additionality) and lack of explicitness in addressing cost-effectiveness. This remains the epicentre of the challenges facing FCO - no universal and straightforward high-quality approach for addressing them. However, it is important to advance a methodology that combines current knowledge with social justice, equity, and preservation of biodiversity in carbon projects and standards for effective and long-term carbon sinks[66]. Nigeria's Great Green Wall Initiative (GGWI) can be classified as a forest carbon offset because it aims to combat desertification while acting as a significant carbon sink. The GGWI can be featured in the voluntary carbon markets (VCM) to allow businesses and individuals to offset the emissions they create.

<https://ggwnigeria.gov.ng/>

RENEWABLE ENERGY



Renewable energy offers a key opportunity for carbon offsetting needed to actualise the net-zero world[67]. For example, electricity from renewable energy sources offers little to no direct emissions. This implies that replacing or substituting electricity from oil or natural gas plants with electricity from renewable energy will reduce CO₂ emissions per megawatt-hour (MWh)[68]. The Federal Government of Nigeria, through the Rural Electrification Agency, has introduced programs like Solar Power Naija, which focus on decreasing dependence on fossil fuels and encouraging clean energy alternatives[69].

AGRICULTURAL CARBON SEQUESTRATION



Sustainable and smart agricultural practices, such as agroforestry and conservation agriculture, play a critical role in carbon offsetting through carbon sequestration. Studies highlight that soil organic carbon storage in Africa has substantial potential for mitigating climate change[70]. In Nigeria, initiatives like climate-smart agriculture are being promoted to enhance carbon storage while improving food security [71]. Effective carbon offset strategies, such as sustainable and smart agriculture, are essential for balancing economic development with a climate-compatible environment.

4.4.3 EXISTING CARBON OFFSET PROJECTS IN NIGERIA

4.5 MODELLING DATA

Figures 9 through 11 present important data modelling data from the LEAP model. Figure 9 shows the energy demand of the three focused states in the Niger Delta region, with 2020 as the base year. In the base year, 310.23 PJ (Petajoules) of energy was consumed, with an average energy intensity of 21.45 GJ (Gegajoules) per capita, which translates to 881 PJ for the entire nine states of the Niger Delta region. The residential and building, agriculture and fishing, industry, transport and services, respectively, contributed to total energy consumption by 59.4%, 0.3%, 3.3%, 32.7% and 4.3%.

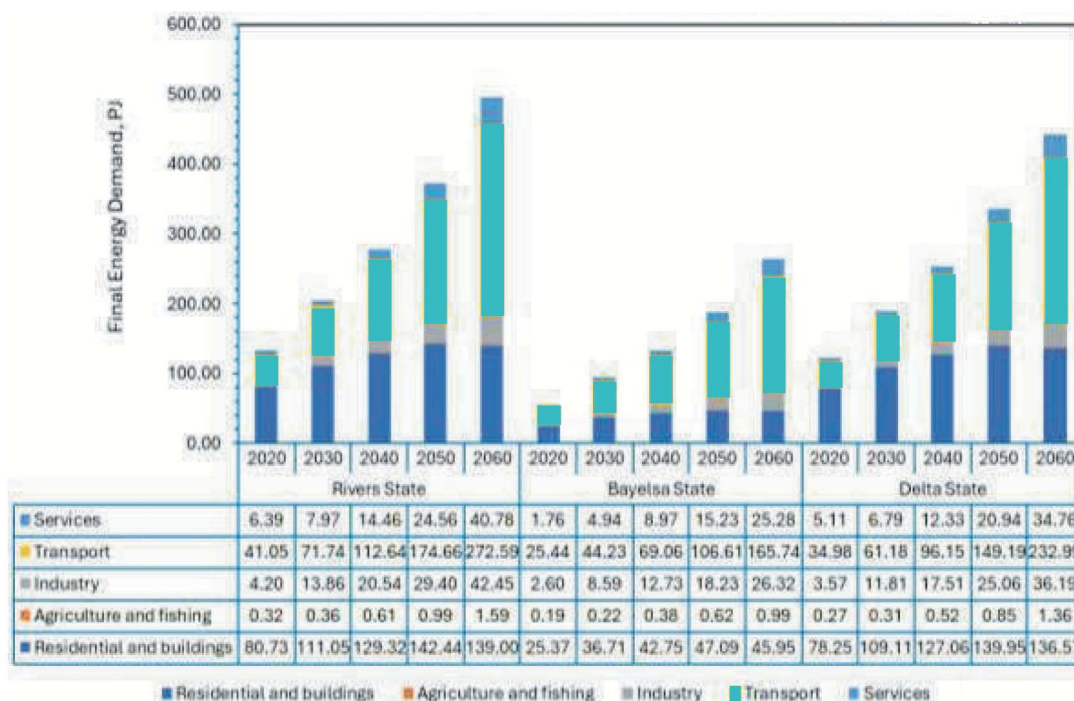


Figure 9. Final Energy Demand by Sectors

Figure 10 shows the contribution of various energy sources to the total energy consumption in 2020. From the figure, fuelwood alone contributes 57.9%, while fossil fuel (liquid, gas, and solid) contributes 36.3%. Electricity contributes 2.3%, while other biomass energy sources contribute 3.5%. The significant contribution of fuelwood can be attributed to the high demand for fuelwood to support inefficient firewood cookstoves for cooking and heating, as indicated in the high final energy consumption in the residential and building (see Figure 9). The significant consumption of firewood is a major contributor to deforestation. In addition, the transport sector's energy demand is met by fossil fuels, mainly liquid fuels, to power fossil-based internal combustion vehicles. With increasing population and economic growth, the energy demand of the transport sector will surpass the residential and building sector beyond 2030, contributing about 56% of the total energy demand by 2060.

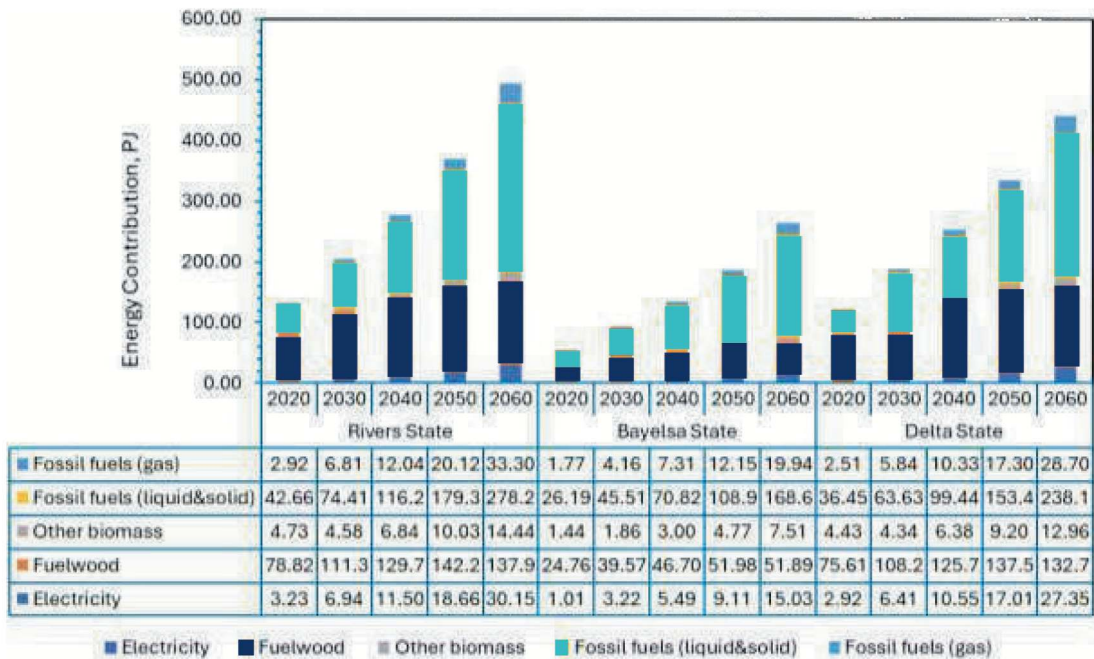


Figure 10. Energy Mix

Figure 11 presents the sectoral contribution to GHG emissions across the three states. In the base year (2020), 52.00 mtCO₂e (million metric tons) of GHG emissions were emitted, with an average GHG emission intensity of 3.59 tonCO₂e per capita, which translates to 147.7 mtCO₂e for the entire nine states of the Niger Delta region. According to the 2020 figures, the Agriculture, Forestry, and Other Land Use (AFOLU) sector contributed the highest to the total emissions at 26.8%. The emissions from the AFOLU are a result of the felling of trees to support the energy demand for cooking and heating by the residential and building sector and enteric fermentation. The oil and gas sector is the second highest emission contributor at 26.1%. The emissions from the oil and gas sector can be attributed to fugitive emissions from oil and gas exploration.

The power sector contributed 19.7% to the total emissions, which is attributed mainly to off-grid power generation through petrol and diesel-generating sets. The transport sector contributed 13.8%, which can be attributed to the use of fossil-based vehicles. The residential and building, industry processes and product use (IPPU) and waste contributed 4.0%, 2.5% and 6.9%, respectively. The emissions from the residential and building sector are attributed to the use of gas for cooking and heating, which do not include the emission from burning of firewood because it has been accounted for in the AFOLU sector. Without any significant climate change mitigation measures, it is expected that the nine states in the Niger Delta region total emission will rise to 379.8 mtCO₂e by 2060, which is 156% (3.9% annual growth rate) increase relative to 2020 emissions.

At 35.6%, the transport sector will contribute the most to the total emissions by 2060 due to an increase in transport demand to drive the expected economic population growth.

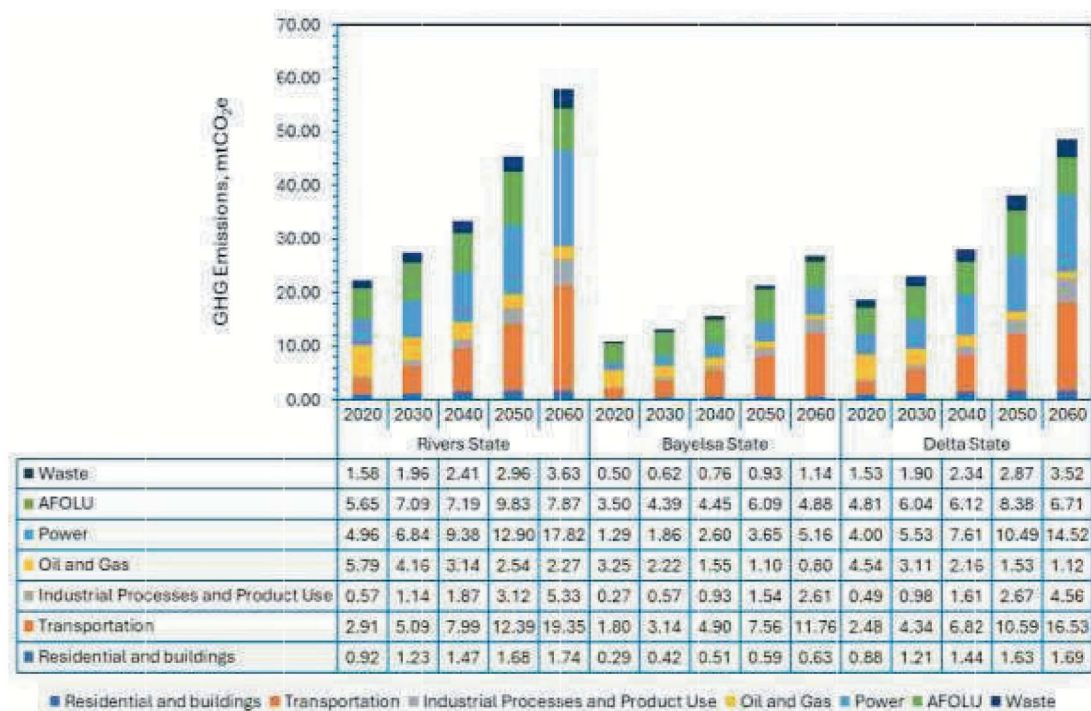


Figure 11. GHG Emissions by Sector

4.6 GIS-BASED DEFORESTATION DATA

The deforestation trends observed across the Niger Delta states from 2021 to 2022 indicate significant variations in forest loss dynamics, with some states experiencing rapid increases while others show more stable or even declining rates, as indicated in Table 2. Overall, the region witnessed an increase in deforestation, with total forest loss rising from 1,890,000 hectares in 2021 to 2,440,000 hectares in 2022. This represents a total forest loss percentage increase from 16.85% to 21.79%, translating to an alarming 29.10% rise in the rate of deforestation. These figures underscore the growing threat to forest ecosystems in the region, highlighting the urgent need for stronger conservation and management strategies. The significant rise in the deforestation rate can be partly attributed to the need to meet the energy demand for cooking and heating by the residential and building sector, which corroborates the data presented in Figure 10.

The situation in Rivers and Bayelsa states is particularly concerning, as both states experienced some of the highest rates of change in forest loss. Rivers saw its deforestation rate jump from 5.52% in 2021 to 16.09% in 2022, marking a dramatic 190.25% increase, while Bayelsa's forest loss surged by an even more striking 208.68%. These increases suggest a surge in land-use change activities, possibly linked to fuel wood for cooking, urbanization, oil exploration, and illegal logging. Delta state also experienced notable increases in forest loss from 9.56% to 15.51%. These trends highlight the persistence of deforestation pressures, potentially driven by oil and gas activities, wood for energy, urbanisation, logging, agricultural expansion, or infrastructure development.

The observation is not different in other states in the Niger Delta region. Edo State exhibited the highest percentage of forest loss in both years, increasing from 29.74% in 2021 to 37.81% in 2022. This sharp increase of 27.15% suggests heightened deforestation activities, potentially driven by logging, agricultural expansion, or infrastructure development. Similarly, Akwa Ibom recorded a significant increase in deforestation, rising from 14.83% to 22.45%, indicating a substantial acceleration of forest degradation. In addition, Abia state's percentage rise in deforestation is from 19.78% to 20.91%. Ondo, despite having a high deforestation percentage, showed a more moderate increase of 3.95%, suggesting a relatively stable but continuous forest loss trend.

Table 2. Deforestation Rate of Change from 2021 to 2022

STATES	TOTAL FOREST AREA (2000) (HA)	FOREST LOSS 2021 (HA)	PERCENTAGE FOREST LOSS 2021 (%)	FOREST LOSS 2022 (HA)	PERCENTAGE FOREST LOSS 2022 (%)	RATE OF CHANGE IN FOREST LOSS (%)
Abia	460,000	91,000	19.78%	96,200	20.91%	+5.71%
Bayelsa	932,000	21,900	2.35%	67,600	7.25%	+208.68%
Ondo	1,430,000	228,000	15.94%	237,000	16.57%	+3.95%
Rivers	798,000	44,100	5.52%	128,000	16.09%	+190.25%
Akwa Ibom	646,000	95,800	14.83%	145,000	22.45%	+51.36%
Cross River	2,030,000	362,000	17.83%	302,000	14.88%	-16.57%
Delta	1,580,000	151,000	9.56%	245,000	15.51%	+62.25%
Edo	1,920,000	571,000	29.74%	726,000	37.81%	+27.15%
Imo	518,000	65,100	12.57%	64,700	12.49%	-0.61%
Total	11,200,000	1,890,000	16.85%	2,440,000	21.79%	+29.10%

4.7 COMMUNITY ENGAGEMENT

Three focus groups were held in three communities across the three focal states in the Niger Delta – Oshoki (Rivers), Ogbolomabiri (Bayelsa) and Omavovwe (Delta), see Figure 12 for the group photograph in each of the communities. The communities overwhelmingly showed interest in participating in carbon offset projects provided that the carbon offset projects will improve their livelihood and environmental sustainability. However, they have a low awareness of carbon offset projects, which indicates a strategic opportunity for governments and partners to build community engagement through education and participatory planning. Appendix A shows the picture gallery of the community engagement through focus group discussion and questionnaire administration. The appendix shows some core energy and livelihood activities in the community, including carbon offset-aligned projects.

A recurring concern expressed among surveyed residents is the destruction of livelihood and pollution by the oil and gas production communities. The residents highlighted through indigenous knowledge that climate change has negatively impacted livelihood, especially farming, and heightened the prevalence of mosquitoes and other diseases originally strange to the communities. Many community members expressed distrust in oil and gas companies and local leadership, claiming that funds were often diverted for personal use. As a result, they would prefer that companies and organisations implement projects directly instead of channeling resources through local chiefs and youth leaders. They believed this approach would ensure that the projects are initiated and completed and that the benefits reach the intended recipients/beneficiaries. Despite these challenges, the community remains open to new initiatives that would improve their wellbeing. However, respondents emphasised the need for adequate sensitisation on such initiatives to ensure that residents understand the purpose of each project and how they could actively participate.

The focus group discussions highlighted oil and gas companies as a significant contributor to environmental degradation, including climate change, in the Niger Delta region. In addition, the communities pointed out the inequalities and injustices resulting from oil and gas activities, which have exacerbated insecurity and conflicts in the area. Table 3 presents a critical analysis of the inequalities and injustices produced by the oil and gas industry throughout its history.

Table 3. Inequality and injustice produced by the oil and gas industry

S/NO	INEQUALITY / INJUSTICE	TYPE	POLITICAL RELEVANCE	EVIDENCE
1	Crude Oil spillage	Environmental, economic (destroy sources of livelihoods)	High	High
2	Adverse health impact due to gas flaring	Health, social and environmental	High	Medium
3	Resource curse, i.e., multidimensional poverty in the midst of abundant national oil wealth	Economic	High	High
4	Land dispossession without consent	Social, Political	High	Medium
5	Resource control tussle	Political; Economic; Social	High	Medium
6	Insufficient local content (employment, underemployment and contracts)	Economic	High	High
7	Insecurity (increased crime and militancy)	social and political, others	High	High
8	Wealth Concentration	Economic	High	High
9	Loss of livelihoods (fishing and farming)	Economic	High	High
10	Lack of Compensation and Justice	Economic, social	High	Medium
11	Limited access to social amenities (confusion on who to provide social amenities – government says companies and vice versa)	Social	High	High



(a) Oshoki community in Ahoada West LGA, Rivers State



(b) Ogbolomabiri community in Nember LGA, Bayelsa State



(c) Omavovwe community in Ughelli North, Delta State

Figure 12. Sampled communities for focus group discussion

The study sampled a total of eight Local Government Areas (LGAs) across three States in the Niger Delta region—Bayelsa, Delta, and Rivers (Table 4). In Bayelsa State, data were collected from three LGAs: Nembe and Ogbia each accounted for 13.8% of the total sample, while Sagbama contributed 11.5%. Delta State had the highest representation, with Ndokwa West emerging as the most sampled LGA at 18.6%. Warri South followed with 11.9%, and Ughelli North had a smaller share of 8.2%. In Rivers State, Gokana constituted a significant portion at 15.2%, while Ahoada West had the lowest representation among all sampled LGAs, making up just 7.1% of the total.

Table 4. State and LGAs for the study

STATES/LGA				COUNT	%
State	Bayelsa	LGA	Nembe	37	13.8%
			Ogbia	37	13.8%
			Sagbama	31	11.5%
	Delta	LGA	Ndokwa West	50	18.6%
			Ughelli North	22	8.2%
			Warri South	32	11.9%
	Rivers	LGA	Ahoada West	19	7.1%
			Gokana	41	15.2%

GENDER OF RESPONDENTS



The gender distribution of respondents across the three States reveals a generally higher participation of males than females (see Table 5). In Bayelsa State, males accounted for 57.1% of the respondents, while females made up 42.9%. A similar pattern was observed in Delta State, where males comprised 56.7% and females 43.3% of the sample. However, in Rivers State, there are male respondents 78.3%, compared to 21.7% female respondents.

Table 5. Gender distribution

STATES/LGA		FEMALE		MALE	
		Count	%	Count	%
	Bayelsa	45	42.9%	60	57.1%
	Delta	45	43.3%	59	56.7%
	Rivers	13	21.7%	47	78.3%

RESPONDENT'S MAXIMUM EDUCATION LEVEL



The educational attainment of respondents varied across the three States, with the majority holding secondary school qualifications, as shown in Table 6. In Bayelsa State, 45.3% of respondents completed SSCE, followed by 26.4% with a BSc, and 15.1% with a First School Leaving Certificate.

A smaller proportion held higher degrees, with 1.9% having an MSc and 0.9% a PhD, while 10.4% had no formal education. Delta State showed a similar trend, with 50.5% of respondents having SSCE qualifications, followed by 18.4% with a First School Leaving Certificate, and 13.6% with no formal education. Only 12.6% had a BSc, while MSc and PhD holders constituted 3.9% and 1.0%, respectively. In Rivers State, the dominance of SSCE holders was more pronounced, accounting for 56.7% of respondents. BSC holders made up 21.7%, while 15% had only a First School Leaving Certificate. A minimal proportion had postgraduate qualifications, with 3.3% holding an MSc, none with a PhD and the remaining respondents reported having no formal education.

Table 6. Educational distribution

HIGHEST EDUCATIONAL ATTAINMENT		BAYELSA	DELTA	RIVERS
No Formal Education	Count	11	14	2
	%	10.40%	13.60%	3.30%
First School Leaving Certificate	Count	16	19	9
	%	15.10%	18.40%	15.00%

SSCE	Count	48	52	34
	%	45.30%	50.50%	56.70%
BSC	Count	28	13	13
	%	26.40%	12.60%	21.70%
MSC	Count	2	4	2
	%	1.90%	3.90%	3.30%
PhD	Count	1	1	0
	%	0.90%	1.00%	0.00%

EMPLOYMENT STATUS



The employment status of respondents across the three states reveals a higher rate of unemployment in all locations, with some variation in magnitude (see Table 7). In Bayelsa State, 29.5% of the respondents reported being employed. Similarly, Delta State recorded an unemployment rate of 67.3%. While still showing a higher proportion of unemployed individuals, Rivers State had a relatively better employment outlook than the other States. Here, 41.7% of respondents were employed.

Table 7. Employment status in Niger Delta

STATES		EMPLOYED		UNEMPLOYED	
		Count	%	Count	%
	Bayelsa	31	29.5%	74	70.5%
	Delta	34	32.7%	70	67.3%
	Rivers	25	41.7%	35	58.3%

AGE OF RESPONDENTS ACROSS STATES

In Bayelsa, respondents' ages ranged from 21 to 71, with a mean age of 40.64 and a standard deviation of 11.57, as shown in Figure 13. This indicates a moderate spread around the average.

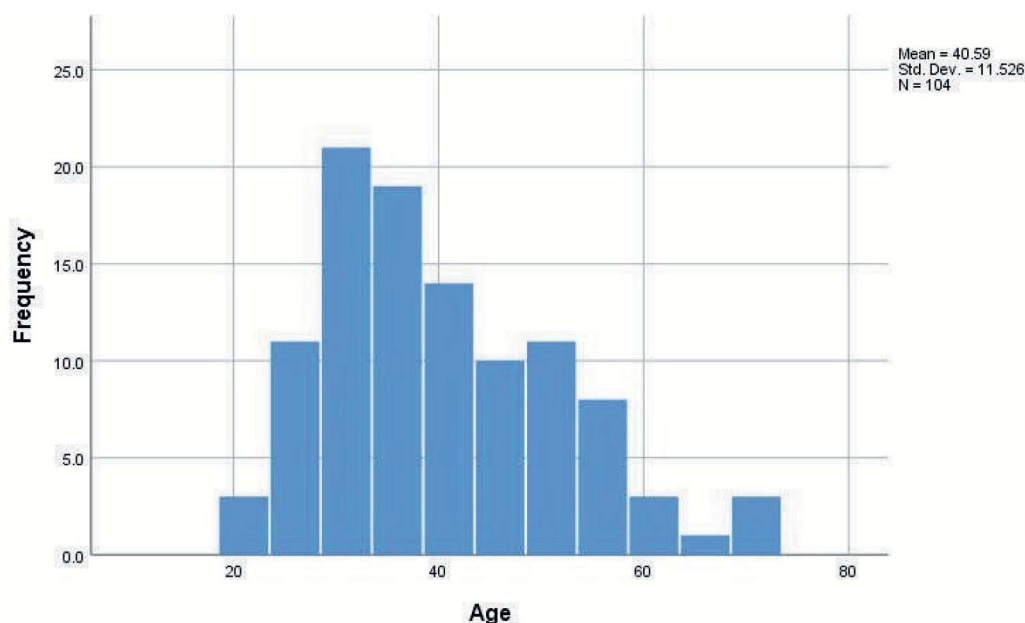


Figure 13. Age of respondents in Bayelsa State

Delta State recorded a slightly broader age range from 15 to 95 years and a mean age of 40.98 years with a higher standard deviation of 14.63, as indicated in Figure 14, suggesting more variability in age among respondents.

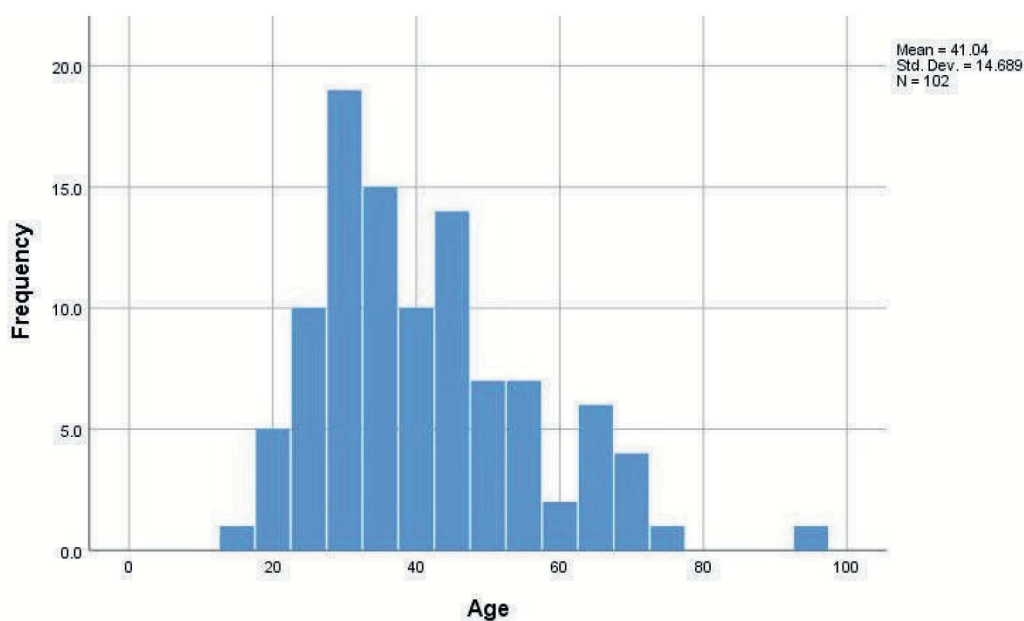


Figure 14. Age of respondents in Delta State

Rivers State had participants aged between 21 and 78, with the highest mean age of 42.32 and a standard deviation of 12.76 (see Figure 15).

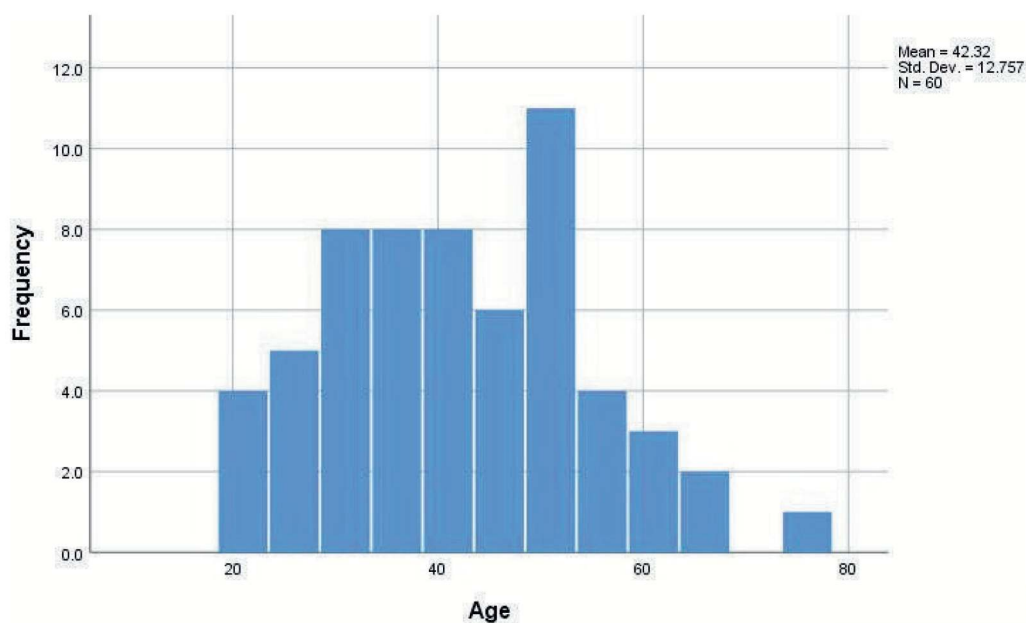


Figure 15. Age of Respondents in Rivers

Key economic activities

The key economic activities among respondents varied across the three States, with farming emerging as the most prominent source of livelihood, as indicated in Table 8. In Bayelsa, 12.6% of respondents were engaged in farming, followed by 9.3% involved in fishing, and 7.1% in petty business. A smaller proportion were engaged in combined farming and fishing (5.2%), while other occupations like civil service (2.2%), artisan work (1.1%), and transportation with motorbike and tricycle (0.7%) had lower frequency. In addition, sharp-sand mining (induced by urbanisation) activities are present across the states, causing

serious environmental damage, namely the destruction of mangroves and environmental mismanagement (see the Appendix). In Delta State, farming was also the most common economic activity, at 14.9%, followed by business at 10.4% and fishing at 6.7%. About 5.9% of respondents were involved in both farming and fishing, while artisan and other sectors such as civil service and transportation occurred less frequently. In Rivers State, business was the most reported economic activity at 8.6%, followed by farming at 4.8% and farming and fishing at 3.0%. None of the respondents were engaged in fishing alone. Artisan work (3.0%), civil service (1.9%), and transportation (1.1%) were also represented to a limited extent.

Table 8. Key economic activities

KEY ECONOMIC ACTIVITIES		BAYELSA	DELTA	RIVERS
Artisan	Count	3	1	8
	%	1.10%	0.40%	3.00%
Business	Count	19	28	23
	%	7.10%	10.40%	8.60%
Civil Servant	Count	6	0	5
	%	2.20%	0.00%	1.90%
Fishing	Count	25	18	0
	%	9.30%	6.70%	0.00%
Farming	Count	34	40	13
	%	12.60%	14.90%	4.80%
Farming and Fishing	Count	14	16	8
	%	5.20%	5.90%	3.00%
Nursing	Count	1	0	0
	%	0.40%	0.00%	0.00%
Pensioner	Count	2	0	0
	%	0.70%	0.00%	0.00%
Transportation	Count	2	0	3
	%	0.70%	0.00%	1.10%

FAMILIARITY WITH CARBON OFFSET PROJECTS IN THE COMMUNITY

Respondents' familiarity with carbon offset projects varied across the three States, with a general trend indicating limited awareness, as indicated in Table 9. In Bayelsa, a significant majority of respondents (66.0%) reported not being familiar with any carbon offset projects within their communities, while only 34.0% indicated some level of awareness. However, there was some presence of carbon offset-aligned projects across the states, like solar-powered potable water systems and solar clean energy (see the Appendix). In Delta State, the pattern was similar, although slightly more favourable, with 57.3% of respondents unfamiliar with such projects and 42.7% expressing familiarity. Rivers State had the highest level of awareness among the three, with 45.0% of respondents acknowledging familiarity with carbon offset projects. However, upon discussion with the focus groups, the majority are not aware of the carbon credit market because it appears they view all climate change mitigation measures as carbon offset projects.

Table 9. Familiarity with carbon offset projects

STATES	NO		YES	
	Count	%	Count	%
Bayelsa	70	66.00%	36	34.00%
Delta	59	57.30%	44	42.70%
Rivers	33	55.00%	27	45.00%

KNOWLEDGE OF CARBON OFFSET PROJECTS

Respondents' knowledge of carbon offset projects revealed varied levels of understanding across the three States, with the majority demonstrating only limited or fragmented awareness of specific project types (see Table 10). In Bayelsa, a small number of respondents identified projects related to natural carbon reduction (2.6%), pollution control (1.9%), solar energy (2.2%), environmental protection (1.1%), and awareness and education (1.1%). About 3% reported only vague or general knowledge. In Delta, the most recognised category was solar energy projects, mentioned by 9.3% of respondents. Other project types, such as environmental protection (1.5%), technical carbon reduction (0.7%), community development (0.7%), and general knowledge (1.9%), were acknowledged to a much lesser extent. No respondents in Delta indicated familiarity with pollution control, awareness and education, or natural carbon reduction projects. Rivers State reflected slightly broader recognition, with 3.0% identifying natural carbon reduction projects, 2.2% noting environmental protection efforts, and 1.5% pointing to community development initiatives. A few respondents also cited vague/general knowledge (1.1%), awareness and education (0.4%), pollution control (0.4%), regulatory approaches (0.4%), and solar energy (0.4%).

Table 10. Distribution of knowledge of carbon offset projects

CARBON OFFSET PROJECTS		BAYELSA	DELTA	RIVERS
Awareness and Education Projects	Count	3	0	1
	%	1.10%	0.00%	0.40%
Community Development Projects	Count	0	2	4
	%	0.00%	0.70%	1.50%
Environmental Protection Projects	Count	3	4	6
	%	1.10%	1.50%	2.20%
Vague/General Knowledge	Count	9	5	3
	%	3.30%	1.90%	1.10%
Project Implementation Projects	Count	0	0	0
	%	0.00%	0.00%	0.00%
Natural Carbon Reduction Projects	Count	7	0	8
	%	2.60%	0.00%	3.00%
Pollution Control Projects	Count	5	0	1
	%	1.90%	0.00%	0.40%
Regulatory Approaches	Count	0	0	1
	%	0.00%	0.00%	0.40%
Solar Energy Projects	Count	6	25	1
	%	2.20%	9.30%	0.40%
Technical Carbon Reduction Projects	Count	0	2	0
	%	0.00%	0.70%	0.00%

PERCEIVED ENVIRONMENTAL CHALLENGES FACED BY THE COMMUNITY

Respondents across the three States identified a range of environmental challenges affecting their communities, with notable variations in perceptions by location, as indicated in Table 11. In Bayelsa, water scarcity emerged as the most prominent issue, acknowledged by 54.7% of respondents. This was followed by climate change impacts (42.4%), deforestation (41.3%), and waste management (39.6%). Soil degradation (34.9%) and air pollution (37.3%) were also cited as considerable concerns. In Delta, Waste management (51.4%) was perceived as one of the most significant environmental challenges (see the Appendix for waste management challenge). Air pollution was identified by 42.0% of respondents, and soil degradation (36.4%) was also a major concern, while climate change impacts (34.9%) and deforestation (35.5%) featured prominently. Water scarcity, although notable, was less of a concern in Delta compared to

Bayelsa, reported by 35.1% of participants. In contrast, respondents from Rivers State reported generally lower levels of concern across all categories. Air pollution (20.7%), climate change impacts (22.7%), and deforestation (23.2%) were perceived as moderate challenges. Soil degradation was identified by 28.7%, while waste management (9.0%) and water scarcity (10.1%) were less frequently reported.

Table 11. Perceived environmental concerns

ENVIRONMENTAL CHALLENGES		BAYELSA	DELTA	RIVERS
Deforestation	Count	64	55	36
	%	41.30%	35.50%	23.20%
Soil degradation	Count	45	47	37
	%	34.90%	36.40%	28.70%
Water scarcity	Count	81	52	15
	%	54.70%	35.10%	10.10%
Waste management	Count	57	74	13
	%	39.60%	51.40%	9.00%
Climate Change Impacts	Count	73	60	39
	%	42.40%	34.90%	22.70%
Air pollution	Count	72	81	40
	%	37.30%	42.00%	20.70%

INTEREST IN CARBON OFFSET PROJECT PARTICIPATION

Across the three States surveyed, there was an overwhelmingly positive response towards participation in carbon offset projects (see Table 12). In Bayelsa, 98.1% of respondents expressed interest in being part of such initiatives. A similar trend was observed in Delta, where 98.1% were also willing to participate. Rivers State followed closely, with 98.3% of respondents showing interest. These reflect a strong collective willingness among community members to engage in environmental initiatives, suggesting a fertile ground for future awareness, education, and implementation of carbon offset programs in the region.

Table. 12. Distribution of interest in participation

STATES	NO		YES	
	Count	%	Count	%
Bayelsa	2	1.90%	104	98.10%
Delta	2	1.90%	101	98.10%
Rivers	1	1.70%	59	98.30%

TYPE OF CARBON OFFSET PARTICIPATION

The respondents in the three States showed varying preferences for types of participation in carbon offset projects (see Table 13). In Bayelsa, tree planting and reforestation emerged as the most popular choice, with 40.1% of respondents expressing interest. This was closely followed by renewable energy projects, which garnered interest of 38.6%, and sustainable agriculture at 34.3%. Clean cooking solutions and waste management and recycling also attracted significant support, with 36% and 43.9% opting for these projects, respectively. Conservation and biodiversity protection received interest from 43.1% of respondents in Bayelsa. In Delta, sustainable agriculture was the leading preference, with 45% of respondents showing interest, while renewable energy (43.1%) and clean cooking solutions (42.7%) were also favoured. Tree planting and reforestation attracted 34% of the respondents. Waste management and recycling projects were equally appealing, with 43.9% selecting them, and conservation & biodiversity protection had 30.8% of support. Rivers saw renewable energy as the least favoured option, with only 18.3% showing interest.

Tree planting and reforestation (25.9%) and clean cooking solutions (21.3%) also had relatively lower support. Sustainable agriculture (20.7%) and waste management and recycling (12.2%) were among the least preferred in the State. However, conservation and biodiversity protection gained significant attention, with 26.2% of respondents in Rivers supporting these initiatives.

Table 13. Distribution of carbon offset projects

CARBON OFFSET PROJECTS		BAYELSA	DELTA	RIVERS
Tree Planting and Reforestation	Count	59	50	38
	%	40.10%	34.00%	25.90%
Sustainable Agriculture	Count	58	76	35
	%	34.30%	45.00%	20.70%
Renewable energy	Count	76	85	36
	%	38.60%	43.10%	18.30%
Clean cooking solutions	Count	64	76	38
	%	36.00%	42.70%	21.30%
Waste management & recycling	Count	54	54	15
	%	43.90%	43.90%	12.20%
Conservation & biodiversity protection	Count	28	20	17
	%	43.10%	30.80%	26.20%

PERCEIVED EXPECTED BENEFITS FROM CARBON OFFSET PROJECTS

The perceived expected benefits from carbon offset projects varied across the three States, as indicated in Table 14. In Bayelsa, job creation and income generation were the most anticipated benefits, with 37.8% of respondents expressing this expectation. Training and skills development followed closely at 39.2%, highlighting a strong desire for capacity-building opportunities. Improved natural resources, such as soil, water, and air, were expected by 34% of respondents, and better health outcomes, including cleaner air and improved cooking practices, were anticipated by 41.6%. Energy access, particularly through solar power and clean stoves, was also expected by 37.8% of respondents in Bayelsa. In Delta, job creation and income generation were similarly a top priority, with 38.2% of respondents selecting these benefits. Training and skills development were also highly valued, with 41% of respondents expressing interest. The benefit of improved natural resources was significant, with 47.9% of respondents expecting positive environmental outcomes. Better health outcomes were expected by 33.8%, while energy access was anticipated by 42.7% of respondents. Respondents in Rivers State showed a slightly different set of priorities. Job creation and income generation were still key benefits expected by 24.1% of respondents. Training and skills development were anticipated by 19.8%, and improved natural resources were expected by 18.1%. Better health outcomes, including cleaner air and better cooking practices, were anticipated by 24.7%, while energy access was expected by 19.6%.

Table 14. Distribution of anticipated carbon offset projects

BENEFITS		BAYELSA	DELTA	RIVERS
Job creation and income generation	Count	91	92	58
	%	37.80%	38.20%	24.10%
Training and skills development	Count	83	87	42
	%	39.20%	41.00%	19.80%
Improved natural resources (e.g., soil, water, air)	Count	49	69	26
	%	34.00%	47.90%	18.10%
Better health outcomes (e.g., clean air, improved cooking practices)	Count	64	52	38

	%	41.60%	33.80%	24.70%
Energy access (e.g., solar power, clean stoves)	Count	54	61	28
	%	37.80%	42.70%	19.60%

PERCEIVED EXISTENCE OF COMMUNITY INITIATIVE IN ALIGNMENT WITH CARBON OFFSET PROJECTS

The perceived existence of community initiatives aligned with carbon offset projects varied across the three States, as indicated in Table 15. In Bayelsa, 32.1% of respondents indicated they were unsure whether such initiatives existed, while 40.6% stated that they did not believe such initiatives were in place. However, 27.4% of respondents confirmed the presence of community initiatives aligned with carbon offset projects. In Delta, 23.3% of respondents were unaware of such initiatives, and 38.8% believed that no such initiatives existed. On the other hand, 37.9% of respondents recognised that community initiatives in alignment with carbon offset projects were present in their communities (see the Appendix). In Rivers, a more significant portion of respondents, 50%, were uncertain about the existence of such initiatives. Only 23.3% of respondents reported that no such initiatives were present, while 26.7% acknowledged the existence of community initiatives aligned with carbon offset projects. These suggest that while a significant portion of respondents in each State are unsure about the existence of community initiatives related to carbon offset projects, a notable proportion also recognises the presence of such initiatives, with varying levels of awareness across the States.

Table 15. Perceived existence of community interventions aligned with carbon offset

STATES	I DON'T KNOW		NO		YES	
	Count	%	Count	%	Count	%
Bayelsa	34	32.10%	43	40.60%	29	27.40%
Delta	24	23.30%	40	38.80%	39	37.90%
Rivers	30	50.00%	14	23.30%	16	26.70%

EXISTING COMMUNITY INITIATIVES IN ALIGNMENT WITH CARBON OFFSET PROJECTS

Among the people who indicated that they know of existing carbon offset projects, they were asked to identify which categories are the initiatives (see Table 16). In Bayelsa, solar streetlights were the most common, reported by about 58% of the respondents. Oil cleanup was reported by about 26% of the respondents, followed by policy and regulation (11%) and tree planting (5%). In Delta, solar streetlights were the most common initiative (44%) (see the Appendix). This is followed by solar pumping machines and streetlights (38%). About 9% identified solar pumping machines and policy and regulation as initiatives existing in their communities in alignment with carbon offsetting. In Rivers, oil cleanup initiatives were the most common initiatives identified (42%). This is followed by solar streetlight (25%) and tree planting (25%). A small number of respondents (8%) mentioned solar pumping machines as an existing carbon offset initiative.

Table 16. Existence of community interventions aligned with carbon offset

COMMUNITY INITIATIVES	BAYELSA	DELTA	RIVERS
Oil Cleanup	26.3%	0.0%	41.7%
Policy and regulations	10.5%	8.8%	0.0%
Solar pumping machine	0.0%	8.8%	8.3%
Solar water pumping and streetlights	0.0%	38.2%	0.0%
Solar streetlights	57.9%	44.1%	25.0%
Tree planting	5.3%	0.0%	25.0%

PERCEIVED CHALLENGES PREVENTING COMMUNITY PARTICIPATION

The perceived challenges preventing community participation in carbon offset projects differ across the three States, as indicated in Figure 17. In Bayelsa, the challenges cited were the lack of awareness or information (39.5%), financial or economic constraints (37.5%) and land ownership or access issues (45.6%). In Delta, the challenges highlighted include lack of awareness or information (39.0% of respondents, financial or economic constraints (42.0%), and government policies or regulations (39.0%). Others are Land ownership or access issues (36.0%) and cultural or social concerns (23.7%). In Rivers, the challenges included the lack of awareness or information (21.4%) and government policies or regulations (31.2%). Others are financial or economic constraints (20.5%), land ownership or access issues (18.4%), and cultural or social concerns (22.0%). In summary, the primary perceived barriers to community participation in carbon offset projects in the Niger Delta region have been identified as a lack of awareness or information, along with financial or economic constraints. These factors have been consistently ranked as the most significant impediments to community participation in the Niger Delta region.

Table 17. Distribution of perceived challenge to prevent community participation

CHALLENGES		BAYELSA	DELTA	RIVERS
Lack of awareness or information	Count	83	82	45
	%	39.50%	39.00%	21.40%
Land ownership or access issues	Count	57	45	23
	N %	45.60%	36.00%	18.40%
Financial or economic constraints	Count	75	84	41
	%	37.50%	42.00%	20.50%
Cultural or social concerns	Count	32	14	13
	%	54.20%	23.70%	22.00%
Government policies or regulations	Count	23	30	24
	%	29.90%	39.00%	31.20%

PERCEIVED SUPPORT NEEDED FOR COMMUNITY PARTICIPATION IN CARBON OFFSET PROJECTS

The perceived support needed for community participation in carbon offset projects varies across the three States, as indicated in Table 18. In Bayelsa, funding and financial incentives (39.9%) were reported most frequently, followed by Training and capacity building (37.4%) of respondents and then technical support and equipment (36.9%). In Delta, funding and financial incentives were similarly a major need, reported by 38.7% of respondents. Training and capacity building (41.1%) and technical support and equipment (41.9%) were also considered important, with policy and legal support mentioned by 33.8% of respondents. In Rivers, funding and financial incentives were seen as the most important support, needed by 21.4% of respondents, while training and capacity building (21.5%) and technical support and equipment (21.3%) were also identified. The need for community mobilisation and awareness programs was expressed by at least 30.0% of respondents.

Table 18. Distribution of perceived support to mobilise community participation

PERCEIVED SUPPORT		BAYELSA	DELTA	RIVERS
Funding & financial incentives	Count	99	96	53
	%	39.90%	38.70%	21.40%
Training & capacity building	Count	80	88	46
	%	37.40%	41.10%	21.50%
Technical support & equipment	Count	59	67	34
	%	36.90%	41.90%	21.30%
Policy & legal support	Count	31	23	14
	%	45.60%	33.80%	20.60%
Community mobilisation & awareness programs	Count	42	42	36
	%	35.00%	35.00%	30.00%

OPENNESS OF THE COMMUNITY TO CARBON OFFSET PROJECT DISCUSSIONS OR WORKSHOPS

The openness of the community to carbon offset project discussions or workshops is high across the three States, as indicated in Table 19. In Bayelsa, 98.1% of respondents expressed openness to such discussions, while only 1.9% were not open to them. Similarly, in Delta, all the respondents indicated their willingness to engage in carbon offset project discussions or workshops. In Rivers, 98.3% of respondents were open to participating, with just 1.7% not expressing interest.

Table 19. Community preference to discussion or workshop on carbon offset projects

STATES	NO		YES	
	Count	%	Count	%
Bayelsa	2	1.90%	104	98.10%
Delta	0	0.00%	103	100.00%
Rivers	1	1.70%	59	98.30%

In the survey conducted among companies, approximately 3% of the invited respondents participated, which may be attributed to bureaucratic processes and limited time. The responses indicated a well-established understanding of climate change and the critical role of carbon offsetting in mitigating its effects. Also, the respondents reported that their organisations have initiated measures to reduce emissions, particularly through enhancements in energy efficiency, energy management, and the mitigation of methane leaks.

4.8 EXISTING CARBON OFFSET PROJECTS

The identified registered carbon offset projects directly located in the Niger Delta region under the CDM are the Afam Combined Cycle Gas Turbine Power Project with a reduction capacity of about 0.6 mtCO₂e per annum and the Pan Ocean Gas Utilization Project with a reduction capacity of about 2.6 mtCO₂e per annum. However, there are existing projects with the Niger Delta that could be aligned to carbon offset projects, name solar water system, solar street lights and renewable energy based hybrid off-grid electrification.

Sourced from <https://cdm.unfccc.int/Projects/projsearch.html>



5.0 SYNTHESIS OF THE RESULTS

5.1 LEGISLATIVE ENVIRONMENT

There are existing legislative and policy frameworks that support energy development and environmental sustainability in Nigeria, namely Nationally Determined Contributions (NDC), Petroleum Industry Act (PIA), Climate Change Act (CCA), Energy Transition Plan (ETP), Long-term Low Emission Development Strategy (LT-LEDS), Carbon Market Activation Policy (proposed). Nigeria's Long-term Low Emission Development Strategy (LT-LEDS) identifies carbon offset mechanisms as a key pathway to achieving net-zero emissions by 2060, while the proposed Carbon Market Activation Policy outlines a framework for carbon trading and climate finance to stimulate investments in low-carbon projects and technologies. However, the existing legislative and policy frameworks do not effectively support the carbon offset market in Nigeria because there is no coherent policy direction focusing on strengthening institutional frameworks, enhancing sub-national engagement, and ensuring integration with national climate goals and climate finance. In addition, the current implementation lacks granularity at the sub-national level, particularly in regions like the Niger Delta, where carbon markets could play a transformative role in addressing environmental degradation, supporting livelihoods, and enabling a just transition.

The Niger Delta region has demonstrated varied progress in climate policy development to support environmental sustainability. Delta State leads with a comprehensive Climate Change Policy and Integrated Territorial Climate Plan, which aims to embed climate considerations into development planning, promote capacity building, and identify mitigation priorities. It encourages the use of carbon offset finance, particularly through REDD+ and Clean Development Mechanism (CDM) methodologies, for mangrove afforestation and restoration projects. The state has further committed to clean energy access through a Renewable Energy Policy Roadmap (2023–2028), focusing on sustainable energy interventions across sectors such as agriculture, MSMEs, education, and health. These efforts signal Delta State's readiness to leverage carbon markets as a tool for sustainable development and environmental protection.

In contrast, Bayelsa and Rivers States show emerging but uneven progress. Bayelsa has conducted climate screening assessments aligned with national strategies, identifying carbon offset mechanisms for select projects, but lacks a formal climate change policy or implementation framework. The absence of a comprehensive action plan limits the state's ability to engage effectively with carbon market opportunities. Rivers State, however, has enacted a Climate Change Law that aligns with national legislation, establishing a climate secretariat, carbon budget, and dedicated climate fund. It also benefits from a Climate Change Adaptation and Mitigation Plan developed by an NGO, which targets emissions reduction and resilience building. Nevertheless, the operational status of this plan remains unclear. Overall, while the policy environment in the Niger Delta is evolving, targeted support is needed to strengthen institutional capacity, develop MRV systems, and ensure the region's full participation in carbon offset markets.

To unlock the full potential of the carbon offset market, policies must prioritize the development of robust Measurement, Reporting, and Verification (MRV) systems, facilitate private sector participation, and establish incentives for businesses to adopt sustainable practices. Strengthening the role of state, local governments and companies in carbon market governance is crucial, especially for community-based projects in forestry, agriculture, and clean energy. Integrating carbon markets into broader development plans, ensuring transparency, and aligning with Nigeria's Climate Change Act, Energy Transition Plan, NDCs, and subnational policies will be essential to mobilise climate finance, build investor confidence, and drive equitable low-carbon growth across the country. A collaborative approach involving government agencies, non-governmental organisations, communities, and other stakeholders needs to be emphasised to implement carbon offset projects in the Niger Delta region effectively.

5.2 DISAGGREGATED MODELLING DATA FOR CARBON OFFSET PROJECTS IN NIGER DELTA

The modelling data provide critical data for assessing carbon offsets in the Niger Delta region. In 2020, energy consumption in three focal states (Rivers, Bayelsa and Delta) was 310.23 PJ (21.45 GJ per capita), extrapolated to 881 PJ across the entire nine states. The residential and building sector dominated energy demand (59.4%), largely driven by inefficient firewood cookstoves, with fuelwood accounting for 57.9% of total energy sources, highlighting a key area for carbon offset interventions due to its link to deforestation and unsustainable biomass use.

GHG emissions in the base year totaled 52.00 mtCO₂e (3.59 tCO₂e per capita), which is 147.7 mtCO₂e across all nine states by extrapolation. The energy emission intensity is about 167 tCO₂e/TJ, which is significantly higher than the global average (~56 tCO₂/TJ), reflecting the high carbon intensity of energy sources in the region (especially fuelwood and fossil fuels) and oil and gas production activities. The major contributions to the emissions are from:

01. AFOLU sector (26.8%) – due to tree felling for firewood (reflects the 29.1% rate of change in forest loss) and livestock emissions.
02. Oil and gas sector (26.1%) – mostly fugitive emissions from exploration.
03. Power sector (19.7%) – primarily off-grid diesel and petrol generation.
04. Transport sector (13.8%) – from fossil-fuel-based vehicles.
05. The residential sector emissions (4.0%) exclude firewood, as those are categorised under AFOLU.

Without mitigation, by 2060, total emissions could reach 379.8 mtCO₂e by linear extrapolation – a 156 % increase from 2020, with theoretical carbon credit potential of 319 mtCO₂e and 4758 mtCO₂e relative to 2020 by 2030 and 2060, respectively. The transport sector is expected to become the largest emitter (35.6%), underscoring the urgency of low-carbon transport strategies. Using Nigeria's updated Nationally Determined Contribution (NDC) targets for emission reduction, the country has set an unconditional target of 20% (equating to an annual rate of 1.67%) and a conditional target of 47% (with an annual rate of 3.9%). Based on these targets, the potential for carbon credits in the Niger Delta region ranges from 5.3 mtCO₂e to 12.4 mtCO₂e by the year 2030. By 2060, the range increases to between 79.5 mt CO₂e and 185.6 mtCO₂e.

5.3 DISAGGREGATED DATA FROM COMMUNITY ENGAGEMENT

The study sampled eight Local Government Areas (LGAs) across Rivers (Gokana, Ahoada West), Bayelsa (Nembe, Sagbama) and Delta (Ndokwa West, Ughelli North and Warri South) in the Niger Delta to assess the readiness and perception of communities toward carbon offset project implementation.

Demographics and Socio-Economic Profile: The sample showed a balanced spread across gender and age, with a slight male dominance and average ages around 40 years. Educational attainment was mainly at the secondary school level (SSCE), while tertiary and postgraduate education was limited. Unemployment was high across all three states, especially in Delta (67.3%), indicating economic vulnerability.

Livelihoods: Farming and fishing were the predominant occupations in Bayelsa and Delta, while petty business and fishing were most common in Rivers. These activities are directly linked to land use and natural resource management, making the region highly relevant for carbon offset projects. The use of motorcycles

for commercial transportation was common across the states. This implies that community-driven implementation models that account for local livelihood and ecological concerns are crucial for sustainable adoption and success of carbon offset projects in the Niger Delta region. The analysis highlights community-based approaches involving local farmers in afforestation/reforestation, and it indicates the dual benefits of carbon sequestration and improved land productivity—thus supporting livelihoods through climate-smart agriculture.

Awareness and knowledge: General awareness of carbon offset projects was low: 66% in Bayelsa, 57.3% in Delta, and 55% in Rivers were unaware. Knowledge was fragmented, with few respondents able to identify specific project types (e.g., solar energy, pollution control, environmental protection). This suggests a strong need for targeted education and sensitisation campaigns as a precursor to policy rollout. Given the unemployment and low formal education levels, policies should include capacity-building and inclusive employment models to maximise impact.

Environmental concerns: Communities reported pressing environmental issues such as water scarcity, waste management, deforestation, and air pollution. Bayelsa and Delta showed more substantial environmental concern than Rivers, providing a fertile ground for policy dialogue and community-driven interventions. The implication is that carbon offset projects should be context-specific, aligning with local priorities like job creation and environmental restoration.

Willingness to participate: Overwhelming support was recorded for participating in carbon offset projects: over 98% across all states expressed willingness. High willingness but low awareness indicates a strategic opportunity for governments and partners to build community engagement through education and participatory planning. Preferred project types varied by state: tree planting, clean cookstoves, waste management (Bayelsa), sustainable agriculture, renewable energy, clean cooking (Delta), and conservation and biodiversity protection, though with overall lower enthusiasm (Rivers).

Perceived benefits: Respondents expected job creation, training/skills development, improved health, and better access to clean energy from these projects. These expectations align well with the co-benefits of well-designed carbon offset programs, especially in under-resourced communities. The perceived benefits (e.g. job creation) appear to be the driver for the overwhelming readiness of the communities to accept carbon offset projects. This is crucial in the context of the global energy transition, with Nigeria targeting net-zero emissions by 2060. Table 20 envisages the inequalities and injustices that the energy transition will produce, which the carbon offset projects could mitigate in the oil and gas-bearing rural communities.

Table 20. Inequality and injustice will be produced by energy transition

S/N.	INEQUALITY / INJUSTICE	TYPE	POLITICAL RELEVANCE	EVIDENCE
1	Job losses	Social, Economic	High	Medium
2	Land grabbing for bioenergy crops	Environmental; Economic	High	Low
3	Widening energy access gap, e.g., high cost of solar technology in low-income areas	Economic	High	Medium
4	Gender exclusion in green jobs	Social; political	Medium	Low
5	Limited access to investment	Economic, Social, Political, Finance	High	High
6	Extinction of communities	Social, economic	Medium	Low
7	Lack of inclusive energy policies	Political	High	High
8	Abandoned responsibilities (abandoning oil spill cleanup and remediation – soil and water)	Environmental	High	Low
9	Skills mismatch	Social, economic	Medium	High
10	Inadequate infrastructure	Social, economic,	High	High
11	Economic crisis (untimely diversification)	Economic, political	High	high

Company interventions: The companies indicated a well-established understanding of climate change and the critical role of carbon offsetting in mitigating its effects. Also, the oil and gas organisations have initiated measures to reduce emissions, particularly through enhancements in energy efficiency, energy management, and the mitigation of methane leaks.

5.4 IDENTIFIED EXISTING AND POTENTIAL CARBON OFFSET PROJECTS

The identified registered carbon offset projects directly located in the Niger Delta region under the CDM are Afam Combined Cycle Gas Turbine Power Project with reduction capacity of about 0.6 mtCO₂e per annum and Pan Ocean Gas Utilization Project with a reduction capacity of about 2.6 mtCO₂e per annum. However, there are existing projects with the Niger Delta that could be aligned to carbon offset projects, name solar water system, solar street lights and renewable energy based hybrid off-grid electrification.

The TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)[72], which is a multi-criteria decision-making method, was used to analysis the data in Table 13 to rank the various carbon offset projects to reflect priority in the context of Niger Delta region. Table 21 shows the ranking of the identified carbon offset projects in the Niger Delta region based on their closeness to an ideal solution.

Table 21. Raked potential carbon offset projects

S/N	CARBON OFFSET PROJECT	CLOSENESS TO AN IDEAL SOLUTION	RANK
1	Tree planting and reforestation	0.712	1
2	Conservation and biodiversity (including mangrove restoration)	0.662	2
3	Clean cooking solutions	0.622	3
4	Renewable energy (including electric vehicles/boats)	0.581	4
5	Sustainable agriculture (e.g. aquaponic)	0.561	5
6	Waste management and recycling	0.514	6



6.0 POLICY PATHWAYS AND CARBON OFFSET MARKET

The Niger Delta, characterised by a longstanding history of oil and gas extraction, is confronted with significant environmental degradation. The implementation of community-controlled carbon offset projects presents an opportunity to mitigate greenhouse gas emissions while simultaneously providing benefits to local communities through climate finance initiatives. It is essential for the policy and legislative framework to transition from a state of fragmented awareness and passive recognition of potential to one of active integration, decentralisation, and strategic market development. By aligning the specific needs of the Niger Delta with Nigeria's national objectives and international frameworks, carbon markets can serve as an effective instrument for promoting low-carbon development and advancing environmental justice.

Therefore, the following

6.1 LEGISLATIVE AND POLICY PATHWAYS

6.1.1 STRENGTHEN NATIONAL-TO-SUBNATIONAL POLICY INTEGRATION

Challenge identified: Existing national frameworks (e.g., LT-LEDS, CCA, ETP, NDCs) are not effectively mirrored or implemented at the subnational level.

Policy Pathway:

- Mandate subnational alignment with national policies through fiscal incentives, policy scorecards, and capacity support programs.
- Develop a National-Subnational Coordination Framework on carbon markets to guide states in drafting compatible climate and carbon market policies.
- Create a Standardised Subnational Climate Policy Toolkit, including templates for Measurement, Reporting, and Verification (MRV), stakeholder engagement, carbon registry access, and emissions inventories.

1.1.2 DEVELOP SUBNATIONAL CARBON MARKET REGULATIONS

Challenge identified: Delta State is leading, but Bayelsa and Rivers need clearer regulatory environments, which is a reflection of the Niger Delta region.

Policy Pathway:

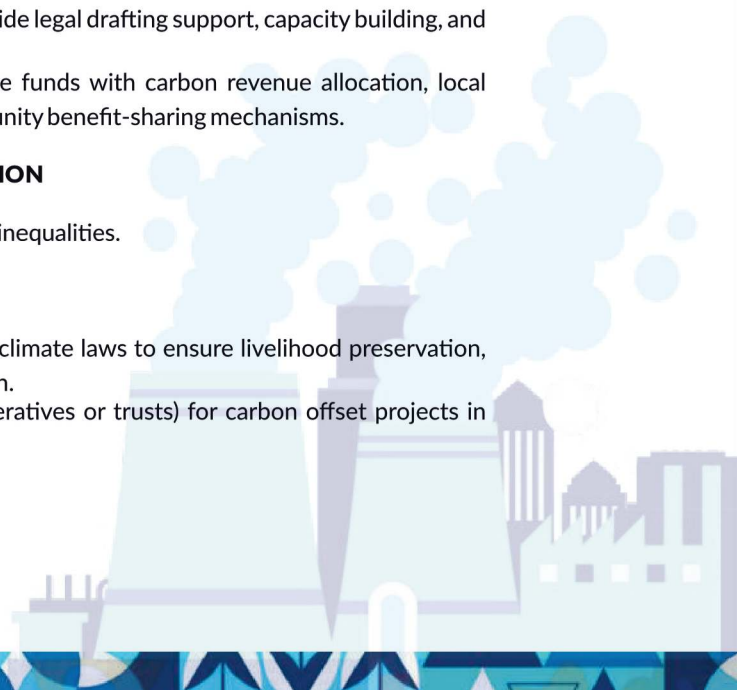
- Adopt model legislation on carbon market governance tailored to state contexts, drawing from Rivers' Climate Law and Delta's Territorial Plan.
- Institute Carbon Market Readiness Programs to provide legal drafting support, capacity building, and stakeholder dialogue platforms.
- States should legislate the establishment of climate funds with carbon revenue allocation, local project validation and verification bodies, and community benefit-sharing mechanisms.

6.1.3 MAINSTREAM CLIMATE JUSTICE IN LEGISLATION

Challenge identified: The energy transition risks deepening inequalities.

Policy Pathway:

- Include just transition clauses in national and state climate laws to ensure livelihood preservation, equitable energy access, and community participation.
- Legislate community ownership models (e.g., cooperatives or trusts) for carbon offset projects in forestry, clean cooking, and renewables.



6.2 CARBON MARKET FRAMEWORK AND ACTIVATION

6.2.1 OPERATIONALISE THE CARBON MARKET ACTIVATION POLICY

Challenge identified: The policy is still being proposed and lacks details on implementation and institutional mechanisms.

Policy Pathway:

- Establish a National Carbon Market Authority (or embed within NESREA/NCCC) with mandates to oversee MRV protocols, accredit verifiers, host a national carbon registry and facilitate international carbon trade (e.g., Article 6 of Paris Agreement).
- Prioritise pilot projects in high-potential sectors (e.g., clean cookstoves, mangrove restoration, and off-grid renewables).

6.2.2 DEVELOP A TIERED MRV FRAMEWORK

Challenge identified: MRV systems are weak or non-existent at the subnational level.

Policy Pathway:

- Create a tiered MRV system, such as Tier 1 (basic reporting for small-scale community projects), Tier 2 (intermediate tracking using digital tools) and Tier 3 (full compliance MRV aligned with international standards, e.g. Verra, Gold Standard)
- Integrate mobile-based MRV platforms for real-time data from rural and forested areas.

6.2.3 CATALYSE PRIVATE SECTOR AND INVESTOR PARTICIPATION

Challenge identified: lack of incentives and low investor confidence.

Policy Pathway:

- Develop carbon credit guarantees and de-risking instruments through public-private climate finance facilities.
- Offer tax incentives, carbon credit purchase agreements, and green bond linkages for verified carbon projects.
- Establish carbon auction platforms to stimulate demand and create price signals.

6.3 COMMUNITY ENGAGEMENT AND CAPACITY BUILDING

6.3.1 EDUCATION AND SENSITISATION CAMPAIGNS

Challenge identified: Awareness of carbon offsetting is low, despite high willingness to participate.

Policy Pathway:

- Launch "Carbon for Communities" Campaigns using radio, social media, and community town halls in local languages.
- Use "training-of-trainers" models to empower local champions and extension agents.

6.3.2 INCLUSIVE EMPLOYMENT AND CO-BENEFITS REALISATION

Challenge identified: Carbon offset projects must align with local development priorities.

Policy Pathway:

- Integrate carbon offset projects into Local Government Development Plans.
- Prioritise project types ranked highest in the TOPSIS analysis, particularly clean cookstoves (reduces AFOLU emissions), mangrove restoration (mitigates environmental degradation), sustainable agriculture (aligns with livelihoods) and off-grid solar electrification (aligns with social wellbeing and economic improvement).

- Include job quotas, skill transfer, and local procurement requirements in project design.

6.4 INSTITUTIONAL ARCHITECTURE AND COLLABORATION

6.4.1 REGIONAL CARBON MARKET PLATFORM

- Establish a Niger Delta Carbon Market Consortium (NDCMC) involving state governments, CSOs, oil companies, and traditional institutions to: (a) Pool projects for economies of scale, (b) coordinate MRV and certification and (c) facilitate access to voluntary and compliance markets

1.4.2 Cross-sectoral advisory council

- Create an Advisory Council on Carbon Finance (ACCF) to interface between ministries (Environment, Finance, Power, Petroleum), NCCC, NESREA, and private sector actors.

1.5 Linking with international Mechanisms

Leverage Article 6.2 and 6.4 of the Paris Agreement to:

- Position Nigeria as a host country for bilateral carbon trades (e.g., with Switzerland, Sweden, or Japan)
- Mobilise investment for carbon offset projects in Niger Delta via the Climate Investment Funds, Adaptation Fund, and Green Climate Fund



REFERENCES

- [1] M. Oyegun, C. U., Lawal, O., & Ogoro, "The Niger Delta Region," in Landscapes and Landforms of Nigeria, & A. O. O. A. Faniran, L. k. Jeje, O. A. Fashae, Ed., 2023. doi: https://doi.org/10.1007/978-3-031-17972-3_7.
- [2] S. Okonkwo, C. N. P., Kumar, L., & Taylor, "The Niger Delta wetland ecosystem: What threatens it and why should we protect it?," *Afr J Environ Sci Tech*, vol. 9, no. 5, pp. 451–463, 2015.
- [3] E. G. Keith, D. A., Rodríguez, J. P., Rodríguez-Clark, K. M., Nicholson, E., Aapala, K., Alonso, A., Asmussen, M., Bachman, S., Basset, A., & Barrow, "Scientific foundations for an IUCN Red List of Ecosystems," *PLoS One*, vol. 8, no. 5, p. e62111, 2013.
- [4] A. Y. B. Dada, O. A., Li, G., Qiao, L., Asiwaju-Bello, Y. A., & Anifowose, "Recent Niger Delta shoreline response to Niger River hydrology: Conflict between forces of Nature and Humans," *Journal of African Earth Sciences*, vol. 139, pp. 222–231, 2018.
- [5] H. L. Welcomme, R., & Dumont, "The Niger river system," in *The ecology of river systems*, Springer, 1986, pp. 9–59.
- [6] D. M. J. Fubara, "Analysis of hydrological characteristics: a case review of the niger delta," *J Water Resour Prot*, vol. 14, no. 9, pp. 611–631, 2022.
- [7] Federal Government of Nigeria, "National Development Plan (NDP) 2021-2025," 2021. [Online]. Available: https://nationalplanning.gov.ng/wp-content/uploads/2021/12/NDP-2021-2025_AA_FINAL_PRINTING.pdf
- [8] NUPRC, "Nigeria's Oil and Gas Reserves Soar: NUPRC Unveils Impressive Figures." [Online]. Available: [https://www.nuprc.gov.ng/nigerias-oil-and-gas-reserves-soar-nuprc-unveils-impressive-figures/#:~:text=Engr Komolafe revealed that as,trillion cubic feet \(TCF\)](https://www.nuprc.gov.ng/nigerias-oil-and-gas-reserves-soar-nuprc-unveils-impressive-figures/#:~:text=Engr Komolafe revealed that as,trillion cubic feet (TCF))
- [9] E. E. Obuah and R. C. Keke, "Mitigating the Negative Externalities of Oil Drilling Activities in the Niger Delta, Nigeria," *Oalib*, vol. 09, no. 05, pp. 1–21, 2022, doi: 10.4236/oalib.1108629.
- [10] Y. Akinpelu, "ANALYSIS: 77% of oil spills in Nigeria occurred in only three states," *Premium Times*. Accessed: Feb. 05, 2021. [Online]. Available: <https://www.premiumtimesng.com/news/headlines/461635-analysis-77-of-oil-spills-in-nigeria-occurred-in-only-three-states.html?tztc=1>
- [11] Statista, "Population growth in Nigeria from 2013 to 2023." Accessed: Jan. 28, 2025. [Online]. Available: <https://www.statista.com/statistics/382235/population-growth-in-nigeria/>
- [12] NUPRC, "The Nigerian Upstream Petroleum Regulatory Commission(NUPRC): 2023 Annual Report," 2023. [Online]. Available: <https://www.nuprc.gov.ng/wp-content/uploads/2024/04/UPDATED-2023-NUPRC-ANNUAL-REPORT.pdf>
- [13] The Nigerian Economic Summit Group, "Niger Delta Regional Development Master Plan." [Online]. Available: https://nesgroup.org/download_policy_drafts/Niger_Delta_Regional_Development_Master_Plan_Chapter_1_1661862437.pdf
- [14] C. Okereke et al., "Deep Decarbonisation Pathways for Nigeria's Low Emission by 2060," 2024.
- [15] National Council on Climate Change, "Nigeria's Long-Term Low Emission Development Strategy - 2060," 2023.

- [16] NUPRC, "Nigerian Gas Flare Commercialisation Programme." Accessed: Jan. 31, 2025. [Online]. Available: <https://ngfcp.nuprc.gov.ng/>
- [17] UNFCCC, "Updated Nigeria's Nationally Determined National Contributions," United Nations. Accessed: Jan. 31, 2025. [Online]. Available: [https://unfccc.int/sites/default/files/NDC/2022-06/NDC INTERIM REPORT SUBMISSION - NIGERIA.pdf](https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20INTERIM%20REPORT%20SUBMISSION%20-%20NIGERIA.pdf)
- [18] OPEC, "Nigeria facts and figures," Annual Statistical Bulletin. Accessed: Jan. 14, 2022. [Online]. Available: https://www.opec.org/opec_web/en/about_us/167.htm
- [19] M. Coffin, A. Dalman, and A. Grant, "Beyond Petrostates: The Burning Need to Cut Oil Dependence in the Energy Transition," 2021. [Online]. Available: <https://carbontracker.org/reports/petrostates-energy-transition-report/>
- [20] D. Saha, G. Walls, D. Waskow, and L. Lazer, "Just Transitions in the Oil and Gas Sector: Considerations for Addressing Impacts on Workers and Communities in Middle-Income Countries," World Resources Institute, no. January, 2023, doi: 10.46830/wriwp.21.00040.
- [21] NCDMB, "Analysis of Human Capital Development Trend in the Nigerian Oil & Gas Industry," 2020. [Online]. Available: <https://ncdmb.gov.ng/images/RD/HCD-Analytics-in-Nigeria-Oil&Gas.pdf>
- [22] A. P. Onyena and K. Sam, "A review of the threat of oil exploitation to mangrove ecosystem: Insights from Niger Delta, Nigeria," *Glob Ecol Conserv*, vol. 22, p. e00961, 2020, doi: 10.1016/j.gecco.2020.e00961.
- [23] M. Manfroni, S. G. F. Bukkens, and M. Giampietro, "The declining performance of the oil sector: Implications for global climate change mitigation," *Appl Energy*, vol. 298, p. 117210, 2021, doi: 10.1016/j.apenergy.2021.117210.
- [24] P. Toledano, M. Dietrich Brauch, T. Mebratu-Tsegaye, and F. J. Pardinás Favela, "Equipping the Nigerian National Petroleum Corporation for the Low-Carbon Transition: How Are Other National Oil Companies Adapting?," Abuja, 2021. doi: 10.2139/ssrn.3726412.
- [25] A. Nwozor, S. Oshewolo, G. Owioye, and O. Okidu, "Nigeria's quest for alternative clean energy development: A cobweb of opportunities, pitfalls and multiple dilemmas," *Energy Policy*, vol. 149, no. November 2020, p. 112070, 2021, doi: 10.1016/j.enpol.2020.112070.
- [26] C. Nwani, E. L. Effiong, S. I. Okpoto, and I. K. Okere, "Breaking the carbon curse: The role of financial development in facilitating low-carbon and sustainable development in Algeria," *African Development Review*, vol. 33, no. 2, pp. 300–315, 2021, doi: 10.1111/1467-8268.12576.
- [27] K. Tokushige and K. Akimoto, "Role and issues of CCS in long-term sustainable emission reductions and toward sustainable development," in *Energy Procedia*, 2011, pp. 5889–5894. doi: 10.1016/j.egypro.2011.02.588.
- [28] B. Saveyn, L. Paroussos, and J. C. Ciscar, "Economic analysis of a low carbon path to 2050: A case for China, India and Japan," *Energy Econ*, vol. 34, no. SUPPL. 3, pp. S451–S458, 2012, doi: 10.1016/j.eneco.2012.04.010.
- [29] C. Bogmans, A. Pescatori, and E. Prifti, "The Impact of Climate Policy on Oil and Gas Investment: Evidence from Firm-Level Data, IMF Working Paper," 2023.
- [30] S. Okotie, N. O. Ogbarode, and B. Ikporo, "The Oil and Gas Industry and the Nigerian Environment," in *The Political Ecology of Oil and Gas Activities in the Nigerian Aquatic Ecosystem*, P. E. Ndimele, Ed., Elsevier Science, 2018, ch. Chapter 4, pp. 47–69. doi: 10.1016/B978-0-12-809399-3.00004-5.

- [31] P. E. Oamen and E. O. Erhagbe, "The impact of climate change on economic and social rights realisation in Nigeria: International cooperation and assistance to the rescue?," *African Human Rights Law Journal*, vol. 21, no. 2, pp. 1–32, Dec. 2021, doi: 10.17159/1996-2096/2021/v21n2a43.
- [32] C. S. Onyenekwe, P. I. Opata, C. O. Ume, D. B. Sarpong, and I. S. Egyir, "Heterogeneity of adaptation strategies to climate shocks: Evidence from the Niger Delta region of Nigeria," *Bio-based and Applied Economics*, vol. 12, no. 1, pp. 17–35, May 2023, doi: 10.36253/bae-13436.
- [33] The World Bank, "Climate Change Knowledge Portal." Accessed: Feb. 05, 2025. [Online]. Available: <https://climateknowledgeportal.worldbank.org>
- [34] E. I. Elenwo and J. A. Akankali, "Impact of Climate Change on Aquatic Fauna of Economic Importance in Niger Delta, Nigeria," *Atmospheric and Climate Sciences*, vol. 04, no. 04, pp. 710–720, 2014, doi: 10.4236/acs.2014.44064.
- [35] E. O. Diemuodeke and T. A. Briggs, "Policy pathways for renewable and sustainable energy utilisation in rural coastline communities in the Niger Delta zone of Nigeria," *Energy Reports*, vol. 4, pp. 638–644, 2018, doi: 10.1016/j.egy.2018.10.004.
- [36] World Bank, "World Bank Carbon Credits to Boost International Carbon Markets." Accessed: Jun. 04, 2024. [Online]. Available: <https://www.worldbank.org/en/news/press-release/2023/12/01/world-bank-carbon-credits-to-boost-international-carbon-markets>
- [37] ACMI, "Africa Carbon Markets Initiative (ACMI): Roadmap Report Harnessing carbon markets for Africa," 2022. [Online]. Available: https://www.energyalliance.org/wp-content/uploads/2022/11/ACMI_Roadmap_Report_Nov_2022.pdf
- [38] Africa Finance Corporation, "How Africa Can Unlock World 's Most Promising Net-Zero Solution," 2023. [Online]. Available: <https://s3.eu-central-1.amazonaws.com/afc-assets/afc/AFC-Africa-Finance-Corporation-White-Paper-WEB.pdf>
- [39] C. G. Heaps, "LEAP: The Low Emission Analysis Platform," [Software version: 2020.1.37] Stockholm Environment Institute, 2021, doi: <https://leap.sei.org>.
- [40] M. O. Ukoba, E. O. Diemuodeke, T. A. Briggs, M. Imran, K. Owebor, and C. O. Nwachukwu, "Geographic information systems (GIS) approach for assessing the biomass energy potential and identification of appropriate biomass conversion technologies in Nigeria," *Biomass Bioenergy*, vol. 170, no. September 2022, p. 106726, 2023, doi: 10.1016/j.biombioe.2023.106726.
- [41] T. R. HANSEN, M. C., POTAPOV, P. V., MOORE, R., HANCHER, M., TURUBANOVA, S. A., TYUKAVINA, A., THAU, D., STEHMAN, S. V., GOETZ, S. J. & LOVELAND, "High-resolution global maps of 21st-century forest cover change," *Science* (1979), 2013.
- [42] D. Hales, *An Introduction to Triangulation*. UNAIDS. [Online]. Available: http://www.unaids.org/en/media/unaids/contentassets/documents/document/2010/10_4-Intro-to-triangulation-MEF.pdf
- [43] A. J. Bondarenko M., Kerr D., Sorichetta A., and Tatem, "Census/projection-disaggregated gridded population datasets, adjusted to match the corresponding UNPD 2020 estimates, for 51 countries across sub-Saharan Africa using building footprints. WorldPop," 2020. [Online]. Available: doi:10.5258/SOTON/WP00683
- [44] Federal Government of Nigeria, "Bouncing Back: Nigerian Economic Sustainability Plan." Accessed: Jan. 30, 2025. [Online]. Available: <https://media.premiumtimesng.com/wp-content/files/2020/06/ESC-Plan-compressed-1.pdf>

- [45] Federal Republic of Nigeria, "Petroleum Industry Act, 2021," 2021. [Online]. Available: <http://www.petroleumindustrybill.com/wp-content/uploads/2021/10/Petroleum-Industry-Act-2021-vs-3-pdf.pdf>
- [46] K. Nwuke, "Nigeria's Petroleum Industry Act: Addressing Old Problems, Creating New Ones," 2021. [Online]. Available: <https://www.brookings.edu/blog/africa-in-focus/2021/11/24/nigerias-petroleum-industry-act-addressing-old-problems-creating-new-ones/>
- [47] W. McBain, "Petroleum Industry Act Let Us Down, Say Niger Delta Communities." Accessed: May 30, 2024. [Online]. Available: <https://african.business/2022/01/energy-resources/nigerias-spill-hit-communities-demand-more-from-petroleum-industry-act/>
- [48] Federal Government of Nigeria, "Nigeria Energy Transition Plan." Accessed: May 30, 2024. [Online]. Available: <https://energytransition.gov.ng/>
- [49] FGN, "National renewable energy action plans (NREAP) (2015 – 2030)," National Council on Power, 2016.
- [50] Federal Government of Nigeria, "Nigeria's Climate Change Act 2021." Accessed: Jan. 28, 2021. [Online]. Available: http://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=112597&p_count=22&p_classification=01
- [51] The Energy Transition Office, "Nigerian Energy Transition Plan." Accessed: Jan. 27, 2025. [Online]. Available: <https://www.energytransition.gov.ng/#Plan>
- [52] Federal Republic of Nigeria, "Nigeria's Carbon Market Activation Policy," 2024.
- [53] Delta State Government, "Delta State Climate Change Policy." Accessed: Feb. 02, 2025. [Online]. Available: https://carbonn.org/uploads/tx_carbonndata/Delta_State_Climate_Change_Policy_01.pdf?utm_source=chatgpt.com
- [54] Clean Technology Hub, "Delta State Renewable Energy Policy Roadmap," 2022. [Online]. Available: <https://ng.boell.org/sites/default/files/2022-09/delta-state-renewable-energy-policy-roadmap-2023-2028.pdf>
- [55] Bayelsa State Government, "Bayelsa State Project Screening Assessment Report." [Online]. Available: https://www.investbayelsa.by.gov.ng/wp-content/uploads/2016/10/BAYELSA-STATE-PROJECT-CLIMATE-SCREENING-ASSESSMENT-REPORT.pdf?utm_source=chatgpt.com
- [56] NCCC, "NCCC Engages with Bayelsa State Governor on Climate Action and Mangrove Conservation." Accessed: Feb. 02, 2025. [Online]. Available: <https://x.com/NCCCNigeria/status/1884874998973681947?mx=2>
- [57] Green Savannah, "Sam Onuigbo's Climate Change Act domesticated in Rivers State." Accessed: Feb. 02, 2025. [Online]. Available: <https://greensavannahdiplomaticcable.com/2022/12/sam-onuigbos-climate-change-act-domesticated-in-rivers-state/>
- [58] C. Okereke, T. Ogenyi, and W. Adegbole, "Climate Change Impacts, Policies, and Actions at the Subnational Level in Nigeria," 2023. [Online]. Available: <https://cccd.funai.edu.ng/wp-content/uploads/dae-uploads/Report-on-Mapping-of-Climate-Impact-Policy-and-Action-at-the-Subnational-Level-of-Nigeria.pdf>

- [59] National Coalition on Gas Flaring and Oil Spills in the Niger Delta, "Climate Change Adaptation And Mitigation Plan for Rivers State." Accessed: Feb. 02, 2025. [Online]. Available: https://cehrd.org.ng/climate-change-adaptation-and-mitigation-plan-for-rivers-state/?utm_source=chatgpt.com
- [60] E. Hachileka, "Carbon markets in Africa: balancing finance mobilization with emission reduction goals," UNDP. Accessed: Feb. 01, 2025. [Online]. Available: <https://www.undp.org/africa/blog/carbon-markets-africa-balancing-finance-mobilization-emission-reduction-goals>
- [61] E. Huber, V. Bach, and M. Finkbeiner, "A qualitative meta-analysis of carbon offset quality criteria," *J Environ Manage*, vol. 352, no. November 2023, 2024, doi: 10.1016/j.jenvman.2023.119983.
- [62] C. Mustapha, "The Air Transportation Industry," in *The Air Transportation Industry*, R. M. Voorde and E. Van De, Eds., Elsevier, 2022, ch. The burden. [Online]. Available: <https://www.sciencedirect.com/book/9780323915229/the-air-transportation-industry>
- [63] A. Abadie, S. Chowdhury, S. K. Mangla, and S. Malik, "Impact of carbon offset perceptions on greenwashing: Revealing intentions and strategies through an experimental approach," *Industrial Marketing Management*, vol. 117, pp. 304–320, Feb. 2024, doi: 10.1016/j.indmarman.2024.01.001.
- [64] X. A. Shinbrot et al., "Natural and financial impacts of payments for forest carbon offset: A 14 year-long case study in an indigenous community in Panama," *Land use policy*, vol. 115, p. 106047, Apr. 2022, doi: 10.1016/j.landusepol.2022.106047.
- [65] C. Xia, C. Guan, D. Ding, and Y. Teng, "Navigating Success in Carbon Offset Projects : A Deep Dive into the Determinants Using Topic Modeling," *Sustainability*, pp. 1–19, 2024, doi: <https://doi.org/10.3390/su16041595>.
- [66] C. Pan et al., "Key challenges and approaches to addressing barriers in forest carbon offset projects," *J For Res (Harbin)*, vol. 33, no. 4, pp. 1109–1122, 2022, doi: 10.1007/s11676-022-01488-z.
- [67] A. Y. Lo, "Carbon offsetting and renewable energy development," *Geographical Research*, vol. 61, no. 2, pp. 158–163, May 2023, doi: 10.1111/1745-5871.12600.
- [68] IPCC, "Climate Change 2022: Mitigation of Climate Change," 2022. [Online]. Available: <https://www.ipcc.ch/report/ar6/wg3/>
- [69] REA, "Solar Power Naija," Rural Electrification Agency. Accessed: Feb. 04, 2025. [Online]. Available: <https://spn.rea.gov.ng/>
- [70] R. Lal, "Managing soils for negative feedback to climate change and positive impact on food and nutritional security," *Soil Sci Plant Nutr*, vol. 66, no. 1, pp. 1–9, Jan. 2020, doi: 10.1080/00380768.2020.1718548.
- [71] T. Tambol, E. K. Derbile, and M. Soulé, "Use of climate smart agriculture technologies in West Africa peri-urban Sahel in Niger," *Sci Rep*, vol. 15, no. 1, p. 2771, Jan. 2025, doi: 10.1038/s41598-024-82813-w.
- [72] E. O. Diemuodeke, A. Addo, C. O. C. Oko, Y. Mulugetta, and M. M. Ojapah, "Optimal mapping of hybrid renewable energy systems for locations using multi-criteria decision-making algorithm .," *Renew Energy*, vol. 134, pp. 461–477, 2019.

APPENDIX A.

ENGAGEMENT WITH OSHIKA COMMUNITY IN RIVERS STATE









APPENDIX B.

ENGAGEMENT WITH KPOR COMMUNITY IN RIVERS STATE



Figure B.1: hydrocarbon degraded land area at Kpor community



Figure B.2. Solar-powered street lights



Figure B.3: Fresh lumber harvested from forest trees



Figure B.4. Survey team with community youth leader and other residents

APPENDIX C.

ENGAGEMENT WITH OGBOLOMABIRI COMMUNITY IN BAYELSA STATE



Figure C.1. Research team's visit to some members of the Community Youth Council



Figure C.2. Team engagement with a Chief





Figure C.4. Research team's engagement in a focus group



Figure C.5. Solar street light electrification project

APPENDIX D.

ENGAGEMENT WITH OBOLU-ORUA COMMUNITY IN BAYELSA STATE



Figure D.1 Using firewood to fry garri





Figure D.2. Use of solar panels to generate electricity.



Figure D.3. Solar-powered lights for the streets



Figure D.4. Solar-powered network mass for the entire community



Figure D.5. Source of water for domestic use, including drinking and cooking

APPENDIX E.

ENGAGEMENT WITH IMIRINGI/ELEBELE COMMUNITY IN BAYELSA STATE



Figure E.1. Solar panel light on the streets of Imiringi



Figure E.2. Shell flow station at Imiringi



Figure E.3, Hydrocarbon-degraded farmlands at Elebele



Figure E.4. Exploited forest trees at Elebele



Figure E.5: The survey team at Elebele

APPENDIX F.

ENGAGEMENT WITH UMUTESI COMMUNITY IN DELTA STATE



Figure F.1. Waste management challenge



Figure F.2. Households' use of solar panels for generating electricity



Figure F.3. Water supply by solar-powered pumps



Figure F.4. Dependence on fuelwood for energy



Figure F.5. Outlet of a power plant of a catering company that caters for most of the oil companies in and around Umuseti; their emissions affect the air quality of the environment



Figure F.6. Survey team's visit to the Okpala-Uku of Umuseti-Ogbe

APPENDIX G.

ENGAGEMENT WITH OMAVOVWE COMMUNITY IN DELTA STATE



Figure G.1. Team member explaining the concept of carbon offset



Figure G.2. Destroyed artisan refinery



Figure G.3. Solar-powered water reticulation



Figure G.4. Destroyed forest



Figure G.5. Economic activities – sharp sand mining (left) and timber milling (right)

APPENDIX H.

ENGAGEMENT WITH OMADINO COMMUNITY IN DELTA STATE



Figure H.1. Use of firewood for commercial use

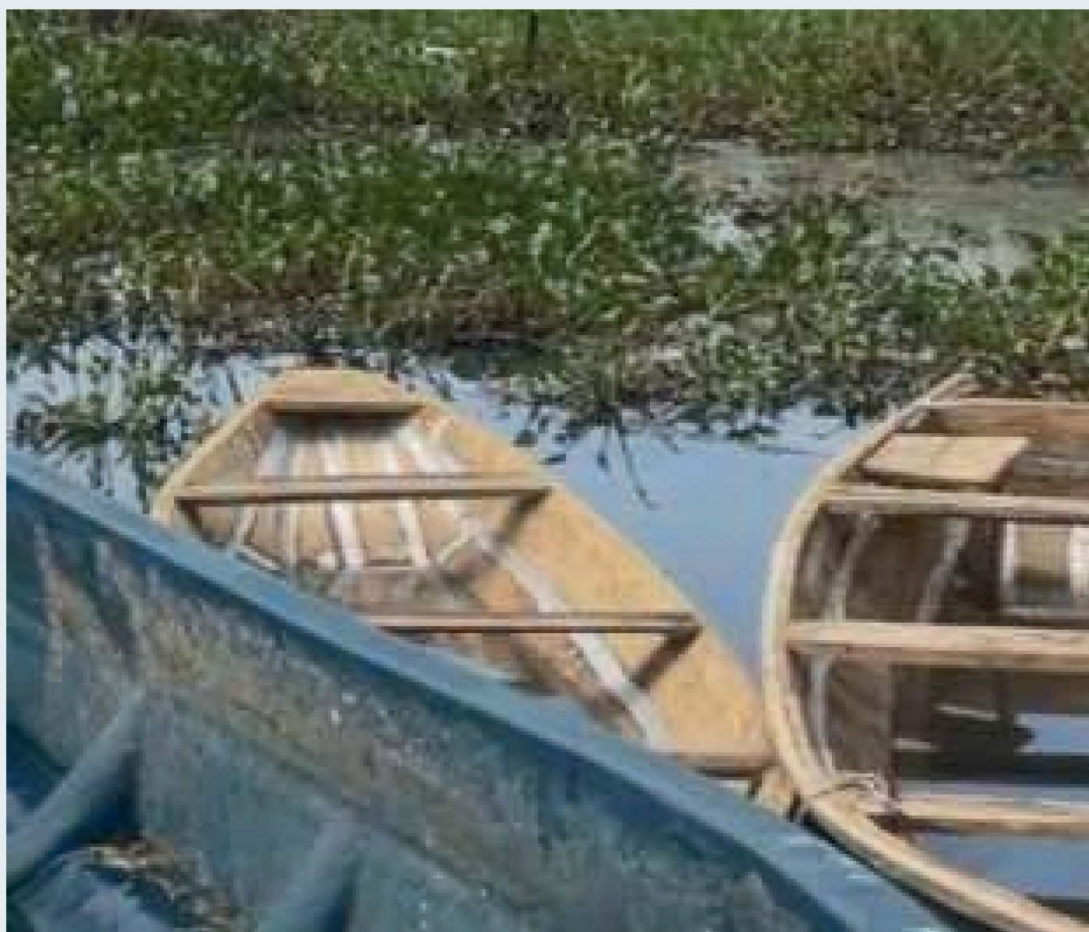
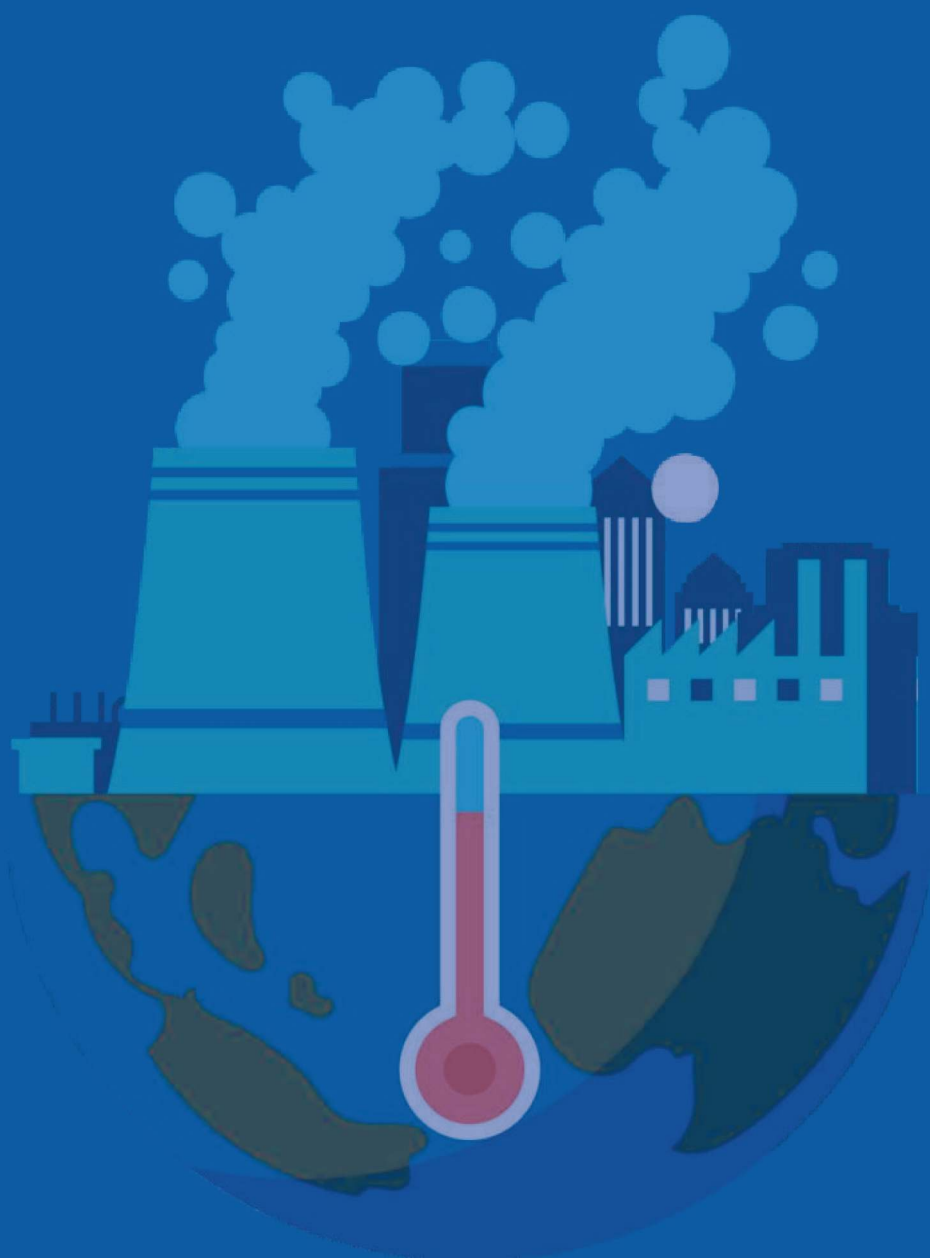


Figure H.2. Means of transportation



Funded by the European Union



IMPLEMENTING PARTNERS:

