UNDP NDC Support Programme

Executive Summary

Assessment of Investment and Financial Flows to Mitigate Climate Change in the Agriculture, Energy (Power), Industry, Oil and Gas, and Transport Sectors and for Adaptation in the Agriculture Sector in Nigeria

April 2021

IN CONTRIBUTION TO THE NDC PARTNERSHIP ACCELERATING CLIMATE AND DEVELOPMENT ACTION

Supported by: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety based on a decision of the German Bundestag

aecid Spanish Agency for International Developement Cooperation

Federal Ministry for Economic Cooperation and Development

UNDP

Investment and Financial Flows to Address Climate Change UNDP Global Project

Climate Change poses significant challenges to development and policy makers are faced with complex tasks to respond to them and to ensure sustainable development. Predominantly in Developing Countries, decision makers must balance: poverty alleviation, socio-economic development, as well as environmental and perhaps, health concerns (as a result of the COVID – 19 pandemic challenge), with key questions bordering on budgetary apportionment associated with climate policies and measures needed to mitigate greenhouse gas (GHG) emissions and adapt to climate changes in key sectors of their economy.

Accordingly, to better understand the scale of funds needed to respond to these climate change measures / actions – in the short and medium term with insight into long term low-carbon climate resilient economy, countries are encouraged to undertake assessments of the required investment and financial flows (I&FF) to address their climate change challenges in their key selected priority sectors. Nigeria is assessing its I&FF within the context of its NDC implementation with the support of UNDP's NDC Support Programme, a Programme made possible by the generous funding from the European Union and the governments of Spain and Germany in contribution to the NDC Partnership.

The aim of the I&FF is to identify the investment and financial flows necessary to implement climate mitigation and adaptation actions that will achieve Nationally Determined Contributions (NDC) targets in 5 priority sectors – Power, Oil and Gas, Agriculture, Industry and Transport which cover more than 80 percent of the Nigerian economy with associated carbon emissions. The I&FF is based on identifying (with the use of data) the commitment or planned investments for implementation of climate change adaptation and mitigation measures as envisioned in the investment and financial flows, which can then inform a more efficient climate policy design around national budgets and investments to meet both climate change, economic growth, and the new national and global development targets spanning within – 2021 to 2025/ 2030/2050. The I&FF also builds on the Economic Sustainability Plan (ESP), designed to cushion the impact of the COVID-19 pandemic and prompt a long-term national planning and sustainable economic recovery path. Key reflection on sectoral policy briefs ,developed in framework of the NDC, was taken into consideration; capturing not only the effects of the policy direction but also impact on policy implication for the targeted (climate) scenario investment as envisioned within the NDC.

Chapter 1 introduces the context in which the I&FF works including its objectives and methodology. Chapter 2 gives a summary of sectoral assessments including policy implication[i] and key uncertainties within the context of achieving the I&FF. Chapter 3 highlights the summary tables of the required investment and Financial flow.

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Abbreviations and Acronyms

Abbreviations	Definitions
BAU	Business as Usual
BS	Baseline Scenario
CCS	Climate Change Scenario
CNG	Compressed Natural Gas
COVID-19	Corona Virus Disease 2019
FGN	Federal Government of Nigeria
GDP	Gross Domestic Product
GHG	Greenhouse Gas
I&FF	Investment and Financial Flows
IF	Investment Flows
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MRV	Monitoring, Reporting and Verifying
NBS	National Bureau of Statistics
NDC	Nationally Determined Contribution
NDC SP	NDC Support Programme
O&M	Operation and Maintenance
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
US$	United State Dollars

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Chapter One

Introduction

The negative impact of climate change especially on environmentally sensitive sectors such as energy, agriculture, and the transport sectors (and perhaps, the health sector) are expected to be concentrated in developing countries and cannot be mitigated without measurable response from national governments. For Nigeria, this impact threatens to put at risk the country's socio-economic development and perhaps, the wider long-term plan for COVID-19 recovery. Accordingly, Nigeria's National Determined Contribution (NDC) – currently being updated - under the Paris Agreement commits the country to achieving a 20% reduction of emissions below business as usual by 2030 unconditionally and up to 45% cut, if adequate technological, financial, and capacity building support is offered from developed countries. Within the existing NDC of 2015, five (5) main sectors - power, oil and gas, agriculture, industry, and transport - covering more than 80 percent of the Nigerian economy with associated carbon emissions were considered and the envisaged total climate actions / measures cost in these sectors was estimated to be around $US 142 billion but with a potentially $US 304 billion in socio-economic impact benefits. Thus, most of the measures identified would either be zero net cost or achieve net economic benefits.

In view of implementing the country's NDCs, various policies have been designed and programmatic local actions are also ongoing, while receiving extended support from development partners including the United Nations Development Programme (UNDP). One key support programme from the UNDP is the UNDP-NDC Support Programme that has been designed to intervene in four [4] axes as detailed below:

1) developing a financial strategy for funding the country's NDCs Sectoral Action Plan
2) increasing private sector involvement in meeting the country's NDCs targets
3) establishing a registry of adaptation and mitigation actions that are contributing to the achievement of NDCs targets.
4) increasing the visibility of the NDCs

This report focuses on the first element: developing a financial strategy for funding developing countries' NDCs Sectoral Action Plan which addresses changes of investments in physical assets and in programmatic measures (collectively referred to as investment and financial flows – I&FF) needed to mitigate greenhouse gas (GHG) emissions and adapt to climate change in key sectors. It is worth noting that the results of I&FF assessments will be used in financial decision making and policy development regarding investment shifts and/or additional capital needed to address climate change, as well as in the development of national negotiation positions for the UNFCCC process.

The investment and financial flows (I&FF) find that more than $ US 511.797 billion is needed through 2030 to implement priority actions that will:

1. Reduce emissions of greenhouse gases from the power, oil and gas, agriculture, industry, and transport sectors and;
2. Adapt to the impacts of climate change in the agriculture sector.

Table 1 below provides breakdown of the investment and financial flow needed through 2030.

Table 1: Breakdown of Investment and Financial Flows through 2030

NDC Sector	*Climate Project Activity*	*Amount (Billion USD)*
Oil and Gas	• Gas flare reduction and commercialization. • Gas pipeline projects to increase gas availability and encourage fuel substitution from high carbon fossil fuels (e.g diesel or coal) to natural gas, introducing Leak Detection and Repair (LDAR) programme. • LNG/LPG/CNG Expansion and Utilization Programme as a fuel switch campaign. • Highly efficient Refineries and biofuel blending to optimize processes and reduce losses in refineries and blending of bioethanol.	39.422
Industry	• Energy efficiency measures in Industries specifically in Cement and Steel Industries. • Fuel switch (whole or partial) in Industries from use of high carbon fossil fuels to use of natural gas;	9.823
Energy	• Increase in Renewable Energy power on national grid, mini-grid and off grid connections. • National LPG Expansion to switch household power generators from premium motor spirit (PMS) and Automotive Gas Oil (AGO) to LPG. • Large Hydro Power Capacity to displace use of captive diesel generators. • Increasing efficiency of transmission and distribution systems to reduce losses. • Increasing efficiency of gas power plants; upgrading current *Open Cycle Gas Turbines* to *Combined Cycle Gas Turbines.*	152.754
Agriculture	• Promote use of improved/early maturing varieties (especially rice production), • Encourage improvement in soil management practices to reduce consumption of fertilizer. • Increasing crop diversification and promoting climate smart agriculture. • Promote integrated crop/livestock systems for circular utilization of resources. • Introduction of low energy production systems using agricultural by-products	68.914
Transport	• Promote aggressively the usage of Liquified Petroleum Gas (LPG) and Compressed Natural Gas (CNG) for transportation by 40% by 2030. • Ensure attaining of blending of biofuel in vehicles for transportation by 30% in 2030. • Encourage the replacement of PMS cars with electric cars at least by about 10% in 2030. • Increase switch of human and freight movement from road to energy efficient rail. • Increase switch of human movement from personal use of vehicles to low carbon emission-based public mass transit.	240.884

From an analytical perspective, an estimated 62% increase of investment is expected from the initial investment required in 2015 (US$ 140 billion) by 2030 (due to monetary and fiscal circumstances in the country including global economics influences). This increment further suggests that that the government of Nigeria will have to invest (from its national budget) an estimated US$ 72 billion (going by the 20% unconditional commitment); while US$ 170 billion is expected from international support in form of funding, technology transfer, training, and capacity development (as per 45% conditional commitment). While the balance of US$ 130 billion could yet be sourced from household / corporate funding with potential external interventions.

Therefore, having completed the I&FF assessment, the FGN is now well placed to discuss the costs of climate change - including developing financial strategy and investment planning - in the international climate change negotiations.

Objectives

The objective of this assessment of investments & financial flows is to strengthen the capacity of national policy makers in developing policy options that address climate change mitigation in the power, oil and gas, agriculture, industry, and transport sectors, as well as climate change adaptation in the agriculture sector. It is anticipated that the assessment will contribute to other national climate change strategies such as the NDC 2020 update; Nigeria's Long Term Vision Planning; and will specifically, engage line ministries (especially the Ministry of Finance, Budget, and National Planning) with the goal of fully integrating the results of this assessment within the 2 Medium-term national development plans of 2021 – 2025 and 2025 – 2030 respectively; and Nigeria Agenda 2050 development plans.

The main objective of the I&FF assessment is to determine the amount funds – and their associated sources – necessary to address climate change concerns at the national level. The assessment includes:

1. A collection and analysis of information on investment and financial flows in key sectors, both for a baseline scenario and for mitigation / adaptation scenarios up to 2030.
2. An identification of measures to address climate change adaptation and mitigation.
3. An identification of incremental I&FF needed to implement the identified measures.
4. An assessment of political implications and policies needed to implement the identified mitigation and adaptation scenarios.

Choice of Sectors

Nigeria has opted to assess the following sectors: agriculture, energy (power), industry, oil and gas, and transport from the perspective of mitigation, and agriculture from the perspective of adaptation. Key climate measures within these five (5) sectors as per the existing NDC of 2015 were: (i) ending gas flaring by 2030; (ii) implement Off-grid solar PV of 13GW (13,000MW) (iii) efficient gas generators (iv) 2% per year energy efficiency (30% by 2030) (v) transport shift car to bus (vi) improve electricity grid and (vii) climate smart agriculture and reforestation.

The country is currently facing a massive **power** generation gap with the situation reaching a crisis point in 2015 where national electricity generation fell to a low of 2,800MW. Further concern is the fact that national grid's average available capacity of around 5000MW is inadequate for the demand. Any increase of demand above this threshold without an efficient and appropriate grid expansion program could result in a total collapse of the grid. As such, many individuals and organisations in Nigeria have turned to decentralised electricity supply in the form of off-grid self-generation using inefficient and polluting fossil fuel-based generators in order to bridge the supply/demand gap; causing negative social and environmental consequences.

The **oil and gas** sector contributes up to 14% of the country's GDP and is responsible for 95% of the foreign exchange earnings of Nigeria. It also contributes to 65% of the Federal Budget. However, it employs only around 0.01% of the working population. The impact of the sector on the environment has also not been positive as it has left in its wake, significant pollution and environmental degradation in the Oil producing states within the Niger Delta. The main sources of GHG emissions in the sector are from gas flaring, fugitive methane, on-site fuel use (across the chain of production). The combined contribution of flaring and venting to the environment is about 80% of GHG emissions in the sector.

For the **transport** sector, the current state of the road system in the country is inadequate. The road system is overburdened and poorly maintained while the fast-growing economy has brought many more cars on the road, most of which using polluting fossil fuel called PMS. This has resulted in severe air pollution in major urban areas and adverse effect on human health and by extension vulnerability to disease.

As Nigeria develops economically, emissions from its **industries** are expected to grow significantly. This economic development is welcome and will bring benefits for all Nigerians. At present, majority of emissions in the sector are from the cement and the iron and steel industry both contributing emission of 53.4% and 46.6% respectively. In the future, other industries might begin to contribute a greater proportion than today. In the absence of an energy efficiency mind-set and the lack of benchmarks or standards this might lead to exponential emissions growth in the sector.

Improving **agriculture** is central part of Nigeria's socio-economic development plan. The livelihoods of Nigeria's poorest farmers are already at risk as agriculture in Nigeria is over 95% rain fed and therefore susceptible to climate change. Rising temperatures, variable rainfall, and security threats in rural and farm settlements, thriving pests lead to poor harvest and crop losses. With growing food demand from a growing population, declining harvests would strain supply, increasing malnutrition and possibly reverse recent progress in alleviating poverty. Furthermore, fuel sources are important elements toward mechanisation and agro-processing and predominantly, fossil fuel is used to power farms and grain drying, poultry rearing and greenhouse heating.

Previous Analyses Utilized

In Nigeria, the following analyses were used to conduct the assessment of investment and financial flows:

1. **Nigeria's Nationally Determined Contribution**: Nigeria's NDC demonstrates its determination to contribute to the success of the Paris climate summit in December 2015 and to grow its economy sustainably, while reducing carbon pollution. The NDC promotes sustainable development while delivering on the government development priorities.

2. **Climate Change Policy Framework:** In order to reflect the increasing importance of climate change issues in Nigeria, the Federal Executive Council adopted in 2012 the Nigeria Climate Change Policy Response and Strategy. To ensure an effective national response to the significant and multi-facetted impacts of climate change, Nigeria has adopted a comprehensive strategy, as well as several specific policies. The strategic goal of the Nigeria Climate Change Policy Response and Strategy is to foster low-carbon, high growth economic development and build a climate resilient society.

3. **Climate Change Adaptation Policies**.

    a. Impacts and Vulnerability: The impacts of climate change in Nigeria vary in extent, severity, and intensity. In the absence of in-depth quantitative research, the economic costs have been approximated.

    b. Adaptation Policy Framework: Nigeria's response to climate change has focused on increasing resilience and managing the unavoidable impacts. The National Adaptation Strategy and Plan of Action for Climate Change Nigeria (NASPA-CCN) describes the country's adaptation priorities, bringing together existing initiatives and priorities for future action. The 2011 NASPA-CCN Vision is

an integrated component of sustainable development, reducing the vulnerability and enhancing the resilience and adaptive capacity of all economic sectors and of all people – particularly women, children, and resource-poor men – to the adverse impacts of climate change, while also capturing the opportunities that arise as a result of climate change.

4. **First / Second National Communications to the UNFCCC:** The initial and second National communication designed in 2003 and 2014 respectively, provided information on emissions and removals of greenhouse gases and details of the activities undertaken to implement the Convention including status of climate change in the country.

5. **The Biennial Update Report 2018:** This document holistically looked at Nigeria's National Circumstances, National Greenhouse Gas Inventory which covers the Energy, Industrial Process and Product use (IPPU), Agriculture, Forest, and Other Land Use (AFOLU) and Waste sectors, information on Mitigation actions and their effects, the Monitoring, Reporting and Verification System, Constraints and Gaps as well as Support received and needed.

6. **Third National Communication to UNFCCC – 2020**: This looked critically at Nigeria's National Circumstances, National Greenhouse Gas Inventory, Mitigation Assessment, Vulnerability & Adaptation and Other Information relevant to the UNFCCC convention which covers the Agriculture, Forest and Land Use (AFOLU), Energy (Renewable & Non-renewable Energy), Human Health, Gender, Transportation, Mining & Quarrying, Education Sector and Waste Sectors, information on Mitigation actions and their effects, the Monitoring, Reporting and Verification System, Constraints and Gaps as well as Support received and needed.

Additionally, specific sectoral analyzes have been used including on identification and prioritization of all the sectors' issues, as well as climate research issues on the oil and gas, transport, and industry sectors. Finally, rigorous consultations, various technical trainings, collaborative activities, and workshops at various stages of the project process were undertaken to ensure the success of the IFF assessment.

Institutional Arrangements and Collaborations

The project was implemented by the Department of Climate Change (DCC) of the Federal Ministry of Environment, which is the National Focal Point (NFP) for climate change in Nigeria. The DCC with the support of the UNDP Team provided policy guidance to the process and maintained overall oversight of the activities through the NDC SP Project Coordinator. The Project had a 16-member Technical Working Group (TWG) drawn from ministries and private sector. In addition, Five Team leaders were assigned to coordinate the five NDC sectors namely Power, Oil and Gas, Agriculture, Industry, and Transport. Each sector comprised of Data analysts, Economist and Finance experts, Climate experts and Institutional support. The five teams were trained in Lagos from 17-19 July 2019 on the use of a UNDP methodology developed under the project for assessing the investment and financial flows. Prior to the training, an awareness and sensitization workshop were held on the 16th July 2019 with key institutional actors from different MDAs who will be supporting in data collection.

Thus, Table 2 shows the numerous national institutions that provided data and other information for the purpose of these assessments.

Table 2: List of national data providers per sector for the assessment

S/N	*Sectors*	*National Institutions*
1	Power	1. Federal Ministry of Power (FMP) 2. Federal Ministry of Environment (FMENV) 3. Energy Commission of Nigeria (ECN) 4. Nigerian Electricity Regulatory Commission 5. Rural Electrification Agency 6. Nigerian Bulk Electricity Trader 7. Transmission Company of Nigeria
2	Oil and Gas	1. Federal Ministry of Petroleum Resources 2. Federal Ministry of Environment (FMENV) 3. Department of Petroleum Resources 4. Nigeria National Petroleum Corporation 5. Nigeria Gas Company 6. Pipelines and Product Marketing Company
3	Agriculture	1. Federal Ministry of Agriculture and Rural Development (including Departments 2. National Centre for Agricultural Mechanization, (NAELRS), 3. Federal Ministry of Water Resources (including Agencies and institutes under the ministry), 4. Federal Ministry of Environment (including Agencies and institutes under the ministry), 5. State Government Ministries, 6. Central Bank of Nigeria (CBA) 7. Agricultural Research Council of Nigeria, 8. Nigerian Agricultural Insurance Corporation, 9. Ministry of National Planning and Budget/Budget Office,

		10. Universities and Colleges of Agriculture,
4	Transport	1. Federal Ministries of Transport, 2. Federal Ministry of Works, 3. Federal Ministry of Environment, and 4. Ministry of Finance, Budget, and National Planning 5. Nigeria Bureau of Statistics (NBS) 6. Federal Airports Authority of Nigeria (FAAN 7. Federal Road Safety Commission (FRSC) 8. Nigerian Institute of Transport Technology (NITT) 9. National Inland Waterways Authority (NIWA) 10. Nigerian Maritime Administration and Safety Agency (NIMASA) 11. Nigerian Shippers' Council. 12. Nigeria Customs Service (NCS); and 13. Standard Organization of Nigeria (SON), 14. National Automotive Design and Development Council of Nigeria (NADDC)
5	Industry	1. Federal Ministry of Industry, Trade, and Investment 2. Small and Medium Enterprises Development Agency of Nigeria, 3. Federal Ministry of Power, 4. Federal Ministry of Agriculture, 5. Nigerian Energy Support Programme (NESP), a partnership between the German Government and European Union (EU) implemented by the Deutsche Gesellschaft Für Internationale Zusammenarbeit (GIZ) 6. Bank of Industry

Additionally, another training was convened by the Lead Consultant and facilitated by the Data Analyst and Economic and Finance Expert from the Oil and Gas Sector Team via virtual medium (zoom link) from 21st to 22nd May, 2020 (as physical training could not be scheduled due to the Covid-19 restrictions) on further use of the methodology with focus on IFF analysis, modelling and interpretation of results including political implications and alignment on the sector's IFF.

Methodology and Key Terminology

Basic I&FF methodology

The overall objective of the I&FF assessment is to determine the extent and sources of funds needed to address climate change at the national level, building directly on national government strategies, plans and programmes. The assessment seeks to answer the question: "From a National development perspective, what are the key policy actions and measures (national strategy) that can be put in place to address climate change in the five (5) selected key sectors, and what level of financial appropriations will be required to achieve and operationalize those national strategies / objectives?"

In this context, the I&FF team examined the following questions:

1. What are the National Development goals to 2030 and its relation to low carbon emission development trajectory?
2. What keys sectors have been considered as having strong development impact in relation to climate change challenges in the country?
3. What are the main mitigation / adaptation measures for those selected sectors in the next 15 years?
4. Who is investing in the sectors / Who are the main stakeholders and sources of finance?
5. What changes / increase in I&FF will be needed in the sectors?
6. What additional I&FF are needed to address climate change?

The I&FF assessment covered the period 2015-2030, using a baseline scenario and a reference scenario of 2015. The assessment looks at the changes in I&FF needed for three different groups: households (families, individual farmers), corporations (private and NGOs), and the government. Values are given in constant 2015 US$. Different currency conversion rates have been used in the different sectors due to different approaches used (Power sector: 1US$ = 198 NGN, Oil and Gas: 1US$ = 197.87NGN Agriculture: 1US$ = 195.52NGN, including interest rates which can be sector specific. Although the conversion and interest rates may differ, it is worth to note that the magnitude of difference these conversion rates bring to the assessments is not exceptionally large – and can be seen as a simplified sensitivity analysis for currency conversion and interest rates.

Conceptually, the methodology employed was simple. Pertinent investment and financial flows are projected for selected scenarios in a baseline scenario that assumes no additional efforts to address climate change. Additionally, a mitigation / adaptation scenario was developed that included additional efforts and scaling up of existing efforts to address climate change. The difference between those two scenarios showed the additional resources needed for climate actions in the sectors. The analysis of investment and financial flows (I&FF) for greenhouse gas mitigation and climate change adaptation is an important activity for the development of effective and appropriate national responses to climate change. This methodology spells out clearly what each investment is and the related terminologies.

The methodological approach of the national assessment of I&FF mitigation followed the eight steps outlined.

1. **Establishing key assessment parameters**
   Key parameters were identified to:
   - Determine in detail the scope of the sector.
   - Identify the preliminary measures of mitigation.
   - Specify the period of evaluation and the reference year; and
   - Select an analytical approach in the methodological guide
2. **Compile historical** IF, FF, and O&M cost data, subsidy cost data (if included explicitly) and other input data for scenarios from 2007 – 2017.

3. **Describe baseline scenario**. Defining the baseline scenario is very important and it is the basis for determining the cost between 'business as usual' scenarios and the more efficient alternatives, the target scenarios. To do this, existing plan and programmes had to be identified and projections developed for the outer years of the analysis period.

4. **Estimating the I&FF scenario in the baseline**.
   In this section of the framework approach the analysis involved:
   - Estimates of I&FF annually disaggregated by investment entity and funding source.
   - Estimates the O&M annually disaggregated by investment entity and funding source.
   - Estimate annual subsidy costs for each relevant investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment.

5. Defining potential mitigation scenarios
This involved identifying the mitigating interventions for each sub-sector of the energy sector and listing them for each type of asset.

6. Deriving detailed annual I&FF estimates
This required:
- Estimating annual changes, I&FF and EM required to implement mitigation scenarios.
- Estimating the annual IF, FF, and O&M costs, and subsidy costs, if included, explicitly, for mitigation scenario
- Estimating the annual IF and FF for each investment type, disaggregated by investment entity and funding source.
- Estimating the annual O&M costs for each IF, disaggregated by investment entity and funding source; and
- Estimating annual subsidy costs for each relevant investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment.

7. Calculate the changes in IF, FF, and O&M costs, and in subsidy costs if included explicitly, needed to implement mitigation.
- Calculate changes in cumulative IF, FF, and O&M costs for all investment types.
- Calculate changes in annual IF, FF, and O&M costs for individual investment types, for individual sources of funds, and for all investment types and funding sources.
- If subsidies are included explicitly, consider calculating changes in cumulative and/or in annual subsidies for IF, FF, and O&M for each investment type and all investment types.

8. Assessing policy implications
These highlight the need to:
- Integrate climate change in regional projects, regional and national strategy.
- Strengthen the capacities of all stakeholders.
- Integrating these options in national reference.
- Involve local entities proactively; give responsibility/empowerment to the people.
- Develop activities that support the generation of income/revenue.

It is expected that this national assessment of I&FF will increase greater awareness and understanding of future investments that address climate change as well as development priorities.

Key Terminologies

The Investment and Financial Flows (I&FF) methodology distinguishes between two distinct types of investments: investment flows and financial flows.

Scenario: A 'scenario' is an internally consistent and plausible characterization of future conditions over some specified period. A 'scenario' is an internally consistent and plausible characterization of future conditions over some specified period. Each sectoral I&FF assessment for mitigation / adaptation requires that both a baseline scenario and a mitigation scenario be developed for that sector. In the I&FF assessment methodology, each scenario will have associated with it a stream of annual IF, FF, and O&M costs. The relevant investment costs for a sector are projected for two scenarios: 1) a baseline scenario, which reflects a continuation of current policies and plans, i.e., "business-as-usual" scenario, and 2) a target (mitigation / adaptation) scenario, in which new policy measures are introduced to forestall continued GHG emission to reduce climate change or to adapt to climate change. The investment costs of the baseline and mitigation / adaptation scenarios are then compared to determine the changes in investments needed to mitigate emissions from the sector. Note that changes in investments may include not only increases in investments (new funding), but also shifts in existing investments (reallocations of existing and currently projected funding levels such that funds in one area decrease, and funds in another area increase).

Investment flow (IF): An "investment flow" (IF) is the capital cost of a new physical asset with a life of more than one year, such as the capital cost of a new power plant, a new automobile, a new household appliance or a new agricultural irrigation system. Investment flows are limited to new physical assets because such investments have climate change implications for the duration of the operating lives of the facilities and equipment purchased.

Financial flow (FF): A "financial flow" (FF) is an ongoing expenditure on programmatic measures; financial flows encompass expenditures other than those for expansion or installation of new physical assets. Examples of financial flows include expenditures for an agricultural extension program for farmers, a malaria prevention program to distribute mosquito nets, or the implementation of improved forest management techniques. These expenditures are "operation and maintenance" type costs, e.g., salaries and raw materials.

Operation and Maintenance (O&M) Costs: it is associated with physical assets purchased with investment flows and will have operation and maintenance (O&M) costs associated with them (i.e., ongoing fixed and variable costs such as salaries and raw materials). Operation and maintenance costs of new assets need to be included in I&FF assessments because these costs can vary considerably among investment flow types and can have a significant effect on the total cost of an investment over its lifetime. For example, O&M costs are a much greater share of total costs (capital costs plus O&M costs) for gas-fired electricity generation than photovoltaic electricity generation. O&M costs include the following categories of costs: Salaries or wages of personnel, Fuel costs such as power and/or fuel for operations, fuel for production, Public utilities such as telephone service, Internet connectivity, etc., Raw materials, Maintenance and/or leasing of equipment, Office supplies and consumables, Advertising, insurance, etc.

Investment Entity: An "investment entity" is the body or thing making the investment in the asset. The sources of the I&FF funds are the origins of the funds invested by the investment entities, e.g., domestic equity, foreign debt, domestic subsidies, foreign aid. These are described below for each investment entity.

1. **Households*:*** Households are individuals or groups of individuals (e.g., families) who act as one unit financially. Households invest in assets, such as homes, farms, vehicles, and facilities for small unincorporated businesses. All their investment funds, which include equity (savings, remittances by

relatives in foreign countries), debt (loans from friends, relatives, or financial institutions), and government support in the form of subsidies (e.g., rebates, tax deductions, or tax credits on purchases), are assumed to be domestic to simplify the assessment of I&FF.

2. **Corporations:** Corporations include both financial corporations and non-financial corporations and can be either for profit or not-for-profit.
3. **Governments:** Governments are the national, provincial, state, and local governments of a country. Financial and non-financial corporation's owned wholly or in part by governments, such as public universities and research institutions, and publicly held oil companies, utilities, and water authorities, are included in this category.

Mitigation Scenario: The mitigation scenario includes measures to mitigate GHG emissions the mitigation scenario should describe the expected socio-economic developments, technological change (if appropriate), new measures to mitigate GHG emissions and the expected investment in the sector given the implementation of mitigation measures.

Base Year: The base year is the first year of the assessment period, the first year of baseline, mitigation, and adaptation. The base year should be a recent year for which information on the I&FF and O&M is available so that the IF, FF, and O&M costs for the first year of these scenarios are all historical data. In fact, the reference year as the starting waves of cost data for each scenario is based.

N.B - Due to limited data, this IFF assessment did not include calculations and estimates of projections in respect of annual GHGs emissions, energy conserved, produced and consumed over the assessment period for three of the sectors and the various scenarios.

Chapter Two

Summary of sectoral assessment

The IFF assessment for the sectors is based on historical expenditures from 2013 – 2014, trends from 2015 - 2020; forecast 2021-2030.Hence, presenting a concise guide and plan towards restructuring of countrywide budget – feeding into both the National Development Plan, specifically the medium-term and long-term development planning (2021 to 2025 and 2021 to 2030 respectively) - spending that encourages low emission development while growing the economy. Below is the summarised IFF details for the five (5) sectors; however, full report on the individual sector reports is available for further elaboration and cross referencing.

Energy (Power) sector

Sector scope

Following team meetings on the sectoral scope, the Power sector Team identified the key scope in the Energy sector to be addressed with their corresponding envisioned IFF:

Mitigation Action Focus

1. Increase gas availability and utilization.
2. Grid extension and improving efficiency through rehabilitation of the transmission / distribution system.
3. Facilitate the development of large hydro development.
4. Promotion of Renewable Energy and the clean energy technologies for power generation.
5. Shift towards LPG / CNG in place of higher carbon intensive fossil fuels such as diesel and kerosene as well as charcoal and fuelwood for captive power / heat generation (mini-grid, interconnected mini-grid and industries such as telecom, banking and agro-processing) and clean cooking LPG adoption.

Elaborating a bit, increase adoption in Renewable Energy sources and the use of Liquefied Petroleum Gas (LPG) / Compressed Natural Gas (CNG) were both selected as the substitute to diesel either as primary or captive power sources. In addition, the dilapidated and poor grid efficiency which has resulted in high transmission losses and stranded power that averages 2GW was also considered.

Base year and assessment period

The base year of the assessment was chosen as 2015 while the assessment period for the exercise has also been agreed as 2015 – 2030 according to the contextual nature of the assessment and I&FF methodology. In the utilization of the currency in the exercise, the Nigeria (NGN) was converted to constant 2015 USD. The central bank policy rate of 9.5% was used to compute the Present Value. The current value of the Naira was first deflated using the CPI and then converted to US$. The exchange rate used was taken from the Central Bank of Nigeria Annual Reports where 1US$ is equal to 198 NGN.

Mitigation actions for which I&FF were assessed & results.

The national expert team has determined that the total cost of mitigation projects by 2030 in the Power sector of Nigeria is conservatively placed at about US$152,754 million through the implementation of priority actions around (See table 3 below).

Table 3:Breakdown of total cost for mitigation activities in the power sector

S/N	***Mitigation Actions***	*US$ million*
1	Promotion of renewable energy sources such as solar and small-scale hydro systems for rural electrification	102,092
2	Increase in efficiency of Gas turbines (OCGT to CCGT)	15,422
3	Large hydro based generations	13,012
4.	Improving and rehabilitation of Transmission & Distribution networks	2,379
5.	National LPG Expansion programme (diesel/petrol generators conversion to LPG generators – Captive Generation)	17,450

Thus, in the target scenario, the use of diesel based captive power is not expected to increase beyond 20% and therefore major investment on Gas infrastructure is being projected in 2022 up until 2043. Additionally, with the policy objective of private sector led growth, corporate entities are expected to be major investors and not government. The government intervention will focus mostly on creating enabling policy environment to attract private investment to invest and develop measures being put forward in the IFF analysis towards reducing climate change and dependence on the environment for energy source.

Below presents the IFF calculations within the Energy Sector:

The baseline scenario displays the business-as-usual expenditures during 2015-2030. The first table shows the expenditures broken down by those investing, i.e. households, private sector corporations and the government. For example, the investment into Captive Power by Households indicates that between 2015 and 2030, households are projected to spend 2,126 million US$ for auto-producer electricity generation units.

The second table shows the same expenditures of the baseline scenario broken down by different years in which the expenditures are projected to occur. For example, the figure 799 for investment under Gas Fired Plant in 2021 indicates that across households, corporations, and government 799 million US$ are projected to be spent in 2021.

Table 4: Baseline Scenario: Cumulative Discounted IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source (million 2015US$)

Category of Investment Entity	Source of I&FF Funds	Gas Fired Plants			Large Hydro			Captive Power			Renewables			All Investment Types		
		IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
Households	Total Household Funds (all domestic)	0	0	0	0	0	0	2126	0	213	610	6	27	737	6	240
Corporations	Total Corporation Funds	6265	63	485	173	2	86	1418	0	142	0	0	0	686	64	723
Government	Total Government Funds	1566	16	121	43	0.4	22	0	0	0	2441	24	111	13041	40	254
Total		**7831**	**78**	**606**	**216**	**2**	**108**	**3544**	**0**	**354**	**3051**	**31**	**139**	**14643**	**111**	**1207**

Table 5: Baseline Scenario Annual IF, FF, & O&M Estimates for Baseline Scenario

Year	Annual IF, FF, & O&M Estimates for Baseline Scenario (million 2015US$)														
	Gas-Fired Plant			Hydro Power Plant			Captive Power			Renewables			All Investment Types		
	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
2015	0	0	28.39	0	0	13	230	0	23	999	10	6	1229	10	71
2016	1075	11	35	99	1	12	228	0	23	2052	21	18	3454	32	88
2017	697	7	38	118	1	11	228	0	23	0	0	16	1043	8	88
2018	1104	11	43	0	0	10	227	0	23	0	0	14	1331	11	90
2019	0	0	38	0	0	9	225	0	23	0	0	13	225	0	82
2020	0	0	34	0	0	8	224	0	22	0	0	11	224	0	75
2021	799	8	37	0	0	7	223	0	22	0	0	10	1022	8	77
2022	717	7	40	0	0	6	222	0	22	0	0	9	939	7	78
2023	636	6	41	0	0	6	221	0	22	0	0	8	857	6	77
2024	554	6	41	0	0	5	220	0	22	0	0	7	774	6	74
2025	489	5	41	0	0	4	219	0	22	0	0	6	708	5	73
2026	440	4	40	0	0	4	218	0	22	0	0	5	658	4	72
2027	391	4	39	0	0	3	217	0	22	0	0	5	608	4	69
2028	342	3	38	0	0	3	215	0	22	0	0	4	558	3	66
2029	310	3	37	0	0	3	214	0	21	0	0	4	524	3	65

2030	277	3	35	0	0	2	213	0	21	0	0	3	490	3	63
Total	**7831**	**78**	**606**	**216**	**2**	**108**	**3544**	**0**	**354**	**3051**	**31**	**139**	**14643**	**111**	**1207**

Table 6: Target Scenario: Cumulative Discounted IF, FF, and O&M Estimates

Category of Investment Entity	Source of I&FF Funds	By Investment Type, Investment Entity, and Funding Source (million 2015US$)																	
		Gas Fired Plants			Large Hydro			Renewables			Transmission and Distribution			CNG/LPG			All Investment Types		
		IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M
Households	Total HH Funds	0	0	0	0	0	0	20418	204	1021	0	0	0	0	0	0	20418	204	1021
Corporations	Total Corporation Funds	12337	123	905	10409	104	520	25523	255	1276	0	0	0	6980	70	349	55250	552	3050
Government	Total Government Funds	3084	31	226	2602	26	130	56150	562	2808	2379	24	119	10470	105	524	74686	747	3806
Total		**15422**	**154**	**1132**	**13012**	**130**	**651**	**102092**	**1022**	**5105**	**2379**	**24**	**119**	**17450**	**174**	**873**	**152754**	**1528**	**7878**

Table 7: Target Scenario: Annual IF, FF, and O&M Estimates by Investment Type (million 2015US$)

YEAR	GAS TURBINE POWER PLANTS			LARGE HYDRO POWER PLANTS			RENEWABLES			Transmission and Distribution			CNG/LPG			ALL INVESTMENT TYPES		
	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M
2015	1,500	15	75	1,180	12	59	17,495	175	875	97	1	5	0	0	0	20,272	203	1,014
2016	2,150	22	108	197	2	20	33,895	339	1,695	112	1	6	0	0	0	36,353	364	1,818
2017	1,394	14	70	235	2	22	5,552	56	278	153	2	8	0	0	0	7,335	73	367
2018	2,208	22	110	667	7	33	4,516	45	226	103	1	5	0	0	0	7,495	75	375
2019	900	9	75	1,104	11	55	3,539	35	177	101	1	5	0	0	0	5,644	56	312
2020	896	9	75	688	7	34	3,818	38	191	255	3	13	1,400	14	70	7,058	71	383
2021	1,565	16	108	1,430	14	72	5,326	53	266	208	2	10	1,450	15	73	9,978	100	529

2022	1,402	14	100	1,281	13	64	4,770	48	239	207	2	10	1,500	15	75	9,161	92	488
2023	919	9	61	1,132	11	57	4,215	42	211	184	2	9	1,550	16	78	8,001	80	415
2024	854	9	58	1,013	10	51	3,771	38	189	161	2	8	1,600	16	80	7,399	74	385
2025	789	8	54	894	9	45	3,328	33	166	142	1	7	1,650	17	83	6,802	68	355
2026	740	7	52	805	8	40	2,995	30	150	164	2	8	1,600	16	80	6,303	63	330
2027	691	7	50	715	7	36	2,663	27	133	146	1	7	1,600	16	80	5,815	58	306
2028	642	6	47	626	6	31	2,329	23	116	127	1	6	1,650	17	83	5,374	54	284
2029	610	6	45	566	6	28	2,107	21	105	116	1	6	1,700	17	85	5,099	51	270
2030	561	6	43	477	5	24	1,774	18	89	103	1	5	1,750	18	88	4,665	47	248
Total	**15,422**	**154**	**1,131**	**13,012**	**130**	**651**	**102,092**	**1,021**	**5,105**	**2,379**	**24**	**119**	**17,450**	**175**	**873**	**152,754**	**1,528**	**7,878**

Table 8: Incremental Cumulative Discounted IF & FF Estimates, By Investment Type, Investment Entity, and Funding Source

Category of Investment Entity	Source of I&FF Funds	Incremental Cumulative Discounted IF, FF, & O&M Estimates (million 2015US$)																	
		Gas Fired Plants			Large Hydro			Renewables			Transmission and Distribution			CNG/LPG			All Investment Type		
		ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	IF	FF	O&M
Households	Total Household Funds	0	0	0	0	0	0	20418	204	1276	0	0	0	0	0	0	20418	204	1021
Corporations	Total Corporation Funds	9662	97	483	10409	104	520	25523	255	1276	0	0	0	6980	70	349	52574	526	2108
Government	Total Government Funds	2416	24	121	2602	26	130	56150	562	2808	2379	24	119	10470	105	209	74017	740	3387
Total		**12078**	**121**	**604**	**13012**	**130**	**651**	**102092**	**1021**	**5105**	**2379**	**24**	**119**	**17450**	**175**	**873**	**147010**	**1470**	**7351**

Table 9: Incremental Annual IF & FF Estimates by Investment Type

YEAR	Annual IF, FF, O & M in million 2015 USD																	
	GAS TURBINE POWER PLANTS			LARGE HYDRO POWER PLANTS			RENEWABLES			Transmission and Distribution			CNG/LPG			ALL INVESTMENT TYPES		
	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M	IF	FF	O & M
2015	1500	15	47	1180	12	46	17495	175	869	97	1	5	0	0	0	20042	200	1002
2016	1078	11	73	197	2	8	33895	339	1677	112	1	6	0	0	0	36125	361	1806

2017	697	7	32	235	2	10	5552	56	262	153	2	8	0	0	0	7107	71	355
2018	1104	11	67	667	7	23	4516	45	212	103	1	5	0	0	0	7268	73	363
2019	900	9	37	1104	11	46	3539	35	164	101	1	5	0	0	0	5418	54	271
2020	896	9	41	688	7	26	3818	38	180	255	3	13	1400	14	70	6834	68	342
2021	685	7	71	1430	14	64	5326	53	257	208	2	10	1450	15	73	9955	100	498
2022	84	1	60	1281	13	58	4770	48	230	207	2	10	1500	15	75	8938	89	447
2023	300	3	20	1132	11	51	4215	42	203	184	2	9	1550	16	78	7480	75	374
2024	300	3	17	1013	10	46	3771	38	200	161	2	8	1600	16	80	6879	69	344
2025	300	3	14	894	9	40	3328	33	182	142	1	7	1650	17	83	6284	63	314
2026	300	3	12	805	8	36	2995	30	164	164	2	8	1600	16	80	5786	58	289
2027	300	3	10	715	7	32	2663	27	145	146	1	7	1600	16	80	5298	53	265
2028	300	3	9	626	6	28	2329	23	129	127	1	6	1650	17	83	4859	49	243
2029	300	3	9	566	6	24	2107	21	113	116	1	6	1700	17	85	4585	46	229
2030	284	3	8	477	5	21	1774	18	12	103	1	5	1750	18	88	4152	42	208
Total	**12078**	**121**	**604**	**13012**	**130**	**651**	**102092**	**1021**	**5105**	**2379**	**24**	**119**	**17450**	**175**	**873**	**147010**	**1470**	**7351**

Policy Implication

Achieving the mitigation action plan for the power sector will imply revision of current policies that guide the activities of the sector. Some of the key points that could affect the implementation of increase in renewable energy-based electricity, LPG to power, grid rehabilitation and expansion are as highlighted below:

1. Review of the Electric Power Sector Reform Act (2005) to incorporate green transition and sustainable energy access opportunities, especially within the power value chain in imperative.
2. Investment in new grid infrastructure will help to facilitate integration of renewable sources of electricity which are intermittent in nature particularly solar and wind power. This will involve the upgrade of national grid to ensure compatibility with renewable energy technologies and allow grid tied generation of power from solar. A quick win to this can be achieved if government would ensure that the contract with Siemens which aims to increasing power supply to 25GW by year 2025 puts renewable integration into the grid as part of the terms of reference.
3. Sustaining the momentum and growth of the off-grid sector with active involvement of Rural Electrification Agency and other key National agency to increase the deployment of climate technologies for isolated and interconnected mini grids, development.
4. Align electrification strategies with key national policies such as the National Renewable Action Plan that targets 13GW of off grid solar by year 2030 and expand scope for other renewable energy sources such hydro and bioenergy development, leading up to development of a circular economy / waste to energy prospects.
5. Allow cost reflective tariff structure that will enable investors to recoup their investments and also make renewable energy attractive while enhancing the enabling environment to facilitate gas and its produces such LPG / CNG for captive power utilisation.
6. Finally, to unlock Nigeria's immense energy access potential, government and businesses need to address governance, institutional, policy, and implementation challenges; different levels of financial market maturity; increase of primary finance for RE and overcoming the underdeveloped private sector capacity to utilise RE energy.

Significant Uncertainties and Methodological Limitations

No mechanism (database system) is yet available to record, monitor and measure progress or development in Nigeria's power sector. Therefore, data paucity which was and still is a major constraint, led to projections made over the assessment period after obtaining data for only a few years. Assumption was made to build upon scenarios to help inform certain calculations towards obtaining key data for the analysis. Accordingly, the assessment did not include the calculations and estimates of projections in respect of annual carbon emissions, energy produced and consumed over the assessment period for the various scenarios.

Oil and Gas

Sector scope

For the IFF report of the O&G sector, the following areas and mitigation actions in line with the government's policies and sectoral plan have been identified as the focal actions (mitigation pathways) within the upstream, midstream, and downstream.

Mitigation Action Focus

- Gas flare reduction projects which focus on all actions implemented, on-going or planned to be included in the National Gas Flare Commercialization programme. (please rephrase. Not very clear.)
- Gas pipeline expansion and utilization projects to increase the gas pipeline infrastructure in the country in line with the government's policy of a gas-driven energy sector.
- LNG/LPG/CNG Expansion and Utilization Programme under the fuel switch campaign of the government which is expected to see a switch of fuel utilization for cooking, power generation, industries and in the auto industry.
- Refinery efficiency and bioethanol blending focuses on government program which task the need to ensure efficient refineries and blending of bioethanol with the petroleum product, Petrol motor spirit which is the most consumed petroleum product in the country currently. (please rephrase)

Base year and assessment period

The overall assessment period is between 2013 – 2030; with two years historical period from 2013 - 2014, a baseline (2015) and a fifteen-year projection of 2016 – 2030. In the utilization of the currency in the exercise, the Nigerian Naira (NGN) was converted to constant 2015 USD. The central bank policy rate of 9.0 per cent is used to compute the Net Present Value. The average exchange rate of $1=197.8763NGN i.e., N197.88 approximately taken from the Central Bank of Nigeria Annual Reports. Based on expert understanding of the industry and cross-references with best practices in the industry on a local and international basis, a margin was built to account for the peculiarities in Nigeria's CAPEX and OPEX as explained in Table 10 below:

Table 10: Underlining assumptions

Measures	*Investment Flows*	*Financial Flows*	*Operations & Maintenance*
Gas Flare Commercialization	70-85% of the cost to be spent on gas process and treatment equipment as well as gas pipelines to connect domestic gas grid	1-5% of the cost will be on capacity building, training, awareness programme, bidding and tendering processes and publicity of the gas flare commercialization programme	This is 20 – 25% of the cost spent on operations and maintenance of the facilities. This includes cost on human and material resources.
Gas Pipeline Projects	70-90% of the cost to be spent on right of way, pipelines, gas processing plants, gas treatment equipment as well as gas pipelines that is the main trunk of pipeline transmitting gas inter-state.	2-5% of the cost will be on capacity building and training on activities such as leak detection and repairs, bidding and tendering processes for companies that will implement projects	This is 10 – 25% of the cost will be spent on operations and maintenance of the facilities. This includes cost on human and material resources.
LPG/LNG/CNG	70-75% of the cost is to be spent on complete set of CNG, LPG and Mini LNG plant	2-5% of the cost will be on capacity building, training, awareness programme, bidding	This is 20 – 25% of the cost spent on operations and maintenance of the facilities.

	equipment for domestic consumption in the country. Except for LPG, others are already in place and it is just for expansion purposes	and tendering processes and publicity of the fuel switch programme of the national government	This includes cost on human and material resources inclusive of feedstock for the plants.
Refinery & Blending	70-80% of the cost is to be spent on refineries, ethanol plant and blending facilities. This cost will include efficient modular refineries, blending facility based on 10% blending of ethanol with PMS that should be in place by 2030	2-5% of the cost will be on capacity building, training, awareness programme, bidding and tendering processes and publicity of the gas flare commercialization programme.	This is 20 – 25% of the cost spent on operations and maintenance of the facilities. This includes cost on human and material resources.

Mitigation measures for which I&FF were assessed & results[1]

The national expert team has determined that the total cost of mitigation projects by 2030 in the oil and gas sector of Nigeria is conservatively placed at about US$ 39.422 billion, through the implementation of priority actions around:

1. Reduction of gas flare by 2025[2] (US$1.889 billion), which focuses on all actions implemented, on-going or planned to include the National Gas Flare Commercialization programme.
2. Gas pipeline projects (US$14.700 billion), to increase the gas utilization capacity of the country in line with the government's policy of a gas expansion programme of the energy sector and within the context of low carbon economic development.
3. Design and Implementation of LNG/LPG Utilization (US$1.299 billion), under the fuel switch campaign of the government which is expected to see a switch of fuel utilization for cooking, power generation, industries and in the auto industry.
4. Increasing refinery efficiency and introducing bioethanol blending (US$ 19.279 billion), that focuses on government program tasked to ensure efficient refineries operation and blending of bioethanol with the petroleum product, Petrol Motor Spirit - which is the most consumed petroleum product in the country currently.

Below presents the IFF calculations within the Oil and Gas Sector:

Table 11 - Table 16 below presents the IFF calculations for the Oil and Gas Sector. The oil and gas baseline scenario display the business-as-usual expenditures during 2015-2030. The tables 11 and 12 shows the baseline expenditures broken down by those investing, i.e., households, private sector corporations and the government. Tables 13 and 14 showcase the expenditures under the climate mitigation (target) scenario. The last set of tables (15 and 16) gives the incremental cost which is the difference between the baseline cost and the climate/target cost all broken down by different years in which the expenditures are projected to occur. All these costs show the expected cost across the households, corporations, and government.

:

[1] Contextual nature of the 4 mitigating measures can be found in the oil and gas sector's IFF report

[2] Market Report: Nigeria to End Gas Flaring by 2025 | Africa Oil & Power (africaoilandpower.com)

Table 11: Baseline Scenario: Cumulative Discounted IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

	Gas Flare Utilization			Efficient Gas Pipeline Projects			Gas Solutions (LPG, CNG & LNG)			Refineries & Biofuel blending		
Investment Entity Category	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M
Household	0.00	0.00	0.00	0.00	0.00	0.00	29.95	0.00	23.74	0.00	0.00	0.00
Corporations	1251.46	39.93	3665.36	10091.74	40.37	3020.64	527.24	5.34	269.30	13478.33	125.83	23329.90
Government	481.65	7.34	2787.06	3394.50	0.92	3149.97	660.01	21.63	252.83	4209.10	6.28	4464.81
Total	**1733.11**	**47.27**	**6452.42**	**13486.24**	**41.28**	**6170.61**	**1217.20**	**26.97**	**545.88**	**17687.43**	**132.12**	**27794.71**

Table 12: Baseline Scenario: Annual IF, FF, and O&M Estimates by Investment Type

Annual total IF, FF, O&M costs by investment types in million 2015 (USD)												
Year	GFU			GPP			GAS (LPG, CNG & LNG)			R&B		
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M
2015	5	0	0.1	100.00	-	112.50	100.00	2.00	25.00	100.00	2.00	189.53
2016	5	0	0.1	100.00	0.00	112.50	100.00	2.00	25.00	758.13	2.00	189.53
2017	5	0	0.01	100.00	0.00	25.00	100.00	2.00	25.00	2,100.00	2.00	689.53
2018	5	0	0.01	100.00	0.00	25.00	100.00	2.00	25.00	4,287.00	-	1,189.53
2019	5	0	0.01	100.00	0.00	25.00	100.00	2.00	25.00	6,000.00	-	1,689.53
2020	5	0	0.36	100.00	0.00	26.05	-	-	25.00	-	-	1,389.53
2021	2.5	0	0.33	100.00	0.00	25.34	-	-	25.00	947.66	-	1,436.91
2022	2.5	0	0.31	100.00	0.00	25.79	-	-	25.00	-	-	1,436.91
2023	2.5	0	0.29	200.00	4.00	75.40	-	-	25.00	-	-	836.91
2024	2.5	0	0.28	200.00	4.00	75.88	-	-	25.00	-	-	836.91
2025	2.5	0	0.26	100.00	2.00	50.41	-	-	25.00	947.66	-	536.91
2026	2.5	0	0.25	100.00	0.00	50.68	-	-	25.00	-	-	536.91

2027	2.5	0	0.24	100.00	2.00	50.79	-	-	25.00	-	-	536.91
2028	2.5	0	0.23	100.00	0.00	50.72	-	-	25.00	-	-	300.00
2029	2.5	0	0.22	100.00	0.00	50.75	-	-	25.00	1,137.19	-	584.30
2030	2.5	0	0.21	50.00	0.00	38.18	-	-	25.00	-	-	584.30
Total	**55**	**0**	**3.21**	**1,750**	**12**	**644.99**	**500**	**10**	**400**	**16,277.64**	**6**	**12,964.15**

Table 13: Target Scenario: Cumulative Discounted IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

BAU Discounted Total IF, FF AND O&M Cost by Investment Type/ Entity												
	GFU			**GPP**			**GAS (LPG, CNG & LNG)**			**R&B**		
Investment Entity Category	**IF**	**FF**	**O&M**	**IF**	**FF**	**O&M**	**IF**	**FF**	**O&M**	**IF**	**FF**	**O&M**
Household	0.00	0.00	0.00	0.00	0.00	0.00	29.95	0.00	23.74	0.00	0.00	0.00
Corporations	1251.46	39.93	3665.36	10091.74	40.37	3020.64	527.24	5.34	269.30	13478.33	125.83	23329.90
Government	481.65	7.34	2787.06	3394.50	0.92	3149.97	660.01	21.63	252.83	4209.10	6.28	4464.81
Total	**1733.11**	**47.27**	**6452.42**	**13486.24**	**41.28**	**6170.61**	**1217.20**	**26.97**	**545.88**	**17687.43**	**132.12**	**27794.71**

Table 14: Target Scenario: Annual IF, FF, and O&M Estimates by Investment Type

	GFU			*t CO2 e*	*GPP*			*t CO2 e*	*GAS (LPG, CNG & LNG)*			*t CO2 e*	*R&B*			*t CO2 e*
Year	**IF**	**FF**	**O&M**		**IF**	**FF**	**O&M**		**IF**	**FF**	**O&M**		**IF**	**FF**	**O&M**	
2015	423.80	8.04	171.66	2.07	100.00	-	112.50	-	100.00	0.00	25.00		100.00	2.00	189.53	
2016	283.50	14.18	171.66	2.66	100.00	-	112.50	-	100.00	0.00	25.00		758.13	2.00	189.53	
2017	273.40	11.72	11.72	3.06	100.00	-	25.00	-	105.00	2.00	26.25		2,100.00	22.00	689.53	
2018	234.40	11.72	11.72	3.06	100.00	-	25.00	-	100.00	2.00	26.25		4,287.00	40.00	1,236.28	
2019	137.77	5.86	5.86	6.58	100.00	-	26.05	-	100.00	2.00	26.25	0.03	6,000.00	60.00	1,689.53	
2020	116.22	0.00	0.00	6.31	450.00	5.00	112.84	-	52.94	-	40.14	0.23	-	-	3,189.53	
2021	420.00	0.00	0.00	8.80	950.00	2.00	263.29	8.96	94.12	-	50.96	0.36	1,131.66	-	3,282.91	
2022	0.00	0.00	0.00	8.80	1,900.00	2.00	500.40	13.38	58.82	2.94	41.70	0.51	655.25	5.63	3,400.73	4.25
2023	0.00	0.00	0.00	8.80	1,900.00	2.00	500.88	16.53	58.82	2.94	41.70	0.64	468.25	5.63	1,853.98	4.34
2024	0.00	0.00	0.00	8.80	1,850.00	7.00	787.91	24.80	117.65	5.88	57.13	0.78	1,489.66	4.50	1,872.41	4.38
2025	0.00	0.00	0.00	8.80	1,850.00	7.00	788.48	26.87	117.65	5.88	26.25	0.85	1,152.16	2.25	1,038.04	4.43
2026	0.00	0.00	0.00	12.37	1,850.00	2.00	788.29	33.07	58.82	2.94	41.69	0.85	-	-	2,386.91	4.47
2027	0.00	0.00	0.00	12.37	1,550.00	6.00	713.22	33.07	58.82	2.94	41.69	0.92	-	-	2,386.91	4.43
2028	0.00	0.00	0.00	11.58	800.00	6.00	713.25	35.82	58.82	2.94	41.69	0.92	-	-	2,296.80	4.38
2029	0.00	0.00	0.00	11.58	800.00	3.00	713.18	42.52	58.82	2.94	41.69	0.92	1,137.19	-	2,296.80	4.34
2030	0.00	0.00	0.00	11.58	300.00	3.00	543.63	46.06	58.82	2.94	41.61	0.95	-	-	2,296.80	4.29
Total	**1889.09**	**51.52**	**372.62**	**122**	**14700**	**45.00**	**6726.40**	**281**	**1299.10**	**38.40**	**595.00**	**8**	**19,279.3**	**144.0**	**30296.2**	**39**

Table 15: Incremental Cumulative Discounted IF & FF Estimates, By Investment Type, Investment Entity, and Funding Source

Discounted Incremental Annual Total IF, FF, O&M costs by Investment types/entity												
	GFU			**GPP**			**GAS (LPG, CNG & LNG)**			**R&B**		
Investment Entity Category	ΔIF	ΔIF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
Household	0.00	0.00	0.000	0.00	0.00	0.00	19.56	49.51	27.60	0.00	0.00	0.00
Corporations	3320.84	4143.57	848.734	2858.72	12912.84	10132.11	263.72	693.88	440.84	21664.65	36808.23	13604.17
Government	1857.80	2332.11	-291.651	2852.10	6153.94	3304.08	-31.65	606.72	401.03	2507.93	6925.90	2474.72
Total	5178.64	6475.68	557.083	5710.82	19066.78	13436.19	251.63	1350.12	869.47	24172.58	43734.13	16078.88

Table 16: Incremental Annual IF & FF Estimates by Investment Type

Year	***GFU***			***GPP***			***GAS (LPG, CNG & LNG)***			***R&B***		
	ΔIF	**ΔFF**	**ΔO&M**	**ΔIF**	**ΔFF**	**ΔO&M**	**ΔIF**	**ΔFF**	**ΔO&M**	**ΔIF**	**ΔFF**	**ΔO&M**
2015	418.80	8.04	171.56	-	0	-	-	-2	0	0	-	-
2016	278.50	14.18	171.56	-	-	-	-	-2	0	0	-	-
2017	268.40	11.72	11.71	-	-	-	5.00	0	1.25	0	20.00	-
2018	229.40	11.72	11.71	-	-	-	-	0	1.25	0	40.00	46.75
2019	132.77	5.86	5.85	-	-	1.05	-	0	1.25	0	60.00	-
2020	111.22	0.00	-0.36	350.00	5.00	86.79	52.94	0	15.14	0	-	1,800.00
2021	417.50	0.00	-0.33	850.00	2.00	237.95	94.12	0	25.96	184	-	1,846.00

2022	-2.50	0.00	-0.31	1,800.00	2.00	474.61	58.82	2.94	16.7	655.25	5.63	1,963.81
2023	-2.50	0.00	-0.29	1,700.00	2.00	425.48	58.82	2.94	16.7	468.25	5.63	1,017.06
2024	-2.50	0.00	-0.28	1,650.00	3.00	712.03	117.65	5.88	32.13	1489.66	4.50	1,035.50
2025	-2.50	0.00	-0.26	1,750.00	5.00	738.07	117.65	5.88	1.25	204.5	2.25	501.13
2026	-2.50	0.00	-0.25	1,750.00	2.00	737.61	58.82	2.94	16.69	0	-	1,850.00
2027	-2.50	0.00	-0.24	1,450.00	4.00	662.43	58.82	2.94	16.69	0	-	1,850.00
2028	-2.50	0.00	-0.23	700.00	6.00	662.53	58.82	2.94	16.69	0	-	1,996.80
2029	-2.50	0.00	-0.22	700.00	3.00	662.43	58.82	2.94	16.69	0	-	1,712.50
2030	-2.50	0.00	-0.21	250.00	3.00	505.45	58.82	2.94	16.61	0	-	1,712.50
Total	**1834.09**	**51.52**	**369.41**	**12950.0**	**33.0**	**5906.43**	**799.1**	**28.34**	**195.00**	**3001.66**	**138.01**	**17332.0**

Policy Implication

The Federal Government and various states have over the years developed several policy documents to promote key elements of climate compatible development, enabling policies, emerging investments, existing local level implementation efforts, and the role of international partnerships. These policies alone will not transform Nigeria's oil and gas sector towards climate mitigation. To incentivize the flow of international finance to mitigation projects in Nigeria, domestic policies and institutions must be properly aligned with more traditional economic incentives to attract investments, enforce efficiency measures, establish sustainable tariff practices for just transition, demonstrate the feasibility of modern technologies, and ensure responsible use of gas resources. Adequate governance, accountability and transparency are key values that will drive this to fruition.

Therefore, the following are policies recommended within the context of the oil and gas IFF result:

- Gas Flaring Reduction: Flaring reduction is and should continue to be the highest priority action, not only to reduce the direct emissions from the flaring, but also to extract maximum benefit from conserving gas through implementation of other mitigation measures.
- Incentivize gas production: Although Nigeria has embarked on its transition to low carbon emission developments, it will not totally end oil production. Therefore, the gas sub-sector should be incentivized to grow as a real sector in the short to medium term before embracing other novel and eco-friendly energy sources in the long term. The FGN may need to empower the Nigeria National Petroleum Corporation to develop a low-carbon strategy and action plan on behalf of the oil and gas sector.
- Innovative use of gas: Liquefied Petroleum Gas (LPG), Liquefied Natural Gas (LNG) and Compressed Natural Gas (CNG) provides innovative ways to utilize gas for domestic use in the country. Owing to the high cost of installing gas gathering and processing facilities at small flare sites, consideration should be given to collecting the small volumes of AG into CNGs, LPGs and LNGs to the point of use. In line with the policy direction of the Federal Ministry of Petroleum Resources, gas is expected to be used for cooking, automobiles, mini, medium and large-scale power generation in the country.
- Research on new energies as global demand for oil may peak and begin to decline before 2030. Impacts over and above this depends on the emergence of disruptive technologies such as batteries for electric vehicles or the hydrogen technology (a prospect for Nigeria due to one of its production sources being gas). These do not only depend on technical innovation but also on the availability of relatively cheap electricity (generated by low carbon fuel sources).[3]
- Deliver competitiveness and market access: e.g., pricing, quality, market entry and incentivizing transiting climate friendly technology and infrastructures for example removal of import tariff on LPG equipment, etc.

Key uncertainty and methodological limitation

Assessing investment and financial flows in relation to GHG emission has been limited to mitigation actions due to the nature of the industry. Data availability was a huge barrier, hence the estimate for data on investment, O&M and FF.

[3] Paris Mismatches: The Impact of the COP21 Climate Change Negotiations on the Oil and Gas Industries - John Mitchell and Beth Mitchell. Energy, Environment and Resources Department | August 2016. Pg. 4.

Agriculture

Sector scope

The Nigeria's Green Alternative outlined six (6) key sub-sectors of developmental focus to achieve a diversified economy, food security, poverty reduction and job creation (FMARD, 2016). These are: Industrial Commodities; Consumer Commodities; Export Commodities; Fresh fruits and Vegetables; Livestock; and Aquaculture- Fisheries and Cold Storage. In addition, the three (3) pillars recognized in the policy thrust for growth of Nigeria's agriculture include promotion and financing of agricultural investment in infrastructure, adoption of improved varieties and breeds of crops and livestock; building capacities and research for agricultural innovation which will enhance productivity and efficiency. However, the National Policy on Climate Change of 2015 further contracted national key focus to Crop production, Livestock, and Fisheries as three (3) agricultural sub-sectors that will be majorly impacted by climate change. Drawing from the National Policy, the I&FF assessment narrowed its sectoral scope to: Crop production, Livestock and Fisheries.

The assessment also considered agroforestry because of the usefulness of this production systems in supporting mitigation and adaptation actions in agriculture. Though the sectoral scope focuses on the three subsectors above, it mainly relied on the issues identified in the policy thrusts of FMARD (2016) and FME (2020) to address mitigation and adaptation actions in the 3 agricultural subsectors. Accordingly, three investment areas were identified to support in the transition towards Climate Smart Agriculture within the context of the sub-sectors identified: Infrastructure and Services, Equipment and Machinery; and Irrigation.

Base year and assessment period

The year 2005 was chosen as the base year for the assessment. The assessment period for the exercise has also been 2015 to 2030. The Nigeria Naira (NGN) was converted to constant 2015 USD, the central bank policy rate of 12.5 per cent is used to compute the Present Value. The current value of the Naira was first deflated using the CPI and then converted to US$. The exchange rate used is taken from the Central Bank of Nigeria for the base year, 2015 was US$ 1 = NGN195.52 to 1USD. This is the twelve-month average of the Exchange Rate/Inter-bank Foreign Exchange Market (IFEM) from the CBN records in 2015. The APP's and NAIP's projection of economic growth rate of 5% was used to make projections of the mitigation and adaptation actions further into the future from where ATA and NAIP stopped.

Mitigation measures for which I&FF were assessed & results.

The agricultural sector is a significant contributor of anthropogenic GHGs. Total net national emissions from Nigeria including removals, amounted to 712,638 Gg CO2-eq with AFOLU (Agriculture, Forestry and Other Land Use) contributing 476,949 Gg CO2-eq (66.9%) of total aggregated emissions (FME, 2018). Agriculture sector alone gave a net emissions of 366,734 Gg CO2-eq with a removal of 4,288 Gg CO2-eq under HWP which is the highest emissions for the period considered in the First Biennial Update Review (FME, 2018). In 2015 the net emissions from the AFOLU sector were 476, 948 Gg CO2-eq while in the year 2000 the emissions from the same sector was 376,861 Gg CO2-eq representing an increase of about 27%.

Among the factors attributed for the increase were:

- the increase in livestock populations and

- increased consumption of nitrogen based synthetic fertilizers (FME, 2018). Emissions from livestock are generated through enteric fermentation and poor manure management from domestic animals such as cattle, sheep, goats, horses, swine, donkeys (asses and mules), camels and poultry.

Total emissions from livestock increased from 21877 Gg CO2-eq in 2000. Enteric fermentation constituted an overall average of about 90% of the total emissions from livestock and manure management contributed the remaining 10%. CH4 emissions from rice cultivation was 7356 Gg CO2-eq in 2015 but in 2009 it was 4225 Gg CO2-eq. Emissions from rice cultivation constituted about 2.6% of the total emissions from aggregated source and non-CO2 emission from land in 2015 (FME 2018).

The national expert team has determined that the total cost of climate action (mitigation and adaptation) projects by 2030 in the Agriculture sector of Nigeria is conservatively placed at about US$ 68.914 billion, through the implementation of priority actions around: Infrastructure, Equipment and Machinery, Irrigation/Drainages in a ratio of 57.59%: 4.66%: 37.75% respectively. Accordingly, the climate measures to be undertaken within the crop production, livestock and fishery subsectors will require the following investments: Infrastructure: US$ 35.973 billion; Equipment's and Machines: US$2.920 billion and Irrigation: US$25.086 billion, respectively.

Some of the mitigation actions and associated Investment costs[4] are depicted:

- Developing improved livestock breeds (US$ 533.09m);
- Production of improved fodder and forage seeds for livestock productivity (US$ 533.05m);
- Provision of facilities for Improved manure Management (US$ 925.9m);
- Crop rotation (fertilizer for Maize-Soybean and other legumes rotation) (US$ 5.23bn);
- Fertilizer quality control (US$ 3.8289m); Improved rice seed (early maturing and with low exudation rate) (US$ 898.83m);
- Sustainable/efficient water resources management (US$ 220.22m).

The total envisioned emission reduction between 2015 and 2030 under the mitigation actions was put at 495,653.8 Gg CO2eq yr-1 under the climate actions scenario.

Adaptation measures for which I&FF were assessed & results.

According to (FME,2011) in the absence of adaptation, climate change could result in a loss of between 2% and 11% of Nigeria's GDP by 2020, rising to between 6% and 30% by the year 2050. For Nigeria to respond to climate change appropriately will mean doing things differently and allocating resources differently. It will require investments beyond the resources of a developing country such as Nigeria. But the cost of not taking any action is significantly higher. The expected loss could be in the range of N15 trillion (US$100 billion) and N69 trillion (US$460 billion) by 2050. Agricultural sector will bear a huge share of this loss with the adverse impacts occurring in the form of rise in temperature, change in pattern of rainfall, sea level rise, and extreme weather events. Adaptation measures relative to climate change in the agricultural sector are numerous and varied and therefore require huge financial resources for human and technical capacity building. Thus, for adaptation actions, the list of activities and associated costs are:

- Construction of embankment (dikes) (US$ 110.14m);
- Provision of potable water for livestock (US$ 177.68m);
- Establishment of grazing reserves (US$ 735.72m);

[4] Full details of climate measure and actions can be found in the IFF Agriculture sector report.

- Establishment of fattening schemes and development of feedlots (US$ 340.35m); (US$ 402.48M) respectively
- Agroforestry and capacity building (US$ 1.113bn)

- Promoting the use of improved/early maturing varieties (especially rice production),
- Encouraging improvement in soil management practices to reduce consumption of fertilizer.
- Increasing crop diversification and promoting climate smart agriculture.
- Promoting integrated crop/livestock systems to ensure circular utilization of resources.
- Introduction of low energy production systems using agricultural by-products to meet energy needs

See below the investment results as calculated in the Agriculture sector:

Table 17: Baseline Scenario: Cumulative IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

Investment entity category / source of funds	Infrastructure				Equipment and Machinery				Irrigation/Dam/Drainage				Cumulative Total for All Investment Entities			
	IF	FF	O&M	subsidies	IF	FF	O&M	subsidies	IF	FF	O&M	Subsidies	IF	FF	O&M	Subsidies
Households	244.39	1235.40	50.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	244.39	1235.40	50.47	0.00
Corporations	131.71	665.20	27.20	0.00	0.00	0.00	0.00	12.63	0.00	0.00	0.00	0.00	131.71	665.20	27.20	12.63
Governments	904.02	191.65	183.83	7.29	47.70	26.70	7.49	9.04	707.92	28.62	141.58	0.00	1659.64	247.25	332.90	16.33
Total funds	1280.24	2092.12	261.12	7.29	47.70	26.70	7.49	19.92	707.92	28.62	141.58	0.00	2035.85	2147.95	410.19	27.21

Table 18: Baseline Scenario: Annual IF, FF, and O&M Estimates by Investment Type

	Infrastructure				Equipment and Machinery				Irrigation/Dam/Drainage				Cumulative Total for All Investment Types			
Year	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy
2015	66.06	107.98	13.49	0.38	2.46	1.39	0.39	0.93	36.53	1.48	7.31	0	105.05	110.85	21.18	1.30
2016	67.71	110.68	13.83	0.39	2.53	1.43	0.40	0.97	37.44	1.51	7.49	0	107.68	113.62	21.71	1.35
2017	69.40	113.45	14.17	0.40	2.59	1.46	0.41	1.00	38.38	1.55	7.68	0	110.37	116.46	22.26	1.40
2018	71.14	116.28	14.53	0.41	2.65	1.50	0.42	1.04	39.34	1.59	7.87	0	113.13	119.37	22.81	1.45
2019	72.92	119.19	14.89	0.42	2.72	1.54	0.43	1.06	40.32	1.63	8.06	0	115.96	122.36	23.38	1.47
2020	74.74	122.17	15.27	0.43	2.79	1.57	0.44	1.10	41.33	1.67	8.27	0	118.85	125.42	23.97	1.53
2021	76.61	125.23	15.65	0.44	2.86	1.61	0.45	1.15	42.36	1.71	8.47	0	121.82	128.55	24.57	1.58
2022	78.52	128.36	16.04	0.45	2.93	1.65	0.46	1.19	43.42	1.76	8.68	0	124.87	131.77	25.19	1.64
2023	80.49	131.57	16.44	0.46	3.00	1.70	0.47	1.24	44.51	1.80	8.90	0	127.99	135.06	25.81	1.70
2024	82.50	134.85	16.85	0.47	3.07	1.74	0.48	1.29	45.62	1.84	9.12	0	131.19	138.44	26.46	1.76
2025	84.56	138.23	17.21	0.48	3.15	1.78	0.49	1.34	46.76	1.89	9.35	0	134.47	141.90	27.05	1.83
2026	86.68	141.68	17.71	0.49	3.23	1.83	0.51	1.40	47.93	1.94	9.59	0	137.83	145.45	27.80	1.89
2027	88.84	145.22	18.15	0.51	3.31	1.87	0.52	1.46	49.13	1.99	9.83	0	141.28	149.08	28.50	1.96

2028	91.06	148.85	18.60	0.52	3.39	1.92	0.53	1.52	50.35	2.04	10.07	0	144.81	152.81	29.21	2.04
2029	93.34	152.57	19.07	0.53	3.48	1.97	0.55	1.58	51.61	2.09	10.32	0	148.43	156.63	29.94	2.11
2030	95.67	156.39	19.55	0.55	3.56	2.01	0.56	1.65	52.90	2.14	10.58	0	152.14	160.54	30.69	2.19
Total	**1280.25**	**2092.70**	**261.46**	**7.29**	**47.70**	**26.97**	**7.49**	**19.93**	**707.92**	**28.62**	**141.58**	**0.00**	**2035.87**	**2148.29**	**410.53**	**27.22**

Table 19: Baseline Scenario: Cumulative IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

	Infrastructure Services												Equipment & Machinery												Irrigation/Dam/Drainage			
Investment	Crop Production				Livestock				Fishery				Crop Production				Livestock				Fishery				Crop Production			
	IF	FF	O&M	Subs.	IF	FF	O&M	Subs.	IF	FF	O&M	Subs.	IF	FF	O&M	Subs.	IF	FF	O&M	Subs.	IF	FF	O&M	Subs.	IF	FF	O&M	Subs.
HH	1765.36	12932.58	353.07	0.00	23.28	0.00	5.83	0.0	103.55	58.06	20.71	0.00	328.65	77.79	65.73	0.00	183.56	71.54	36.71	0.00	77.22	45.42	15.44	0.00	344.87	1384.16	68.97	0.00
Corp.	950.58	6938.51	190.12	0.00	12.52	0.00	3.14	0.0	200.47	76.18	31.06	19.90	176.97	41.89	35.39	0.00	336.15	156.74	82.27	73.27	221.22	79.56	30.12	75.66	185.70	745.32	37.14	0.00
Govt	584.79	13230.94	116.96	46.92	50.01	5.77	12.51	0.00	119.23	76.56	29.81	0.00	90.80	79.79	18.16	60.56	241.90	173.98	60.47	0.00	159.10	76.70	39.77	0.00	18145.95	1419.65	3629.19	25.08
Total funds	3300.72	33102.03	660.14	46.92	85.81	5.77	21.48	0.00	423.26	210.79	81.58	8.33	596.42	199.46	119.28	60.56	761.61	402.25	179.45	73.27	457.54	201.68	85.34	75.66	18676.53	3549.13	3735.31	25.08

Table 20: Target Scenario: Annual IF, FF, and O&M Estimates by Investment Type

Year	Infrastructure					Equipment & Machinery					Irrigation					Cumulative Total for All Investment Types				
	IF	FF	O&M	subsidy	CO2/Yr	IF	FF	O&M	Subsidy	CO2/Yr	IF	FF	O&M	Subsidy	CO2/Yr	IF	FF	O&M	Subsidy	CO2/Yr
2015	452.60	817.48	90.03	2.95	17947	77.96	33.96	16.45	10.08	5749.20	789.51	156.44	157.90	1.06	2394	1320.08	1007.886	264.3842	14.0918	26090.2
2016	171.82	1013.80	33.73	4.11	18313	81.67	35.66	17.24	10.39	5848.20	829.38	163.27	165.88	1.11	2298	1082.88	1212.73	216.84	15.62	26459.20
2017	161.08	1339.06	31.55	3.93	18606	85.57	37.44	18.06	10.73	6140.61	870.35	170.45	174.07	1.17	2334	1117.00	1546.94	223.68	15.82	27080.61
2018	226.40	1358.29	44.58	5.28	18904	89.66	39.31	18.93	11.07	6447.64	914.42	177.98	182.88	1.23	2372	1230.48	1575.58	246.39	17.57	27723.64
2019	237.72	1734.84	46.81	5.54	19207	93.95	41.28	19.84	11.44	6770.02	959.59	185.88	191.92	1.29	2410	1291.26	1962.00	258.56	18.26	28387.02
2020	249.60	2375.23	49.15	5.81	19514	98.46	43.34	20.79	11.82	7108.49	1007.87	194.19	201.57	1.35	2448	1355.94	2612.76	271.51	18.99	29070.49
2021	262.08	2396.23	51.60	6.11	19826	103.19	45.51	21.79	12.22	7463.95	1058.27	202.90	211.65	1.42	2487	1423.54	2644.65	285.05	19.75	29776.95
2022	275.19	2418.28	54.18	6.41	20143	108.16	47.78	22.84	12.64	7837.15	1110.78	212.05	222.16	1.49	2527	1494.13	2678.12	299.18	20.55	30507.15
2023	288.95	2441.43	56.89	6.73	20466	113.38	50.17	23.95	13.09	8229.00	1166.42	221.67	233.28	1.57	2568	1568.75	2713.27	314.12	21.38	31263.00
2024	303.39	2465.74	73.40	7.07	20793	118.86	52.68	25.18	13.55	8640.45	1225.19	231.76	245.04	1.64	2609	1647.44	2750.18	343.62	22.27	32042.45
2025	318.56	2491.25	77.07	7.42	21126	124.61	55.32	26.40	14.04	9072.43	1286.10	242.35	257.22	1.73	2651	1729.28	2788.92	360.70	23.19	32849.43
2026	334.49	2518.06	80.93	7.80	21295	130.66	58.08	27.69	14.55	9526.10	1350.15	253.48	270.03	1.81	2672	1815.30	2829.62	378.64	24.16	33493.10
2027	351.21	2546.19	84.97	8.19	21465	137.00	60.99	29.03	15.09	10002.41	1418.36	265.16	283.67	1.90	2693	1906.57	2872.34	397.68	25.18	34160.41
2028	368.77	2579.19	89.22	8.60	21637	143.66	64.04	30.45	15.65	10502.53	1488.73	277.42	297.75	2.00	2715	2001.17	2920.65	417.41	26.25	34854.53
2029	387.21	2610.39	93.68	9.03	21810	150.65	67.24	31.93	16.25	11027.65	1563.27	290.30	312.65	2.10	2736	2101.14	2967.93	438.27	27.37	35573.65
2030	406.58	2650.34	98.37	9.48	21948	158.00	70.60	33.49	16.87	11578.98	1640.98	303.83	328.20	2.20	2758	2205.56	3024.77	460.05	28.55	36320.98
Total	**4795.67**	**33755.80**	**1056.16**	**104.46**	**323037**	**1815.45**	**803.39**	**384.05**	**209.48**	**131944.80**	**18679.38**	**3549.13**	**3735.88**	**25.08**	**40672**	**25290.49**	**38108.33**	**5176.09**	**339.01**	**495653.80**

Table 21: Incremental Cumulative Discounted IF & FF Estimates, By Investment Type, Investment Entity, and Funding Source

INCREMENTAL CUMULATIVE DISCOUNTED IF, FF, & O&M ESTIMATES BY INVESTMENT TYPE/ENTITIES FOR 2015 – 2030 (2015 Million USD)																
Investment Entity Category/Source of Funds	**INFRASTRUCTURE & SERVICES**				**EQUIPMENT/MACHINERY**				**IRRIGATION/DAM/DRAINAGE**				**TOTAL**			
	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy	IF	FF	O&M Costs	Subsidy
Households	619.10	4866.34	127.04	22.62	212.22	83.17	42.44	0.00	1573.37	604.41	314.67	0.00	2404.69	5553.92	484.16	22.62
Corporations	574.59	2709.48	110.71	8.43	290.98	118.24	58.47	63.12	847.20	325.45	169.44	0.00	1712.77	3153.17	338.62	71.55
Government	391.55	5515.79	98.08	15.31	252.60	128.54	59.97	26.02	5324.10	606.82	1064.82	10.83	5968.25	6251.14	1222.86	52.16
Total Funds	1585.24	13091.61	335.83	46.36	755.80	329.94	160.88	89.14	**7744.67**	**1536.68**	**1548.93**	**10.83**	10085.71	14958.24	2045.64	146.33

Table 22: Incremental Cumulative IF & FF Estimates, By Investment Type

INCREMENTAL ANNUAL IF, FF, O&M ESTIMATES BY INVESTMENT TYPES FOR 2015- 2030																
	INFRASTRUCTURE				**EQUIPMENT/MACHINES**				**IRRIGATION/DAM/DRAINAGE**				**Cumulative Total for All Investment Types**			
Year	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy	IF	FF	O&M	Subsidy
2015	386.54	709.50	76.54	3.24	75.50	32.57	16.07	9.15	752.98	154.97	150.60	1.06	1215.02	897.04	243.20	13.45
2016	104.11	903.12	19.90	4.43	79.15	34.23	16.84	9.43	791.94	161.76	158.39	1.11	975.20	1099.11	195.13	14.97
2017	91.68	1225.61	17.37	4.27	82.98	35.98	17.66	9.72	831.98	168.89	166.40	1.17	1006.64	1430.48	201.42	15.16
2018	155.26	1242.00	30.05	5.64	87.00	37.81	18.51	10.03	875.08	176.39	175.02	1.23	1117.35	1456.20	223.58	16.89
2019	164.80	1615.65	31.91	5.93	91.23	39.74	19.41	10.38	919.27	184.25	183.85	1.29	1175.31	1839.64	235.18	17.59
2020	174.86	2253.06	33.88	6.24	95.67	41.77	20.35	10.72	966.54	192.51	193.31	1.35	1237.08	2487.34	247.54	18.31
2021	185.47	2271.01	35.95	6.56	100.34	43.89	21.34	11.07	1015.91	201.19	203.18	1.42	1301.71	2516.09	260.48	19.06
2022	196.66	2289.92	38.14	6.90	105.23	46.13	22.38	11.45	1067.36	210.30	213.47	1.49	1369.26	2546.35	274.00	19.84
2023	208.46	2309.86	40.45	7.26	110.39	48.48	23.48	11.84	1121.91	219.87	224.38	1.57	1440.76	2578.21	288.31	20.67
2024	220.89	2330.88	56.55	7.63	115.79	50.94	24.70	12.26	1179.57	229.91	235.91	1.64	1516.25	2611.74	317.16	21.54
2025	234.00	2353.03	59.80	8.02	121.47	53.53	25.91	12.69	1239.34	240.46	247.87	1.73	1594.81	2647.03	333.57	22.44
2026	247.81	2376.38	63.22	8.44	127.43	56.26	27.18	13.15	1302.23	251.54	260.45	1.81	1677.47	2684.17	350.84	23.41
2027	262.37	2400.97	66.82	8.88	133.69	59.11	28.51	13.63	1369.24	263.17	273.85	1.90	1765.30	2723.26	369.18	24.41
2028	277.71	2430.34	70.62	9.33	140.27	62.12	29.91	14.14	1438.38	275.39	287.68	2.00	1856.36	2767.85	388.20	25.47
2029	293.87	2457.81	74.61	9.81	147.18	65.27	31.38	14.67	1511.65	288.22	302.33	2.10	1952.71	2811.30	408.33	26.58
2030	310.91	2493.95	78.82	10.31	154.44	68.59	32.93	15.23	1588.08	301.69	317.62	2.20	2053.42	2864.23	429.36	27.74
Total	**3515.42**	**31663.11**	**794.63**	**112.89**	**1767.75**	**776.42**	**376.56**	**189.56**	**17971.46**	**3520.51**	**3594.29**	**25.08**	**23254.63**	**35960.04**	**4765.49**	**327.53**

Policy Implication

The climate actions listed are geared towards achieving emission reductions in crop production, livestock, fisheries, and aquaculture sub-sectors. Thus, they need to be rigorously integrated within national policy frameworks to create the enabling environment in realizing NDC targets. Also, reduction of vulnerability of the people and the agricultural system should be pushed simultaneously by mainstreaming the adaptation actions to ensure that food security is not compromised as the population continues to grow. Accordingly, the policy actions (thrust) should target the following:

- Creation of a "National Climate Change Fund" for small and medium-sized enterprises and pro-poor enterprises to facilitate mobilization and access to resources needed to implement the climate actions.
- Improve the infrastructure which will contribute to growth and emission reduction in the agriculture sector as this will reduce energy consumed as transportation time and cost of refrigerating for preservation purposes are also reduced.
- Build human and institutional capacities on climate change related agricultural extension and awareness creation and food security.
- Fund research and development in Climate Smart Agriculture, Improved breed of crops and animal species, early warning systems
- Support private sector and donor organizations partnership in driving bankable agriculture pipeline projects.
- Promote active and rigorous development of improved feeds with the aim of reducing GHG gas from enteric fermentation in the livestock subsector.
- Focus on research that engender improved varieties for feed production in the livestock industry

Key uncertainties and limitations of the methodology

The assessment of the Agricultural Sector IFF was challenging on account of difficulty in accessing data. The bureaucratic process in public ministries and agencies, in most cases, made the collection of data within the timeframe of this exercise problematic. This was further worsened with the lockdown following the global outbreak of COVID-19 pandemic and the inability of relevant officers to be in their duty posts at federal and State levels in Nigeria. This is particularly so with gathering of data between 2010 and 2015 to support the construction of historic Investment and Financial Flow analysis. To address the challenge of missing data, estimates were derived from assumptions earlier established by the Federal Ministry of Agriculture (FMARD) and Central Bank of Nigeria. For example, some of the data collected were not disaggregated into crop production, livestock, and fisheries sectors or in terms of sources of the funds which made the analysis to fall back to an assumption that the ratio of the Agricultural Activity Mix (Crop production (85%), Livestock (10%) and Fisheries and others (5%) (FMARD, 2016).

Similarly, data on State level investments are mostly lacking and estimates were derived based on the projection made by the Nigerian Agricultural Sector Performance Review (2018) which was also validated during the analysis. The calculation of the cost of mitigation and adaptation actions used the 5% economic growth rate projection made in the FMARD (2016) and FME (2020) to forecast I&FF up to 2030. The assessment in some places relied on expert judgment which might have led to over or understatement of the values in each subsector. Additionally, it is anticipated that as the assumptions change over the years, the estimates arrived at for the mitigation and adaptation plans will consequentially change.

Industry

Sector scope

For the Industry sub-sector, attention was given to the most emission intensive sub-categories which were the primary focus as captured by Nigeria's BUR1 submitted to the UNFCCC in 2018. These included the following:

- Mineral Industry- Cement
- Metal Industry- Iron & Steel

Base year and assessment period

The year 2005 was chosen as the base year for the assessment. The assessment period for the exercise has also been 2015 to 2030. The Nigeria Naira (NGN) was converted to constant 2015 USD, the central bank policy rate of 12.5 per cent is used to compute the Present Value (PV). The current value of the Naira was first deflated using the CPI and then converted to US$. The exchange rate used is taken from the Central Bank of Nigeria for the base year, 2015 was US$ 1 = NGN195.52 to 1USD.

Mitigation measures for which I&FF were assessed & results.

The mitigation scenario explored measures to mainstream energy efficient technologies, climate change mitigation processes and activities in the Industry Sector across the spectrum of the two (2) sub-categories under the scope of assessment, Mineral - Cement and Metal-Iron & steel, with specific focus on CO_2 emission reduction in cement manufacturing where historically, production of cement is an energy intensive process requiring Coal, Gas and Biomass as fuel. Production of Steel contributes GHGs emissions at two major points in the production process.
Historically, the production of Cement is known to be an energy intensive process requiring Coal, Gas and Biomass as fuel for firing the kilns as well as for operations in the various production units. Thus, the assessment focused on the investment/patronage of specific products, i.e. Cement and Steel by corporations while assessing their old less efficient, upgraded efficient technologies, methods and processes used in their production.

To mitigate the effects of climate change in the Mineral Industry- Cement, an investment of US$ 69.24 million will be required and while the steel Industry will require an investment of US$ 668.08 million to resuscitate and maintain the operations of moribund steel industry.

Table 23: Baseline Scenario: Annual IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source (in 2015 mil. US$)

Annual Total IF, FF, O&M costs by Investment types/entity							
		Cement			**Steel**		
Investment Category	**Investment Entity**	**IF**	**FF**	**O&M**	**IF**	**FF**	**O&M**
Household		0.00	0.00	0.00	0.00	0.00	0.00
Corporations	Domestic						
	Domestic equity	62.32	0.00	484.69	0.00	0.00	400.86
	Domestic borrowing	6.92	0.00	323.13	0.00	0.00	267.24
	Total Domestic funds	69.24	0.00	807.82	0.00	0.00	668.09
	Foreign						
	FDI		0.00	17.31	0.00	0.00	0.00
	Foreign borrowing		0.00	259.66	0.00	0.00	0.00
	ODA		0.00	69.24	0.00	0.00	0.00
	Total foreign sources		0.00	346.21	0.00	0.00	0.00
	Total Corporation Funds	69.24	0.00	1,154.02	0.00	0.00	668.09
Government		0.00	0.00	0.00	0.00	0.00	0.00
Total Funds		**69.24**	**0.00**	**1,154.02**	**0.00**	**0.00**	**668.09**

Table 24: Baseline Scenario: Annual IF, FF, and O&M Estimates, By Investment Type

Annual total IF, FF, O&M costs by investment types in million 2015 (USD)						
Year	Cement			Steel		
	IF	FF	O&M	IF	FF	O&M
2015	3.38	0.00	56.36	0.00	0.00	50.16
2016	3.74	0.00	62.30	0.00	0.00	50.16
2017	4.14	0.00	69.05	0.00	0.00	48.25
2018	4.36	0.00	72.62	0.00	0.00	48.25
2019	4.44	0.00	74.01	0.00	0.00	44.14
2020	4.44	0.00	74.01	0.00	0.00	39.72
2021	4.47	0.00	74.57	0.00	0.00	39.72
2022	4.47	0.00	74.57	0.00	0.00	39.72
2023	4.47	0.00	74.57	0.00	0.00	39.12
2024	4.47	0.00	74.57	0.00	0.00	39.12
2025	4.47	0.00	74.57	0.00	0.00	39.12
2026	4.47	0.00	74.57	0.00	0.00	38.12
2027	4.47	0.00	74.57	0.00	0.00	38.12
2028	4.47	0.00	74.57	0.00	0.00	38.12
2029	4.47	0.00	74.57	0.00	0.00	38.12
2030	4.47	0.00	74.57	0.00	0.00	38.12
Total	**69.2**	**0**	**1154.05**	**0**	**0**	**668.08**

Table 25: Target Scenario: Cumulative Discounted IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

Total IF, FF, O&M costs by Investment types/entity							
		Cement			**Steel**		
Investment Category	**Investment Entity**	**IF**	**FF**	**O&M**	**IF**	**FF**	**O&M**
Household		0.00	0.00	0.00	0.00	0.00	0.00
Corporations	Domestic						
	Domestic equity	99.06	0.00	998.26	88.00	0.00	47.83
	Domestic borrowing	396.25	0.00	3,993.02	132.00	0.00	71.74
	Total Domestic funds	495.31	0.00	4,991.28	220.00	0.00	119.57
	Foreign						
	FDI	33.02	0.00	332.75	16.50	0.00	0.00
	Foreign borrowing	257.56	0.00	2,595.47	264.00	0.00	0.00
	ODA	39.62	0.00	399.30	49.50	0.00	0.00
	Total foreign sources	330.21	0.00	3,327.52	330.00	0.00	0.00
	Total Corporation Funds	825.52	0.00	8,318.80	550.00	55.00	119.57
Government		0.00	0.00	0.00	0.00	0.00	0.00
Total Funds		**825.2**	**0.00**	**8,318.80**	**550.00**	**55.00**	**119.57**

Table 26: Target Scenario: Annual IF, FF, and O&M Estimates, By Investment Type

Annual total IF, FF, O&M costs by investment types in million 2015 (USD)						
Year	Cement			Steel		
	IF	FF	O&M	IF	FF	O&M
2015	7.25	0.00	15.24	0.00	0.00	0.00
2016	42.89	0.00	107.55	0.00	0.00	0.00
2017	49.19	0.00	219.87	0.00	0.00	0.00
2018	53.56	0.00	273.09	0.00	0.00	0.00
2019	56.07	0.00	303.21	0.00	0.00	0.00
2020	56.07	0.00	433.16	50.00	5.00	0.00
2021	56.29	0.00	436.51	50.00	5.00	11.96
2022	56.84	0.00	528.89	50.00	5.00	11.96
2023	51.69	0.00	613.44	50.00	5.00	11.96
2024	54.68	0.00	648.83	50.00	5.00	11.96
2025	54.68	0.00	648.83	50.00	5.00	11.96
2026	54.68	0.00	648.83	50.00	5.00	11.96
2027	54.68	0.00	741.52	50.00	5.00	11.96
2028	57.66	0.00	879.71	50.00	5.00	11.96
2029	59.65	0.00	910.05	50.00	5.00	11.96
2030	59.65	0.00	910.05	50.00	5.00	11.96
Total	**825.53**	**0.00**	**8318.78**	**550.00**	**55.00**	**119.6**

Table 27: Incremental Cumulative Discounted IF & FF Estimates, By Investment Type, Investment Entity, and Funding Source

Incremental Discounted Annual Total IF, FF, O&M costs by Investment types/entity							
		Cement			**Steel**		
Investment Category	**Investment Entity**	**IF**	**FF**	**O&M**	**IF**	**FF**	**O&M**
Household		0.00	0.00	0.00	0.00	0.00	0.00
Corporations	Domestic						
	Domestic equity	32.66	0.00	456.51	78.22	0.00	-313.804
	Domestic borrowing	307.62	0.00	2899.67	104.30	0.00	-154.469
	Total Domestic funds	340.28	0.00	3356.18	182.52	0.00	-468.274
	Foreign						
	FDI	20.61	0.00	196.93	10.30	0.00	0.00
	Foreign borrowing	142.93	0.00	1296.21	146.50	0.00	0.00
	ODA	19.54	0.00	162.81	24.42	0.00	0.00
	Total foreign sources	183.08	0.00	1655.95	181.22	0.00	0.00
	Total Corporation Funds	523.36	0.00	5012.13	363.74	48.89	-468.274
Government		0	0.00			0.00	0.00
Total Funds		**523.36**	**0.00**	**5012.13**	**363.74**	**48.89**	**-468.274**

Table 28: Incremental Cumulative Annual IF & FF Estimates, By Investment Type,

Year	Investment Types					
	Cement			Steel		
	ΔIF	**ΔFF**	**ΔO&M**	**ΔIF**	**ΔFF**	**ΔO&M**
2015	3.87	0.00	-41.12	0.00	0.00	-50.16
2016	39.15	0.00	45.25	0.00	0.00	-50.16
2017	45.05	0.00	150.82	0.00	0.00	-48.25
2018	49.2	0.00	200.47	0.00	0.00	-48.25
2019	51.63	0.00	229.2	0.00	0.00	-44.14
2020	51.63	0.00	359.15	0.00	0.00	-39.72
2021	51.82	0.00	361.94	0.00	0.00	-27.76
2022	52.37	0.00	454.32	0.00	0.00	-27.76
2023	47.22	0.00	538.87	0.00	0.00	-27.16
2024	50.21	0.00	574.26	0.00	0.00	-27.16
2025	50.21	0.00	574.26	0.00	0.00	-27.16
2026	50.21	0.00	574.26	0.00	0.00	-26.16
2027	50.21	0.00	666.95	0.00	0.00	-26.16
2028	53.19	0.00	805.14	0.00	0.00	-26.16
2029	55.18	0.00	835.48	0.00	0.00	-26.16
2030	55.18	0.00	835.48	0.00	0.00	-26.16
TOTAL	**756.33**	**0.00**	**7164.73**	**0.00**	**0.00**	**-548.48**

Policy Implication

About policy influence for the sector towards climate change mitigation, the following have been suggested:

- The Central Bank of Nigeria should set up a dedicated finance pool at low interest rate to encourage Cement, Iron and Steel Manufacturers who are eager to invest in the construction of energy efficient plants and facilities.
- There FGN via the Federal Inland Revenue Services- FIRS, should provide incentives and tax reliefs to cement manufacturers who meet a certain threshold of GHGs emissions reduction.
- Enforceable industrial end-use energy efficiency regulatory interventions should be integrated into a National Industrial Development Policy and planning strategy documents.
- Develop and implement policies that offer incentives or issue certificates to cement, Iron & Steel manufacturers with capacity and active evidence of actual use of low carbon energy and energy efficient technologies. The goal of this structure will be for the Industry sector to contribute in significant ways to mitigating climate change.
- The Federal Government of Nigeria- FGN, through the Department of Climate Change of the Federal Ministry of Environment- DCC, should put in place incentives-based mechanism for rewarding cement and Iron and Steel companies that have mainstreamed the global best practices on low carbon utility in manufacturing standards and practices in their facilities.

Key Uncertainties and Methodological Limitation

Data access and/or paucity were major limitation to the assessment. No access could be gained to records of investment as the private sector participants were not willing to provide information considered confidential. On the parts of government, no access could be gained to records of monitoring of investment flows and GHGs emission reduction in Nigeria's Industry sector. Granted that some industry players had assured the release of some of the data available to them, the onset of COVID-19 made that impossible with the attendant lockdown of the economy. This led to projections made over the assessment period with the few data obtained from some industry literature, especially for cement investment which cover 2004 and 2008 only. Annual projections made for the assessment period were based on these sector-specific investment data which was disaggregated using GHGs emissions from the sub-categories which were indexed to the macro-economic parameters of the country.

Transport

Sector scope

To improve understanding of the cost of GHG emissions within the transport sector and their relative significance to facilitate the identification of policies and measures for emissions mitigation, the transport team focused on two major scopes: (i) switch from petroleum motor spirit (PMS) to low carbon emission fuel and, (ii) modal shift from road to rail and public mass transit (BRT and metro). The road transportation in Nigeria remains a major user of fossil fuel, with a 54% increase recorded over the past two and a half decades.

Base Year and Assessment Period

The base year of the assessment is chosen as 2015. The assessment period for the exercise has also been agreed as 2015 – 2030 according to the contextual nature of the assessment and I&FF methodology. In the utilization of the currency in the exercise, the Nigeria (NGN) was converted to constant 2015 USD. The central bank policy rate of 9.0% is used to compute the Present Value. The current value of the Naira was first deflated using the CPI and then converted to US$. The average exchange rate for 2015 is 1US$ is equal to NGN198, however, using this gives us negative incremental values. Therefore, 1US$ is equal to NGN360 is used, this represents the average exchange rate for 2015-2020.

Mitigation measures for which I&FF were assessed & results.

- Promote aggressively the usage of Liquified Petroleum Gas (LPG) and Compressed Natural Gas (CNG) for transportation by 40% by 2030.
- Ensure attaining of blending of biofuel in vehicles for transportation by 30% in 2030.
- Encourage the replacement of PMS cars with electric cars at least by about 10% in 2030.
- Increase switch of human and freight movement from road to energy efficient rail.
- Increase switch of human movement from personal use of vehicles to low carbon emission-based public mass transit.

The tables 29 – 33 below gives the cost under the baseline scenario, target/climate scenario and the incremental cost which is the differential between the climate and target scenario. Table 32 gives the total cost of mitigation projects by 2030 in the transport sector of Nigeria. This is conservatively placed at a mitigation cost of about US$172449.5 with $38550.60 million and $133898.90 million accounting for cost relating to modal shift from road to rail and fuel technology, respectively.

Below presents the IFF calculations of the Transport Sector[5]

Table 29: Baseline Scenario: Cumulative Discounted IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

Year	Modal Shift			Fuel & Tech		
	IF	FF	O&M	IF	FF	O&M
2015	749.89	37.50	187.468	6103.80	30.52	3121.817
2016	705.61	35.28	176.399	5706.62	28.53	3273.201
2017	745.37	37.27	186.343	5333.43	26.66	3697.361
2018	313.87	15.69	78.465	3344.20	16.72	5079.508
2019	473.01	23.65	118.249	6151.74	30.76	1785.056
2020	496.89	24.85	124.220	3978.50	19.89	1490.275
2021	467.26	23.36	116.814	4376.23	21.88	1244.175
2022	439.39	21.97	109.848	3771.98	18.86	1038.713
2023	413.19	20.66	103.297	3518.29	17.59	867.1835
2024	388.55	19.43	97.138	3284.30	16.42	723.9783
2025	365.38	18.27	91.345	3067.31	15.33	604.4234
2026	343.59	17.18	85.897	2864.07	14.32	504.6104
2027	323.10	16.16	80.775	2672.86	13.36	421.2793
2028	303.84	15.19	75.958	2493.64	12.47	351.7104
2029	285.72	14.29	71.429	2325.53	11.63	293.6294
2030	268.68	13.43	67.169	2167.81	10.84	245.1398
Total	**7083.35**	**354.17**	**1770.814**	**61160.34**	**305.80**	**24742.06**

[5] Data was significantly a huge challenge, so investment calculations was heavily relied on external data and then extrapolated within the context of Nigeria's economic setting, specifically focusing in 'All investment types' narratives.

Table 30: Baseline Scenario: Annual IF, FF, and O&M Estimates, By Investment Type

Year	Modal Shift			Fuel & Tech		
	IF	FF	O&M	IF	FF	O&M
2015	817.38	40.87	204.34	6653.14	33.27	3402.78
2016	838.33	41.92	209.58	6780.04	33.90	3888.89
2017	965.28	48.26	241.32	6906.95	34.53	4788.19
2018	443.06	22.15	110.76	4720.61	23.60	7170.14
2019	727.78	36.39	181.94	9465.22	47.33	2746.53
2020	833.33	41.67	208.33	6672.35	33.36	2499.34
2021	854.17	42.71	213.54	7999.92	40.00	2274.40
2022	875.52	43.78	218.88	7515.91	37.58	2069.70
2023	897.41	44.87	224.35	7641.36	38.21	1883.43
2024	919.84	45.99	229.96	7775.14	38.88	1713.92
2025	942.84	47.14	235.71	7914.97	39.57	1559.67
2026	966.41	48.32	241.60	8055.68	40.28	1419.30
2027	990.57	49.53	247.64	8194.48	40.97	1291.56
2028	1015.34	50.77	253.83	8333.06	41.67	1175.32
2029	1040.72	52.04	260.18	8470.69	42.35	1069.54
2030	1066.74	53.34	266.68	8606.88	43.03	973.28
Total	**14194.72**	**709.75**	**3548.64**	**121706.4**	**608.53**	**39925.99**

Table 31: Target Scenario: Cumulative Discounted IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

Discounted Annual Total IF, FF, O&M costs by investment types/entities in million 2015 USD						
	Modal Shift			Fuel & Tech		
Investment Entity Category/Source of Funds	IF	FF	O&M Costs	IF	FF	O&M Costs
Total Household Funds	21220.51	1061.03	10610.26	73705.82	368.53	25636.31
Corporations	0.00	0.00	0.00	0.00	0.00	0.00
Domestic	0.00	0.00	0.00	0.00	0.00	0.00
Domestic equity	4672.41	233.62	2336.20	16228.80	81.15	5644.69
Domestic borrowing	2857.74	142.88	1428.87	9925.87	49.63	3452.41
Total Domestic Sources	7530.15	376.50	3765.07	26154.67	130.77	9097.10
Foreign		0.00	0.00	0.00	0.00	0.00
FDI	655.44	32.77	327.72	2276.57	11.38	791.84
Foreign borrowing	751.66	37.59	375.83	2610.75	13.05	908.07
ODA	137.92	6.90	68.96	479.04	2.40	166.62
Total Foreign Sources	1545.02	77.26	772.51	5366.36	26.83	1866.53
Total Corporation Funds	9075.17	453.76	3108.71	40169.67	200.85	10963.63
Government			0.00	0.00		
Domestic			0.00	0.00		
Domestic funds	843.54	42.18	421.77	2929.89	14.65	1019.08
Foreign			0.00	0.00		
Foreign borrowing	116.08	5.81	58.04	403.19	2.02	140.24
Bilateral ODA	479.25	23.96	239.62	1664.57	8.32	578.97
Multilateral ODA	439.67	21.98	219.84	1527.13	7.64	531.16
Total Foreign Sources	1035.00	51.75	517.50	3594.89	17.98	1250.38
Total Government Funds	1878.54	93.93	939.27	6524.79	32.63	2269.45
Total Funds	**32174.22**	**1608.71**	**14658.24**	**120400.27**	**602.01**	**38869.39**

Table 32: Target Scenario: Annual IF, FF, and O&M Estimates, By Investment Type

Year	Modal Shift			Fuel & Tech		
	IF	FF	O&M	IF	FF	O&M
2015	48.10	2.41	24.05	6653.14	33.27	4083.33
2016	48.10	2.41	24.05	7004.59	35.02	4666.67
2017	2781.10	139.06	1390.55	7141.35	35.71	5745.83
2018	2781.10	139.06	1390.55	5132.22	25.66	8604.17
2019	2781.10	139.06	1390.55	9935.22	49.68	3295.83
2020	2781.10	139.06	1390.55	7803.41	39.02	2999.21
2021	2733.00	136.65	1366.50	9042.84	45.21	2729.28
2022	2733.00	136.65	1366.50	8635.98	43.18	2297.37
2023	2733.00	136.65	1366.50	8768.38	43.84	2090.61
2024	2733.00	136.65	1366.50	8618.56	43.09	1902.45
2025	2733.00	136.65	1366.50	8782.31	43.91	1731.23
2026	2733.00	136.65	1366.50	8947.53	44.74	1541.36
2027	2733.00	136.65	1366.50	9111.70	45.56	1402.64
2028	2733.00	136.65	1366.50	9276.33	46.38	1276.40
2029	2733.00	136.65	1366.50	9440.77	47.20	1155.11
2030	2733.00	136.65	1366.50	9604.56	48.02	1051.15
Total	**38550.6**	**1927.56**	**19275.3**	**133899**	**669.49**	**46572.6**

Table 33: Incremental Annual IF & FF Estimates, By Investment Type

Year	Modal Shift			Fuel & Tech		
	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
2015	-773.25	-38.66	-182.28	-549.34	-2.75	343.39
2016	-797.85	-39.89	-189.34	-884.42	-4.42	38.95
2017	1182.24	59.12	832.44	-1392.52	-6.96	-351.35
2018	1527.14	76.36	874.34	-1084.82	-5.42	-1074.73
2019	1079.74	53.99	721.82	-3008.01	-15.04	-604.47
2020	824.95	41.25	620.81	-2019.43	-10.09	-711.01
2021	640.87	32.04	533.98	-3053.18	-15.27	-781.39
2022	496.08	24.8	466.92	-3181.8	-15.91	-916.73
2023	360.94	18.05	404.82	-3604.15	-18.02	-920.86
2024	234.61	11.73	347.26	-4134.57	-20.68	-910.3
2025	116.29	5.82	293.85	-4511.54	-22.55	-888.76
2026	5.27	0.26	244.24	-4874.52	-24.37	-871.29
2027	-99.12	-4.96	198.08	-5222.44	-26.11	-834.05
2028	-197.5	-9.88	155.09	-5557.15	-27.79	-793.36
2029	-290.41	-14.52	114.98	-5878.84	-29.39	-752.42
2030	-378.38	-18.92	77.5	-6187.78	-30.94	-708.53
Total	**3931.62**	**196.59**	**5514.53**	**-55144.5**	**-275.72**	**-10736.9**

Policy Implication

Findings from our analysis indicate that individuals and corporation will incur the highest investment resulting from switching of PMS engines to LPG or biofuel engines, it therefore becomes imperative for the government to provide:

- Subsidies or incentives to improve the interest of individuals and cooperation in switching from PMS to low carbon emission alternatives.
- Establish monitoring systems with indicators to measure progress in the transition towards sustainable low carbon transport and mobility at regional, national, and local levels.
- Optimize freight and logistics supply chains.
- Increase low-carbon energy supply in concert with projected e-mobility demand and remaining internal combustion solutions.
- Pursue transformation of urban transport and land use to drive decarbonization.
- Deploy transport sector pricing mechanisms (e.g. electronic road pricing, parking policies, emissions-based vehicle taxation, number plate auctioning) on a broad scale to catalyse sectoral transformation and de-risk long term investments in low carbon technologies
- Phase out fossil fuel subsidies (and/or support global efforts for subsidy reform) and reinvest in improved transport services. To do this, appropriate safety nets must be put in place to absorb the macro-economic shocks for the masses.

Significant Uncertainties and Methodological Limitations

No mechanism (database system) is yet available to record, monitor and measure progress or development in Nigeria's transport sector. Therefore, data paucity, which was and still a major constraint, led to projections made over the assessment period after obtaining data for only a few years. A significant number of assumptions was utilized to build upon scenarios to help inform certain calculations towards obtaining key data for the analysis. For example, it was assumed that by 2030, electric vehicles, CNG and LPG vehicles will be part of the mix and not more than 20% of the total vehicles in Nigeria by 2030 as part of the technology and fuel shift climate mitigation scenario. Accordingly, the assessment did not include the calculations and estimates of projections in respect of annual carbon emissions, energy produced and consumed over the assessment period for the various scenarios.

Chapter 3

Summary tables of incremental investment costs

Table 34: Incremental Annual I&FF for All Investments in Each Sector (in million 2015 US$)

	Incremental Annual Total (2015-2030) IF & FF (million 2015US$)																	
Year	Mitigation															Adaptation		
	Industry			Oil & Gas			Power			Transport			Agriculture			Agriculture		
	Δ IF	ΔFF	ΔO&M	Δ IF	ΔFF	ΔO&M	Δ IF	ΔFF	ΔO&M	Δ IF	ΔFF	ΔO&M	Δ IF	ΔFF	ΔO&M	Δ IF	ΔFF	ΔO&M
2015	3.87	0	-91.28	418.8	6.04	171.56	20042	200	1002	-1322.59	-41.41	161.11	74.71	505.36	15.07	114.7.07	393.25	229.66
2016	39.15	0	-4.91	278.5	12.18	171.56	36125	361	1806	-1682.27	-44.31	-150.39	69.85	574.50	13.98	805.55	406.83	161.33
2017	45.05	0	102.57	273.4	31.72	12.96	7107	71	355	-210.28	52.16	481.09	65.30	704.55	13.07	740.07	433.81	148.21
2018	49.2	0	152.22	229.4	51.72	59.71	7268	73	363	442.32	70.94	-200.39	61.04	633.50	12.22	735.36	399.65	147.26
2019	51.63	0	185.06	132.77	65.86	8.15	5418	54	271	-1928.27	38.95	117.35	57.07	736.31	11.43	689.50	427.18	138.07
2020	51.63	0	319.43	514.16	5.00	1901.57	6834	68	342	-1194.48	31.16	-90.2	53.35	927.82	10.68	646.96	474.57	129.54
2021	51.82	0	334.18	1545.62	2.00	2109.58	9955	100	498	-2412.31	16.77	-247.41	49.87	831.64	9.99	606.85	433.17	121.51
2022	52.37	0	426.56	2511.57	10.57	2454.82	8938	89	447	-2685.72	8.89	-449.81	46.62	745.59	9.33	569.02	395.64	113.93
2023	47.22	0	511.71	2224.57	6.57	1458.96	7480	75	374	-3243.21	0.03	-516.04	43.59	668.61	8.73	533.74	361.61	106.86
2024	50.21	0	547.1	3254.81	13.38	1779.38	6879	69	344	-3899.96	-8.95	-563.04	40.75	599.72	9.62	500.73	330.73	103.55
2025	50.21	0	547.1	2069.65	13.13	1240.19	6284	63	314	-4395.25	-16.73	-594.91	38.09	538.07	8.99	469.49	302.68	97.07
2026	50.21	0	548.1	1806.32	4.94	2604.05	5786	58	289	-4869.25	-24.11	-627.05	35.61	482.89	8.40	440.21	277.21	91.00
2027	50.21	0	640.79	1506.32	6.94	2528.88	5298	53	265	-5321.56	-31.07	-635.97	33.29	433.48	7.85	412.98	254.04	85.36
2028	53.19	0	778.98	756.32	8.94	2675.79	4859	49	243	-5754.65	-37.67	-638.27	31.13	389.46	7.34	387.13	233.50	80.00
2029	55.18	0	809.32	756.32	5.94	2391.40	4585	46	229	-6169.25	-43.91	-637.44	29.10	349.82	6.86	363.02	214.28	75.00
2030	55.18	0	809.32	306.32	5.94	2234.35	4152	42	208	-6566.16	-49.86	-631.03	27.20	314.76	6.41	340.29	197.56	70.30
Total	**756.33**	**0**	**6616.25**	**18584.85**	**250.87**	**23802.91**	**147010**	**1470**	**7351**	**-51212.9**	**-79.13**	**-5222.37**	**756.58**	**9436.06**	**159.98**	**9387.97**	**5535.70**	**1898.64**

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[i] Policy implications for all the 5 sectors considered the policy brief analysis undertaken in August 2020 for NDC 2030. Kindly refer to it for more details.