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Climate Technology Centre & Network

Federal Ministry of Environment - Department of Climate Change

Federal Ministry of Science and Technology – Department of Environmental Sciences and Technology

Technology Needs Assessment and associated action plan for climate change mitigation and adaptation in Nigeria's most vulnerable economic sectors

Report on the Pre-selection of Sub-Sectors

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Contents

1. Executive summary	5
2. Introduction and objectives.....	7
3. Methodology for the pre-selection of sub-sectors	8
4. Country context	10
5. Climate change priorities.....	13
6. Sectoral development priorities.....	16
7. Selection and prioritization process	24

List of Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
ATA	Agricultural Transformation Agenda
BUR	Biennial Update Report
BUR1	First Biennial Update Report
CTCN	Climate Technology Centre and Network
FAO	Food and Agriculture Organization of the United Nations
FMEEnv-DCC	Federal Ministry of Environment – Department of Climate Change
FMST	Federal Ministry of Science and Technology
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse gas
GW	Gigawatt
IFC	International Finance Corporation
INDC	Intended Nationally Determined Contribution
IPPU	Industrial Processes and Product Use
LED	Light emitting diodes
MW	Megawatt
NASPA-CCN	National Adaptation Strategy and Plan of Action for Climate Change Nigeria
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NIP	National implementation plan
NIRP	Nigeria Industrial Revolution Plan
NPCC	National Policy on Climate Change
NREEEP	National Renewable Energy and Energy Efficiency Policy



PV	Photovoltaic
RESIP	Rural Electrification Strategy and Implementation Plan
TNA	Technology Needs Assessment
TNC	Third National Communication
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar
YTB	Year-to-date



1. Executive summary

This report addresses the methodology used for the identification and prioritization of sectors and subsectors that would be covered in the Technology Needs Assessment (TNA) in Nigeria. The sub-sector selection is the second step in conducting the TNA process, and the outcome of this step will be used as an input to identify the long list of technologies, which will then become the basis for discussion and selection of technologies in the next stage. In pre-selecting the sub-sectors, Nigeria's national strategies and policies were reviewed and analyzed, and later assessed against a set of criteria to ensure that the technologies identified are in line with Nigeria's development and climate change mitigation and adaptation priorities and targets.

The overall objective of this activity is to enable the development of a comprehensive TNA and action plan to meet the climate change mitigation and adaptation priorities and targets in Nigeria. Nigeria is a relatively small contributor to worldwide greenhouse gas (GHG) emissions, with a total net national emissions amounting to 609,784 ktCO₂ equivalent in 2016. Emissions per capita from 2000 to 2016 varied between 3.26 and 3.59 ktCO₂ equivalent.¹ Nigeria faces several challenges in mitigation and adaptation by the country, which are highlighted in Nigeria's Third National Communication (TNC) to the United Nations Framework Convention on Climate Change (UNFCCC) in March 2020 and other relevant documents. The TNC also emphasizes the importance of technology transfers for Nigeria to address the impacts of climate change.

In light of this, Nigeria has requested the support of Climate Technology Centre and Network (CTCN) and United Nations Industrial Development Organization (UNIDO) for the development of a TNA and associated action plan for climate change mitigation and adaptation. These documents will be used by Nigeria to implement its climate action plans, and to propose financing requests toward climate finance sources such as the Green Climate Fund (GCF). The TNA will also need to respond to an intersectional analysis of gender differentials and the different needs, priorities and interests of women and men.

In this context, the three priority sectors for TNA in Nigeria are agriculture and land use, energy, and industry and commerce. These sectors were validated in the inception workshop conducted in September 2018, which was led by the Federal Ministry of Science and Technology (FMST), in collaboration with Federal Ministry of Environment's Department of Climate Change (FMEnv – DCC). The three priority sectors are not only key in addressing Nigeria's development challenges, but are also climate-sensitive and vulnerable to the impacts of climate change. Consequently, the sub-sectors were selected from these three priority sectors.

As part of pre-selecting the sub-sectors, all key national strategies and sectoral policies were reviewed and analyzed to identify development priorities. This process also included the review of climate change priorities of the country, which included NDC, Biennial Update Report (BUR), and other relevant documents. Overall, a total of 17 documents were reviewed in this process, and the identification of sub-sectors was conducted by performing a thorough assessment and desktop review of all the documents.

In the agriculture and land use sector, four sub-sectors were identified, namely, crop production, livestock production, forestry, and fish production. The agriculture sector, including land use and forestry, is a key driver for Nigeria's economy and the overall development of the country, since it is the main source of livelihood for most Nigerians. However, the sector is also vulnerable to climate impacts such as depletion of water resources and unpredictable rainfall patterns, which can lead to

¹ Federal Republic of Nigeria. 2020. *Third National Communication (TNC) of the Federal Republic of Nigeria under the United Nations Framework Convention on Climate Change (UNFCCC)*.



loss in productivity. Moreover, the agriculture sector accounts for the largest GHG emissions in Nigeria, contributing to approximately 60.1 percent of overall GHG emissions.² Therefore, focusing on the sub-sectors in the agriculture and land-use sector is essential in addressing development and climate change issues in Nigeria.

Following the agriculture sector, the energy sector accounts for the second largest GHG emissions, at 33.9 percent.³ Electricity supply, energy demand and energy efficiency were identified as the sub-sectors for this sector, with each of its sub-sectors having its own objectives. For electricity supply, Nigeria aims to increase access to electricity to 75 percent and 90 percent of the population (rural and urban) by 2020 and 2030, respectively, and at least 10 percent of renewable energy mix by 2025. Regarding energy demand, the sector aims to reduce the percentage contribution of fuelwood consumption in the domestic, agricultural and industrial sectors and to facilitate the use of alternative energy resources to fuelwood. Finally, energy efficiency has been identified as part of an effort to achieve cleaner and greener energy and reducing energy related GHG emissions, especially related to electricity generation, transmission, and distribution losses.

The industry and commerce sector is comprised of four sub-sectors that are considered as “anchor sectors” to drive Nigeria’s industrialization. These subsectors are agribusiness and agro-allied sectors, solid minerals and metals, oil and gas-related manufacturing, and construction, light manufacturing, and services. Developing the industry sector is essential to support the growing population in Nigeria and the required economic growth to achieve its developmental targets, and most importantly, expanding and transforming the economy which is not dependent on the volatile global oil market.

After the selection of the sub-sectors, they were pre-scored by the consulting team using a set of criteria in order to assist the actual selection and prioritization process by the key stakeholders. These criteria include, (1) relevance to development priorities; (2) potential for climate change mitigation; (3) potential for climate change adaptation; and (4) overall enabling environment, including regulatory, institutional, financial, and information. The initial scoring was further revised reflecting stakeholder feedback and input obtained through validation workshop and consultations. As a result, the prioritized subsectors were confirmed with consensus from the TNA Committee: crop production, livestock production, forestry, energy supply, energy demand, energy efficiency, agribusiness and agro-allied sectors, solid minerals and metals, construction and manufacturing.

² Ibid.

³ Ibid.



2. Introduction and objectives

Nigeria is the largest economy in sub-Saharan Africa. Although Nigeria's economy is diversifying, the country still faces a number of development and climate change challenges. Nigeria has submitted its Third National Communication (TNC) to the United Nations Framework Convention on Climate Change (UNFCCC) in March 2020, after its First Biennial Update Report (BUR1) in 2018, and its Nationally Determined Contribution (NDC) in 2015. These documents clearly highlight the challenges in mitigation and adaptation met by the country.

Nigeria is a relatively small contributor to worldwide greenhouse gas (GHG) emissions, with a total net national emissions amounting to 609,784 ktCO₂ equivalent in 2016. Emissions per capita from 2000 to 2016 varied between 3.26 and 3.59 ktCO₂ equivalent.⁴ The 2016 GHG inventory, conducted as part of the TNC, shows that the Agriculture, Forestry and Other Land Use (AFOLU) sector was by far the largest source of emissions, with 60.1 percent, followed by the energy sector with 33.9 percent. Under a Business-As-Usual scenario, the TNC estimated that Nigeria should see its emissions increase by more than 58 percent until 2035.

On the adaptation side, several vulnerabilities and climate risks have been identified, such as increased droughts and floods, water scarcity, desertification, flood vulnerability and low agricultural yields, among others.

These documents have identified potential mitigation and adaptation actions, as well as potential technologies for the fulfillment of Nigeria's climate commitments. Specifically, the TNC highlighted the importance of technology transfers for Nigeria to answer to the impacts of climate change. It also highlights some of the challenges the country faces in identifying and introducing technologies, such as inadequate awareness on available technologies, low capacity, poor understanding of commercial applications, Intellectual Property challenges and issues in terms of enabling environment, among others.

Within this context, Nigeria has requested the support of Climate Technology Centre and Network (CTCN) and United Nations Industrial Development Organization (UNIDO) for the development of a Technology Needs Assessment (TNA) and associated action plan for climate change mitigation and adaptation. These will be used by Nigeria for the implementation of its climate action plans and for financing requests toward climate finance sources, such as the Green Climate Fund (GCF). The TNA will also need to respond to an intersectional analysis of gender differentials and the different needs, priorities and interests of women and men.

The TNA process is expected to support the setting up of coordination mechanisms to govern the TNA process and better coordinate climate action in the country, while at the same time achieving Country Programming objectives. It will encompass the identification and prioritization of technologies that can support the achievement of the country's climate objectives. The TNA and the action plan developed will provide the guidance required by Nigeria in developing its climate finance pipeline. It will bridge the gap among the technologies, enabling environment and investments.

This report summarizes the methodology utilized for sub-sector selection and prioritization for the priority sectors considered for the TNA in Nigeria. The pre-selection of sub-sectors constitutes the second step in conducting the TNA process. The outcome of this step will be used as an input to identify the long-list of technologies, which will be further prioritized in the next step of the TNA process.

⁴ Federal Republic of Nigeria. 2020. *Third National Communication (TNC) of the Federal Republic of Nigeria under the United Nations Framework Convention on Climate Change (UNFCCC)*.



3. Methodology for the pre-selection of sub-sectors

The overall objective of the assignment is to develop a comprehensive TNA and action plan for climate change mitigation and adaptation in Nigeria. This will involve identifying relevant technologies that would enable Nigeria to meet its NDC and other development strategies to achieve the country’s climate change mitigation and adaptation targets. The assignment will also include developing the capacity for Nigeria to implement climate change actions by strengthening and coordinating national efforts in achieving both climate change mitigation and adaptation, and country programming objectives.

For the TNA in Nigeria, three priority sectors have already been identified in the inception workshop in September 2018, which was led by the Federal Ministry of Science and Technology (FMST), in collaboration with Federal Ministry of Environment’s Department of Climate Change (FMEnv – DCC). The three sectors selected for the TNA are agriculture and land use, energy, and industry and commerce. The pre-selection of sub-sectors, therefore, will be for these three priority sectors.

In pre-selecting the sub-sectors, all key national strategies and sectoral policies were reviewed and analyzed to identify development priorities. This is important as technologies prioritized for the TNA need to contribute to both development and climate priorities. This process also included the review of climate change priorities of the country, which included NDC, Biennial Update Report (BUR), and other relevant documents. A total of 17 documents were reviewed and the list of these documents is provided in table 1.

Table 1: List of documents reviewed

Policy/strategy/action plan reviewed	
1.	Vision 20: 2020
2.	Transformation Agenda 2011 – 2015
3.	Intended Nationally Determined Contribution (INDC)
4.	First BUR (BUR1)
5.	Third National Communication
6.	National Policy on Climate Change (NPCC)
7.	National Action Plan on Gender and Climate Change for Nigeria
8.	Agriculture Promotion Policy
9.	Agriculture Policy
10.	National Forestry Policy
11.	National Energy Policy
12.	National Renewable Energy and Energy Efficiency Policy (NREEP)

13.	Rural Electrification Strategy and Implementation Plan
14.	National Energy Master Plan (draft)
15.	National Energy Efficiency Action Plan (NEEAP)
16.	Nigeria Industrial Revolution Plan
17.	Economic Recovery & Growth Plan

Once development strategies and climate change targets were identified, sub-sectors were identified that contribute to meeting these objectives. The identification of sub-sectors was conducted by undertaking a detailed assessment and desktop review of all documents listed in Table 1.

After sub-sectors were identified, they were assessed against four criteria, namely:

- Potential for climate change mitigation (GHG emissions)
- Potential for climate change adaptation (vulnerability)
- Relevance to development priorities
- Overall enabling environment, including regulatory, institutional, financial and information

For each sub-sector, each criterion was scored from 0 to 3, with 3 being the highest.

- 3: High
- 2: Moderate
- 1: Low
- 0: None

The result from this exercise will score sub-sectors of the three priority sectors. The initial scoring by the consulting team will be used as a reference to guide the actual selection and prioritization process by the key stakeholders at the validation workshop. During the stakeholders' validation workshop, the scoring for each sub-sector was discussed and assessed by the stakeholders, mainly taking into consideration the potential for climate change mitigation and adaptation, as well as the enabling environment. Through the discussion at the stakeholders' validation workshop, the scoring for each subsector and the prioritized subsectors are confirmed by the TNA committee, which in turn will be the basis for preparing the long-list of technologies in the subsequent step. The following sections will discuss the process undertaken to arrive at the initial scoring of sub-sectors.



4. Country context

The Federal Republic of Nigeria is located in West Africa, spanning an area of 923,768 km².⁵ Nigeria is a key regional player in West Africa with a population of approximately 200 million and it is the largest market in Africa.⁶ Nigeria accounts for 47 percent of West Africa's population, and has one of the largest populations of youth in the world.⁷ In terms of economy, between 2006 and 2016, Nigeria's gross domestic product (GDP) grew at a rate of 5.7 percent, on average, driven by increase in oil prices.⁸ In addition, between 2005 and 2015, Nigeria's Human Development Index value increased by 13.1 percent.⁹ However, Nigeria continues to face key development challenges, such as reducing its reliance on oil and diversifying the economy, addressing insufficient infrastructure, and building strong and effective institutions, among others. While the economy grew steadily from 2006 to 2016, it has slowed considerably, to around 2 percent in 2018, well below the average of many peer countries.¹⁰ In addition, Nigeria's economy entered a recession in 2020 due to falling global oil prices and implementing measures to fight the spread of COVID-19.¹¹ Today, Nigeria hosts the largest number of poor people in the world.¹² The impacts of COVID-19 pandemic could further increase the poverty rate and reduce the country's economic and development outcomes.¹³ The heavy reliance on the oil and gas sector for its fiscal revenue, generating on average more than half of all revenues and nearly 90 percent of the nation's exports, has exposed Nigeria to the instability of oil prices, which creates economic uncertainty and deters investment.¹⁴ It is expected that Nigeria's economy will grow by 1.5 percent in 2021 and 2.9 percent in 2022, based on expected recovery of oil prices and production.¹⁵

In terms of gender and equality, Nigeria ranked 139 out of 156 on the Global Gender Gap Index released by the World Economic Forum in March 2021. The Index tracks gender gaps in Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment.¹⁶ This suggests that there remain challenges in reducing the gender gap in Nigeria. Furthermore, it is expected that due to existing inequalities, vulnerable groups – including women, children, farmers, persons with disability, elderly persons and youth – who are already living in poverty face higher risks and greater burdens from the impact of climate change.¹⁷

To address key development challenges, Nigeria developed its long-term development policy, the Vision 20:2020, which covers the eleven-year period between 2009 and 2020. It is the blueprint to develop Nigeria into one of the top 20 economies in the world with a minimum GDP of USD 900 billion and a per capital income of USD 4,000 per annum.¹⁸ Achieving this vision requires an economic growth

⁵ The World Bank. Climate Change Knowledge Portal – Nigeria.

⁶ IFC. 2020. A Country Private Sector Diagnostic: Creating Markets in Nigeria – Crowding in the Private Sector: Nigeria's Path to Faster Job Creation and Structural Transformation.

⁷ The World Bank. Climate Change Knowledge Portal – Nigeria.

⁸ Ibid.

⁹ Ibid.

¹⁰ IFC. 2020. A Country Private Sector Diagnostic: Creating Markets in Nigeria – Crowding in the Private Sector: Nigeria's Path to Faster Job Creation and Structural Transformation.

¹¹ African Development Bank. Nigeria Economic Outlook.

¹² IFC. 2020. A Country Private Sector Diagnostic: Creating Markets in Nigeria – Crowding in the Private Sector: Nigeria's Path to Faster Job Creation and Structural Transformation.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ African Development Bank. Nigeria Economic Outlook.

¹⁶ World Economic Forum. 2021. Global Gender Gap Report 2020.

¹⁷ Federal Ministry of Environment, 2020. National Action Plan on Gender and Climate Change for Nigeria.

¹⁸ National Planning Commission. 2009. Nigeria Vision 20:2020.



at an average of 13.8 percent during the period, driven by the agricultural and industrial sectors over the medium-term, supported by increased access to energy. The Vision 20:2020 was to be achieved through three medium-term national implementation plans (NIPs): 1st NIP (2010 – 2013), 2nd NIP (2014 – 2017), and 3rd NIP (2018- 2020). Currently, the succeeding plan that was to succeed the Vision 20:2020 cannot be found on the public domain.

The three key sectors driving the long-term development in Nigeria are, however, also climate-sensitive, in terms of contribution to GHG and precursor gases emission as well in their vulnerability to the impacts of climate change. As such, Nigeria is committed to addressing climate change by ratifying to the Paris Agreement, submitting its first NDC and preparing the National Adaptation Strategy and Plan of Action for Climate Change Nigeria (NASPA-CCN).¹⁹

4.1 Agriculture and land use sector

The agriculture sector is a key driver of Nigeria's economy. It is also the largest sector and employer of labour, contributing approximately 27 percent to the GDP between October to December in 2020 and employing approximately 70 percent of the country's labour force.²⁰ Women make up a significant portion of the labour force, at 75 percent of the agricultural labour force in Nigeria.²¹ Nigeria has an abundance of land, approximately 82 million hectares, in which less than half of is currently under cultivation, presenting a transformative opportunity for Nigeria.²²

Nigeria is a major importer of food, spending approximately USD 3 to 5 billion annually on food. This excludes technology imports to support agricultural mechanization and food processing. The sector faces two critical challenges related to sector development: the inability to meet domestic food requirements, which is a key factor in the country's food insecurity situation, and the inability to export at quality levels required for market success.²³ The two key sectoral challenges are mainly driven by outdated land tenure system that constraints access to land, a very low level of irrigation development, limited adoption of research findings and technologies, high cost of farm inputs, poor access to credit, inefficient fertilizer procurement and distribution, inadequate storage facilities and poor access to markets have all resulted in low productivity, at an average of 1.2 metric tons of cereals/ha, with high postharvest losses and waste.²⁴ The sector also experiences direct impacts of climate change such as depletion of water resources and unpredictable rainfall patterns, further impacting production system and crop productivity.

4.2 Energy sector

The energy sector plays a critical role in supporting the long-term development vision for Nigeria, as it is estimated that approximately 35,000 megawatts (MW) of additional electricity generated on-grid and off-grid is needed to achieve the target. The projected growth rate required to achieve the target will demand even greater electricity generation from a combination of sources by 2030. In addition to increasing electricity generation, improving access to electricity is essential to support the proposed modernization and industrialization for development. It is estimated that 70 percent of the population that live in rural areas currently do not have access to the electricity grid. This inadequate access to

¹⁹ The World Bank. Climate Change Knowledge Portal – Nigeria.

²⁰ <https://www.statista.com/statistics/1193506/contribution-of-agriculture-to-gdp-in-nigeria/>

²¹ Federal Ministry of Environment, 2020. National Action Plan on Gender and Climate Change for Nigeria.

²² IFC. 2020. A Country Private Sector Diagnostic: Creating Markets in Nigeria – Crowding in the Private Sector: Nigeria's Path to Faster Job Creation and Structural Transformation.

²³ Federal Ministry of Agriculture and Rural Development. The Agriculture Promotion Policy (2016 – 2020).

²⁴ FAO. Nigeria at a glance.



electricity has had negative impact on the overall economic growth in Nigeria by placing significant constraints on the productive capacity of micro-entrepreneurs and rural supply chains.²⁵ On the other hand, increase in economic activity and population growth have significantly increased fuelwood use to meet its energy demand. This is increasingly driving the risk of deforestation and increase in associated GHG emissions.

4.3 Industry and commerce sector

Nigeria is blessed with a significant abundance of a wide range of raw materials, including as granite, marble, and sand. This, coupled with growing demand for affordable housing to support the growing population makes the construction sub-sector ideal for development. The construction material subsector, such as cement and iron and steel, also accounted for the highest GHG emissions from the IPPU sector in 2015, contributing 53.4 percent and 46.4 percent of the aggregated emissions, respectively.²⁶ This suggests that application of efficient technology will be required to assist in reducing both energy use and GHG emissions, as the industrial sector is the bedrock of economic transformation in any country.

²⁵ Federal Republic of Nigeria. 2015. NREEEP. Federal Ministry of Power.

²⁶ Government of Nigeria. 2018. BUR 1.



5. Climate change priorities

Nigeria is committed to addressing climate change impacts. Nigeria has been actively engaged in international climate change negotiations since becoming a Party to the UNFCCC in 1994, and ratifying the Kyoto Protocol in 2004. To date, Nigeria has submitted its first (2003), second (2014) and third national communications (2020) and BUR1 in 2018. Nigeria is currently in the process of updating its NDC and preparing its second BUR.

In addition to these documents, Nigeria has also proposed and adopted a number of policies related to climate change. These include the National Policy on Climate Change (NPCC) in 2013 and NASPA – CCN in 2011, among others. The NPCC is a strategic policy response to climate change that aims to foster low-carbon, high-growth economic development path and build a climate-resilient society.²⁷ It clearly identifies climate change as one of the major threats to economic development goals and food security. The NPCC has identified the various adaptation and mitigation measures to integrate the threat of climate change into national sustainable economic development strategy in Nigeria.

5.1 Nigeria’s NDC, 2017

Nigeria’s NDC includes both unconditional and conditional GHG emissions reduction targets for climate change mitigation. These targets include 20 percent unconditional and 45 percent of conditional GHG emissions reduction compared to the business-as-usual level by 2030.²⁸ Key measures to meet these targets have been identified and include, ending gas flaring by 2030, installing 13 gigawatt (GW) of off-grid solar photovoltaic (PV), using efficient natural gas electricity generating plants, achieving 2 percent in energy efficiency per year and leading to 30 percent by 2030, shifting to intermodal transport towards mass transportation, improving electricity grid, and implementing climate smart agriculture and reforestation. For conditional target, Nigeria expects that additional international support in the form of finance and investment, technology and capacity building will allow to achieve increasing level of energy efficiency and reducing the use of generators.

Table 2 Objectives and key measures for climate change mitigation

	Unconditional contribution	Conditional contribution
Objective	20 percent emissions reduction	45 percent emissions reduction
Key measures	<ul style="list-style-type: none"> ▪ Improving energy efficiency by 20 percent ▪ 13 GW of renewable electricity provided to rural communities currently off-grid ▪ Ending gas flaring 	<ul style="list-style-type: none"> ▪ Increasing level of energy efficiency ▪ Reducing the use of generators

The NDC also includes strategies for key sectors that are critical in meeting climate change adaptation objectives in Nigeria. These sectors include agriculture and land use, energy, and industry and commerce, which are aligned with the three priority sectors in scope of the TNA. Proposed strategies are in line with the NASPA-CCN that guides the integration of climate change adaptation in sustainable development of Nigeria. Table 3 summarizes proposed measures for both climate change mitigation

²⁷ Federal Ministry of Environment. 2013. NPCC.

²⁸ Government of Nigeria. 2017. INDC.

and adaptation in the three priority sectors.

Table 3 Summary of all mitigation and adaptation measures identified for the three priority sectors

	Mitigation measures	Adaptation measures
Agriculture and land use	<ul style="list-style-type: none"> Climate smart agriculture Reforestation 	<ul style="list-style-type: none"> Adopt improved agricultural systems for both crops and livestock Implement strategies for improved resource management (e.g. increase use of irrigation systems, increase rainwater and sustainable ground water harvesting) Forests (1): strengthen the implementation of the national Community-Based Forest Resources Management Programme; (2) support review and implementation of the National Forestry Policy; (3) develop and maintain forest inventory system; (4) provide extension services; and (5) improve management of forest reserves and enforce impact logging practice
Energy	<ul style="list-style-type: none"> Renewable energy (off-grid solar PV of 13 GW) Improve electricity grid 2 percent per year energy efficiency (30 percent by 2030) 	<ul style="list-style-type: none"> Include increased protective margins in construction and placement of energy infrastructure (i.e. higher standards and specifications) Undertake risk assessment and risk reduction measures, specifically across thermal and gas generating power supplies Improve existing energy infrastructure Develop and diversify secure energy backup systems Expand sustainable energy sources and decentralize transmission
Industry and commerce	<ul style="list-style-type: none"> Adoption of green technology in industry 	<ul style="list-style-type: none"> Increase knowledge and awareness of climate change risks and opportunities Undertake and implement risk assessments and risk reduction measures targeted towards greener production Incorporate climate change into

		<p>ongoing business planning</p> <ul style="list-style-type: none"> ▪ Review and enforce land plans in industrial areas in light of climate change ▪ Encourage relocation of high-risk industries, facilities and markets ▪ Promote and market emerging opportunities from climate change ▪ Encourage information savings and insurance schemes, and arrange for the availability of medium-term credit
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5.2 Supporting climate change strategies and policies

The NPCC, BUR1, and TNC all support the NDC and proposed actions are in line with those measures identified in the NDC. The development of the NDC was closely informed by the NPCC in 2013. The BUR1 and TNC emphasize the need of measures in the three priority sectors as critical in Nigeria's efforts in addressing climate change mitigation and adaptation. In addition, the National Action Plan on Gender and Climate Change for Nigeria also identify agriculture, forestry and land use, and energy with particular reference to subsectors such as transport, as two of its five priority sectors. This further supports the alignment of priority sectors and Nigeria's climate and development objectives with gender equity considerations.

In the agriculture, forestry and land use change sector, key strategies highlight the need to provide access to improved seeds, fertilizers and appropriate technologies, such as irrigation systems and finance, to enhance food security in Nigeria. They also emphasize that improving agriculture is a central part of Vision 20:2020 and that the ambition laid out in Agricultural Transformation Agenda (ATA) cannot be met without climate smart agriculture.

For the energy sector, attaining the long-term energy security by providing access to energy for all is a top priority in achieving the national development objectives. Currently, about 70 percent of the population in rural communities that are off the grid still lack access to electricity. It is, therefore, essential that electricity is provided using off-grid renewable energy resources.

The industry and commerce sector in Nigeria is one of the key sectors that are expected to support the projected economic growth in the country. At present, majority of the emissions from the industry sector are generated from the cement and iron and steel industries, accounting for 53.4 percent and 46.6 percent of the overall sectoral GHG emissions, respectively. It is therefore imperative essential that best available technology be used to improve efficiency and reduce future emissions.²⁹ For the commerce sector, available information on the public domain is extremely limited and further inputs will be required from stakeholders to better define the scope, sub-sectors, and its roles in meeting development and climate objectives in Nigeria.

The proposed objectives and measures for climate change mitigation and adaptation in NDC directly align with overall development objectives in Nigeria. The long-term development objectives of Nigeria and specifically to the three sectors are described in detail in the following section.

²⁹ Government of Nigeria. 2018. BUR 1.

6. Sectoral development priorities

The long-term development of Nigeria is mainly guided by the long-term strategies encapsulated in Vision 20:2020, with objectives to optimize human and natural resources to achieve rapid economic growth and to translate that growth into equitable social development for all citizens. These objectives are further supported by three pillars. Table 4 provide a summary of Vision 20:2020, its objectives and pillars.

Table 4 Summary of Vision 20:2020

Objective	
Vision 20:2020	<ol style="list-style-type: none"> 1. To optimize human and natural resources to achieve rapid economic growth 2. To translate that growth into equitable social development for all citizens
Pillars	
(1) Guaranteeing the productivity and wellbeing of the people	<ul style="list-style-type: none"> ▪ Eradicate extreme hunger and poverty ▪ Enhance access to quality and affordable healthcare ▪ Provide sustainable access to potable water and basic sanitation ▪ Provide accessible and affordable housing ▪ Build human capacity for sustainable livelihoods and national development ▪ Promote gender equality and empower women ▪ Improve access to micro-credit ▪ Foster a culture of entertainment and recreation for enhanced productivity
(2) Optimizing the key sources of economic growth	<ul style="list-style-type: none"> ▪ Stimulate primary production to enhance the competitiveness of Nigeria's real sector ▪ Significantly increase production of processed and manufactured goods of export ▪ Stimulate domestic and foreign trade in value-adding goods and services ▪ Strengthen linkages between key sectors of the economy
(3) Fostering sustainable social and economic development	<ul style="list-style-type: none"> ▪ Develop efficient, accountable, transparent and participatory governance ▪ Establish a competitive business environment characterized by sustained macroeconomic stability ▪ Enhance national security and improve the administration of justice ▪ Promote unity in diversity, national pride, and the conservation of the nation's cultural heritage ▪ Develop sufficient and efficient infrastructure to support sustained economic growth

- Preserve the environment for sustainable socio-economic development
- Promote the sustainable development of Nigeria's geo-political regions into economic growth poles

Vision 20:2020 highlights the important role the three priority sectors selected for the TNA will play in supporting the overall vision and development objectives of Nigeria. Extensive industrial growth is required in achieving the vision, which is supported by the second pillar anchored on industrial growth in six industries in Nigeria. The six industries include, (1) refining and petrochemicals, (2) chemicals and pharmaceuticals, (3) food, beverages and tobacco, (4) textiles, wearing apparel, and leather, (5) basic metal, iron and steel and fabricated metal, and (6) non-metal mineral products. In addition, increased amount of energy is needed to support the required industrial growth, in which the third pillar, fostering sustainable social and economic development, calls for sustainable electricity generation for on- and off-grid energy to generate approximately 35,000 MW of electricity to have been accomplished by 2020 to achieve the vision.³⁰ Agriculture was also identified as one of the seven real sectors in the Transformation Agenda 2011 – 2015, which was based on the Vision 20:2020, and emphasized the need to secure food and feed needs supported by development and dissemination of appropriate and efficient technologies.³¹

The following sub-sections will focus on sectoral objectives for the three priority sectors and their link to the overall national long-term objectives described above.

6.1 Agriculture and land use sector

The agriculture and land use sector is comprised of four sub-sectors, namely, crop production, livestock production, forestry, and fish production.³² The long-term development of the sector is guided by a number of medium-term plans, such as the Agricultural Promotion Policy and the Agricultural Transformation Agenda, each working to solve the core issues at the heart of limited food production and delivery of quality standards. For three out of the four sub-sectors, namely, crop production, livestock production, and fish production, development policies support achieving self-sufficiency in the production through access to inputs, services, and technologies. For the forestry sub-sector, the National Forest Policy is in place to address the large gap between demand and supply of fuelwood, highlighting the large dependence on fuelwood to meet its energy demand, mainly for the rural population. Over dependence on fuelwood is driving increasing risk in depletion of forest and woodland reserves in Nigeria. It has been estimated that the country's 15 million hectares of forest and woodland reserves could be depleted within the next 50 years.³³ This is expected to drive further impacts on the environment, such as soil erosion, desertification, loss of biodiversity and flooding, among others.

A summary of policy objectives for the four sub-sectors are summarized in table 5.

Table 5 Summary of policy objectives

Objective	
Crop production	<ul style="list-style-type: none"> ▪ To make Nigeria self-sufficient in the production of crops, including domestic and export crops

³⁰ National Planning Commission. 2009. Nigeria Vision 20:2020.

³¹ Government of Nigeria. The Transformation Agenda 2011 - 2015.

³² Federal Republic of Nigeria. 2020. TNC.

³³ Federal Republic of Nigeria. 2014. National Energy Masterplan. Energy Commission of Nigeria. FMST.

<p>Livestock production</p>	<ul style="list-style-type: none"> ▪ To make Nigeria self-sufficient in the production of livestock products ▪ To improve the nutritional status of Nigerians through the domestic provision of high quality, protein-rich livestock products ▪ To provide locally all necessary raw material input for the livestock industry ▪ To allow for a meaningful and efficient use of livestock by-products ▪ To improve and stabilize rural income emanating from livestock production and processing ▪ To effectively protect the rural livestock farmer from the unpredictable risks ▪ To provide rural employment opportunities ▪ To effect proper land use and maintenance of ecosystem for expanded livestock production
<p>Fish production</p>	<ul style="list-style-type: none"> ▪ To achieve self-sufficiency in fish production within five years ▪ To develop and modernize means of fish production, processing, storage and marketing by the adoption of improved technology and management practices ▪ To promote export trade in shrimps, crabs, oysters, periwinkles and shark fins ▪ To improve the quality of life in fishing villages through provision of infrastructure and basic utilities ▪ To provide and improve employment opportunities in rural areas ▪ To accelerate research on all aspects of fisheries ▪ To consolidate and improve existing training programmes ▪ To promote fisheries curricula in the nation's institution ▪ To ensure proper utilization of all agro-industrial by-products ▪ To encourage private entrepreneurs through training and provision of credit for the development ▪ To rapidly develop aquaculture
<p>Forestry</p>	<ul style="list-style-type: none"> ▪ Forest management: (1) to increase the total area under sustainable forest management to 25 percent of the nation's land area; and (2) to encourage forest industries to establish plantations to meet at least 60 percent of their raw materials' requirements ▪ Forest industries: to develop strategies for waste reduction and utilization at all stages of industrial activities ▪ Agro-forestry: (1) to help eradicate hunger through basic, pro-poor food production systems based on agroforestry methods of soil fertility and land regeneration; (2) to lift more rural poor from poverty; (3) to advance health and nutrition of the rural poor through agroforestry systems; (4) to conserve biodiversity through integrated conservation based on agroforestry technologies; (5) to protect watershed services through agroforestry; and (6)

to assist the rural poor to better adapt to climatic change and to benefit from emerging carbon markets, through tree cultivation

- **Wood fuels:** (1) to ensure sustainable supply of wood fuels; (2) to conserve and protect the environment; (3) to provide income generating opportunities to communities; and (4) to promote viable alternatives to wood fuels
- **Drought and desertification control:** (1) to reduce the rate of desertification in the country; and (2) to mitigate the adverse effects of droughts and desertification

6.2 Energy sector

In supporting the required long-term development needs for Nigeria, the energy sector has objectives for each of its sub-sectors, namely, electricity supply, energy demand, and energy efficiency. For electricity supply, Nigeria aims to increase access to electricity to 75 percent and 90 percent of the population (rural and urban) by 2020 and 2030, respectively, and at least 10 percent of renewable energy mix by 2025. Specific to renewable energy, Nigeria has developed the Renewable Energy Master Plan, which includes installed capacity targets, including 2,000 MW by 2025 for small-hydro, 500 MW of solar by 2025, 200 MW of biomass-based power plant by 2025, and 40 MW of wind energy by 2025. Furthermore, Nigeria aims to achieve universal coverage of 100 percent electrification by 2040.³⁴

For energy demand, to address the increasing use of fuelwood driven by growing population, the sector aims at reducing the percentage contribution of fuelwood consumption in the domestic, agricultural and industrial sectors and to facilitate the use of alternative energy resources to fuelwood. For this sub-sector, the sector also aims to promote biomass as an alternative energy resource especially in the rural areas.

The energy sector also focuses on achieving energy efficiency as part of an effort to achieve cleaner and greener energy, with objectives to increase the share of electricity generated from renewable sources such as solar, wind and biogas, by 1 percent every year compared to 2012 level, reduce electricity generation, transmission and distribution losses from the current level of 15 – 40 percent to less than 10 percent by 2020, replacing all incandescent light bulbs in every home, industry, institution, and establishment with light emitting diodes (LED) and other energy saving lamps by 2025, achieving a broad range of equipment energy efficiency standards and labelling by 2025, and reducing energy-related GHG emissions by 15 percent compared to the 2013 level by 2025.³⁵

In terms of gender consideration in the energy sector, at the household level, due to the gendered division of labour, the health of women and children is disproportionately affected by the use of firewood or charcoal for cooking.³⁶ In Nigeria, more than 98,000 deaths among women annually are attributed to ailments related to indoor and outdoor pollution.³⁷ This suggests that addressing the increasing use of fuelwood at the household level will achieve climate objectives in Nigeria while also improving the health conditions of women and children, further supporting overall development in Nigeria.

In achieving the sectoral objectives, key policies, action plans and strategies have been prepared to

³⁴ Federal Ministry of Power, Works and Housing. 2016. RESIP.

³⁵ Federal Republic of Nigeria. 2016. NEEAP.

³⁶ Federal Ministry of Environment, 2020. National Action Plan on Gender and Climate Change for Nigeria.

³⁷ USAID. 2017. Power Africa Gender Analysis for Nigeria.

guide the sector development. These documents include, but not limited to, National Energy Policy, National Renewable Energy and Energy Efficiency Policy (NREEEP), Rural Electrification Strategy and Implementation Plan, National Energy Master Plan, and National Energy Efficiency Action Plan (NEEAP). These key strategies identify strategies to achieve the sectoral objectives, further supporting Vision 20:2020. The Ministry of Power is also currently developing a National Action Plan on Gender Mainstreaming in Energy Access which will further support gender informed sectoral development.

Table 6 summarizes overall sector objectives against key sub-sector objectives.

Table 6 Summary of objectives in the energy sector

Objective	
Electricity supply	<ul style="list-style-type: none"> ▪ To provide electricity to all state capital, local government headquarters as well as other major town by the year 2020 ▪ To ensure the provision of electricity to all remote and off-grid areas of Nigeria as well as increasing the energy mix of grid supplied electricity in line with regional policy and target ▪ To stimulate industrialization in the rural areas in order to minimize rural-urban migration ▪ To provide reliable and stable power supply to consumers, especially to industries ▪ To ensure the removal of bottlenecks limiting utilization of the full capacity of the existing electric power plants and development of off-grid electricity in Nigeria ▪ To broaden the energy options for generating electricity, including renewable energy resources <ul style="list-style-type: none"> ○ Hydropower: (1) to increase the percentage contribution of hydro electricity to the total energy mix and to ensure that a minimum contribution of 10 percent is maintained at all times from large and small hydropower combined; (2) to extend electricity to rural and remote areas through the use of mini and micro hydropower schemes; (3) to diversify the energy resource base and the mix between large, mini and micro hydro; (4) to ensure minimum damage to the ecosystem arising from hydropower development; (5) to attract private sector investments into the hydropower subsector; (6) to further contribute to remote and off-grid power development in Nigeria; (7) to develop socially acceptable and equitable hydropower; and (8) to ensure the safety and security of large and small hydro generating facilities ○ Solar: (1) to increase the percentage contribution of solar energy to the total energy mix and to ensure a minimum electricity contribution of 3 percent by 2020 and 6 percent by 2030; (2) to extend electricity to rural and remote/off-grid areas, through the use of solar home systems and ultimately promote solar photovoltaic and solar thermal applications to ensure that solar energy can be used for production of electricity; (3) to increase the share of solar water heating technologies for social services, commercial and industrial processes ○ Wind: (1) to develop wind energy as an alternative energy resources; (2) to develop local capability in wind energy technology; (3) to use wind energy for provision of power to rural areas and remote communities far removed

	from the national grid; (4) to apply wind energy technology in areas where it is technically and economically feasible; and (5) to develop and implement incentives for the development of wind farms and for the adoption of community-based wind system off the grid
Energy demand	<ul style="list-style-type: none"> ▪ Fuelwood: (1) to greatly reduce the percentage contribution of fuelwood consumption in the domestic, agricultural and industrial sectors; (2) to arrest the ecological problems of desert encroachment, soil erosion and deforestation; (3) to facilitate the use of alternative energy resources to fuelwood; and (4) to reduce health hazards arising from fuelwood combustion. ▪ Biomass: (1) to promote biomass as an alternative energy resource especially in the rural areas; (2) to promote efficient use of agricultural residues, animal and human waste as energy sources; and (3) to reduce health hazards arising from combustion of biomass fuel.
Energy efficiency	<ul style="list-style-type: none"> ▪ To increase the share of green electricity by 1 percent every year on Year-to-Date (YTB) basis compared to 2012 level ▪ To ensure reduction of electricity generation, transmission, and distribution losses from the current level of 40 – 50 percent to less than 10 percent by 2020 ▪ To replace all incandescent light bulbs in every home, industry, institution, and establishment in Nigeria with LEDs and other energy saving lamps by 2025 ▪ By 2025, to establish a broad range of equipment energy efficiency standards and labelling ▪ By 2025, to reduce energy-related GHG emissions by 15 percent compared to the level of 2013 ▪ To consider energy efficiency and conservation in key sectors: residential sector, industry, transportation, services/commercial sector, agriculture, and energy efficient building designs

6.3 Industry and commerce sector

The development of the industry sector is critical to support the diversification of Nigeria’s economy. In 2014, the industry sector accounted for only 3 percent of export revenues but over 50 percent of imports, spending over USD 30 billion annually on import of various manufactured goods.³⁸ Developing the industry sector is essential to support the growing population and the required economic growth to achieving the Vision 20:2020, and most importantly, developing an economy which is not dependent on the volatile global oil market. In meeting this demand, developing a robust local industry will ensure local domestic production of a large segment of goods currently imported as well as build sub-sectors that will generate employment for the growing population.

In terms of sector development policy, the Vision 20:2020 was set out to achieve an overall long-term development of the industry sector in Nigeria. Under the Vision 20:2020, the industry sector aimed to achieve greater global competitiveness in the production of processed and manufactured goods by linking industrial activity with primary sector activity, domestic and foreign trade, and service activity.³⁹

³⁸ Federal Government of Nigeria. 2014. Nigeria Industrial Revolution Plan.

³⁹ World Institute for Development Economics Research. 2014. WIDER Working Paper 2014/019: Industrial development and growth in Nigeria – lessons and challenges.

The Vision 20:2020 was supported by a 5-year medium-term development plan, the Nigeria Industrial Revolution Plan (NIRP), covering the period up to 2020. The plan identifies four sub-sectors that are considered as “anchor sectors” to drive Nigeria’s industrialization. These sub-sectors include, agribusiness and agro-allied sector, solid minerals and metals, oil and gas related manufacturing, and construction, lighting manufacturing and services.⁴⁰ The policy also identifies seven enablers or support structures that will transform the four sub-sectors, which are, infrastructure, skills, innovation, investment climate, standards, local patronage, and financing.⁴¹

For the commerce sector, there is very limited information on the public domain and sub-sectors cannot be identified at this time. Inputs from key stakeholders will be collected to identify and analyse the relevant sub-sectors.

Table 7 summarizes objectives for the four sub-sectors identified under the industry sector.

Table 7 Summary of objectives in the industry and commerce sectors

Table 7 Summary of objectives in the industry and commerce sectors	
Agribusiness and agro-allied sector	<ul style="list-style-type: none"> ▪ Food processing: (1) facilitate the development of private sector led aggregators and bulk buyers of agro produce to bridge the gap between smallholder farmers and large industrial processors; (2) create regular platforms for large industrialists and buyers of key agro-products to engage large, medium, and smallholder farmers on standards needed at manufacturing plants; (3) organize stakeholders to jointly govern usage and needs for users of major transport corridors. ▪ Sugar: establish some 28 sugar factories of varying capacities and bring about 250,000 hectares of land into sugar cane cultivation over the next 10 years ▪ Palm oil processing: meet 100 percent of domestic demand and replace current imports and contribute surplus production that can be exported by 2020 ▪ Cocoa processing: (1) increase cocoa bean output by increasing cultivations, improving yields, and standardizing harvest procedures; (2) facilitate the development of cocoa warehousing investment; (3) identify and facilitate public-private interventions in key rural road infrastructure; and (4) review export incentives scheme ▪ Leather products: (1) promote large single-owned cattle ranches or establishment of grazing reserves for multiple small-scale herders; (2) improve technical standards of hides, skins and tanneries; (3) commercialize local tannery technology; and (4) develop capacity for export standards and knowledge ▪ Rubber products: (1) increase raw rubber output; (2) harmonize tariff regime; and (3) review export incentives ▪ Textiles and apparels: (1) develop energy supply scheme to ensure regular supply of electricity to textile firms in Norther Nigeria; (2) implement cotton supply interventions; (3) implement cotton standards; and (4) use

⁴⁰ Federal Government of Nigeria. 2014. Nigeria Industrial Revolution Plan.

⁴¹ Ibid.

	cotton fund to retool existing plans
Metals and solid minerals processing	<ul style="list-style-type: none"> ▪ Cement: (1) sustain the achievement of the past 10 years; (2) seek alternative uses of cement to boost local demand; and (3) make Nigeria a significant net exporter of cement to the sub-region by 2020 ▪ Auto assembly: (1) promote auto sector development by developing auto supplier parks; (2) increase procurement of locally assembled automobiles; (3) develop capacities of auto skills and anti-smuggling measures; and (4) attract at least five international firms into the country (e.g. Daimler, General Motors, Nissan, Toyota, Honda) ▪ Aluminium: develop the aluminium subsector by streamlining tariff regime, reviewing standards, and providing incentives to export scrap aluminium ▪ Basic metals/steel: (1) promote investment downstream; (2) prove-up mineral resources; (3) provide incentives on exporting scrap metal; and (4) cluster new steel players in each of Nigeria's geo-political zones
Oil and gas related manufacturing	<ul style="list-style-type: none"> ▪ Petrochemicals, fertilizers, and methanol: increase the economic contribution to the Nigerian economy from the oil and gas downstream sector in the range between USD 9 billion and 16 billion extra per annum
Construction, light manufacturing, and services	<ul style="list-style-type: none"> ▪ Construction (housing supply): develop and sell low-income and middle-income housing estates (with minimum of 300 units per project) to boost housing stock in Nigeria ▪ Light manufacturing: further develop durable home goods by implementing product standardization, developing technical standards on specific products, develop value-chain partnerships, and securing intellectual property ad branding ▪ Services: develop services in retail and formal trade sectors, haulage services, call centres, shared service centres, and engineering services

The following section will provide analysis of each sub-sector and identify steps in conducting the scoring and prioritization of sub-sectors.

7. Selection and prioritization process

In order to select and prioritize sub-sectors, each sub-sector identified in section 5 is analyzed in this section. The sub-sectors are, then, evaluated based on the four criteria to assess their relevance to meeting both climate objectives and development objectives in Nigeria.

Table 8 provides a list of all sub-sectors identified in each of the three sectors.

Table 8 Summary of all sub-sectors identified in each of the three sectors

Sub-sectors	
Agriculture and land use	<ul style="list-style-type: none"> ▪ Crop production ▪ Livestock production ▪ Fish production ▪ Forestry
Energy	<ul style="list-style-type: none"> ▪ Electricity supply ▪ Energy demand ▪ Energy efficiency
Industry and commerce	<ul style="list-style-type: none"> ▪ Agribusiness and agro-allied sector ▪ Solid minerals and metals ▪ Oil and gas-related industry ▪ Construction, light manufacturing and services

7.1 Agriculture and land use sector

The agriculture sector is an important sector for the overall development of Nigeria. Despite the significant role the oil and gas sector plays in the overall economy, agriculture remains the base of the Nigerian economy, providing the main source of livelihood for most Nigerians.⁴² As indicated in the Transformation Agenda and Vision 20:2020, achieving food security is a prerequisite to support the growing and projected population growth. The agriculture sector also accounts for the largest GHG emissions, contributing to approximately 67 percent of overall GHG emissions.⁴³ It is also one of the sectors most sensitive to climate change. Under the business-as-usual scenario, it is estimated that agricultural productivity could decline between 10 to 25 percent by 2080.⁴⁴ This loss in productivity would be detrimental to the already constrained food production to meet its domestic demand. Therefore, it is essential that necessary measures are taken to ensure the sector addresses both development and climate change challenges.

The agriculture sector in Nigeria is comprised of four sub-sectors. These include, crop production, livestock production, fish production, and forestry. Each of the sub-sector is detailed in sub-sections below.

⁴² FAO. Nigeria at a glance.

⁴³ Government of Nigeria. 2018. BUR 1.

⁴⁴ Federal Republic of Nigeria. 2017. INDC.



7.1.1 Crop and livestock production

In Nigeria, increases in crop and livestock production have not kept pace with population growth, resulting in rising food imports and declining levels of national food self-sufficiency.⁴⁵ For the crop production sub-sector, this is a result of heavy reliance on rainfed agriculture, reliance on smallholder land ownership, poor planting materials and farm inputs/support such as fertilizer application, weak agricultural extension systems, among others used in subsistence farming which generally lead to low productivity.⁴⁶ For the livestock production, the low productivity is driven by low productive breeds, inadequate access to feeds and grazing lands, lack of processing facilities, low value addition and low technical inputs and extension service support in the management of the livestock and associated diseases.⁴⁷ As such, the focus of development in these sub-sectors is to achieve self-sufficiency in production for basic foods, agro-based and other industries.

Crop and livestock production sub-sectors are also particularly important in addressing climate change. Relevant strategies have been identified in the NDC as well as in the NASPA-CCN. According to the TNC, the crop production sub-sector, accounted for 8.1 percent of total sectoral GHG emissions in 2016 while livestock sub-sector contributed to 7.9 percent of the total sector emissions.⁴⁸ Strategies to address climate change in the crop and livestock production sub-sectors focus on climate smart agriculture and include, adopting improved agricultural systems, such as diversifying livestock and improving range management, increasing access to drought resistant crops and livestock feeds, adopting soil better management practices, and providing early warning or meteorological forecasts. Strategies also include implementing strategies for improved resource management, such as increasing the use of irrigation systems and increasing rainwater and sustainable groundwater harvesting, increasing planting of native vegetation cover and promotion of re-greening efforts, and intensifying crop and livestock production in place of slash and burn.⁴⁹

In terms of overall enabling environment, for crop production, while there exists a supportive environment, barriers such as overall decentralized approach to designing industrial policies and initiatives have resulted in inconsistent agricultural policies, hindering sectoral development opportunities.⁵⁰ For the livestock production sub-sector, there is a strong need to enhance institutional capacity to stimulate income and employment opportunities in the rural areas, protect the livelihoods of small farmers, and improve resource use efficiency at all levels of the value chain, among others.⁵¹ Barriers related to access to quality inputs, skills, machinery and modern agricultural technology, market information, and agriculture-specific infrastructure, such as irrigation and storage, also exist, requiring measures to further improve the enabling environment for the sub-sector.

7.1.2 Fish production

The fish production sub-sector contributes to approximately 3 to 4 percent of Nigeria's annual GDP and is an important contributor to the population's nutrition requirements.⁵² The sub-sector also provides employment opportunities and income for a large group of artisanal fishermen and small traders. Nigeria has strong potential in scaling up aquaculture. However, despite of this potential,

⁴⁵ FAO. Nigeria at a glance.

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ Federal Republic of Nigeria. 2020. TNC.

⁴⁹ Federal Republic of Nigeria. 2017. INDC.

⁵⁰ FAO. Nigeria at a glance.

⁵¹ Ibid.

⁵² Ibid.



production remains low, resulting in Nigeria importing about 60 percent of fish consumed.⁵³ As such, the development focus for this sub-sector, similar to crop and livestock production, is to achieve self-sufficiency in production.

This sub-sector is expected to experience impacts of climate change, especially from impacts on water resources driven by sea level rise and extreme weather events. However, this sub-sector does not emit large volumes of GHG emissions as mitigation related activities are mostly related to improving fuel efficiency of vessels and switching to sails or changing fishing practices that reduce emissions from fishing activities.⁵⁴ In addition, mitigation measures may also include protection and development of carbon storage in the form of mangroves, seagrass beds, salt marches, to potentially remove and store atmospheric carbon.⁵⁵ As such, there is less opportunity for this sub-sector to mitigate impacts of climate change in Nigeria. Adaptation measures could include setting catch limit based on change in reproductive results and protecting valuable areas.⁵⁶ Limited opportunity in the climate change mitigation is also supported by lack of specific strategies identified in any climate policies in Nigeria.

In terms of overall enabling environment, similar to crop and livestock production, while a supporting environment exists, barrier such as lack of technical and information capacities in this sub-sector, such as information on capture and culture fisheries and development of cooperatives and fishing groups to promote potential of this sub-sector limits further development of the sub-sector, as identified in the Agricultural Policy.

7.1.3 Forestry

The forestry sub-sector is an important sub-sector in both meeting the development needs as well as addressing impacts on climate. The sector accounted for 2 percent of the GDP and 8 percent of the agricultural value added over the last two decades.⁵⁷ In relation to energy, the overuse of fuelwood driven by population growth in Nigeria is resulting in risk of deforestation. This gap in demand and supply urgently needs to be addressed through introduction of improved forest management and forest industries as well as introduction of alternatives to fuelwood. Such measures will also mitigate adverse effects of droughts and desertification.⁵⁸ The forestry sub-sector is also the highest emitter of GHGs in the agriculture and land use sector, accounting for 84 percent of total emissions.⁵⁹

In terms of overall enabling environment, further measures are needed to develop regulatory, institutional, technical and information capacity, including accelerating research and training programmes for this sub-sector. All existing policies in this sub-sector highlight this need of capacity building in order to ensure sub-sector develops sustainably.

7.2 Energy sector

The demand for energy is expected to increase significantly as the population grows and per capita energy consumption increases driven by industrialization and other long-term development programmes. It is projected that approximately 35,000 MW of electricity is needed by 2020 to achieve Vision 20:2020, supported by on- and off-grid electricity generation. The projected growth rate required

⁵³ Ibid.

⁵⁴ FAO. 2014. Climate Change Adaptation in Fisheries and Aquaculture: Compilation of initial examples.

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Federal Ministry of Environment. 2006. National Forest Policy.

⁵⁸ Ibid.

⁵⁹ Federal Republic of Nigeria. 2020. TNC.



to achieve the vision will demand even greater electricity generation by 2030. Provision of reliable and stable electricity supply is also needed to support growth of the industry sector. The energy sector has objectives to increase access to electricity to 75 percent and 90 percent (rural and urban) by 2020 and 2030, respectively, and at least 10 percent of renewable energy mix by 2025. Furthermore, Nigeria aims to achieve universal coverage of 100 percent electrification by 2040.⁶⁰ The energy sector accounts for the second largest GHG emissions, at 28.2 percent, after the agriculture sector.⁶¹

In Nigeria's energy sector, fugitive emissions from leaks or other unintended releases of gases, are a substantial source of GHG emissions, accounting for 34.4 percent of total emissions of the energy sector in 2016.⁶²

The energy sector in Nigeria is comprised of three sub-sectors. These include electricity supply, energy demand, and energy efficiency. Each of the sub-sector is detailed in sub-sections below.

7.2.1 Electricity supply

The main sources of energy used in electricity supply in Nigeria are thermal and hydro, which approximately account for 80 percent and 20 percent, respectively.⁶³ Other energy sources such as renewable energy sources contribute less than 1 percent of the energy mix.⁶⁴ Currently, approximately 70 percent of rural population in Nigeria are not connected to the grid. In addition, the 90 percent of those connected to the grid do not receive adequate power supply. This is mainly caused by the significant loss in electricity experienced during transmission and distribution. As such, Nigeria has long struggled with poor access to and an unreliable electricity supply, in which most households and businesses receive less than five hours of electricity per day.⁶⁵ This inconsistent electricity supply has driven most businesses to acquire inefficient diesel -powered generators, contributing not only to significant GHG emission but also use of more expensive electricity than electricity provided through the grid.⁶⁶ The sub-sector currently accounts for 81.9 percent of total emissions of the energy industries category.⁶⁷ As such, implementing appropriate technologies to mitigate climate change impacts while supporting increasing supply of electricity would be essential for the sector's overall development. This will include exploring options of renewable energy sources, such as off-grid solutions delivered through solar power systems.

In addition, electricity access or lack of access to electricity, impacts women and men differently as they play different roles in their homes, workplaces and communities.⁶⁸ Lack of access to energy disproportionately affects person with disability and those with chronic health illnesses – women and men – who rely on electricity to power vital equipment.

However, the scale-up of electricity supply, especially using renewable energy sources, is hindered by a number of constraints. These include limited demand assessment, high cost structure, limited technical expertise, lack of customer awareness, custom regulations, and trust of off-grid renewable

⁶⁰ Federal Ministry of Power, Works and Housing. 2016. RESIP.

⁶¹ Government of Nigeria. 2018. BUR 1.

⁶² Federal Republic of Nigeria. 2020. TNC.

⁶³ Adeyanju, G. C., Ajide, O., Osobajo, O. A. and Otitoju, A. 2020. "Exploring the potentials, barriers and option for support in the Nigeria renewable energy industry." *Discovery Sustainability*, 1:7.

⁶⁴ Ibid.

⁶⁵ IFC. 2020. A Country Private Sector Diagnostic: Creating Markets in Nigeria – Crowding in the Private Sector: Nigeria's Path to Faster Job Creation and Structural Transformation.

⁶⁶ Federal Republic of Nigeria. 2020. TNC.

⁶⁷ Ibid.

⁶⁸ Federal Ministry of Environment, 2020. National Action Plan on Gender and Climate Change for Nigeria.



energy solutions, such as solar PV.⁶⁹ Most importantly, the low cost of petroleum fuels, which is largely subsidized, remains as a major barrier to deploying alternative sources of energy, such as renewable energy sources.⁷⁰ There is also the barrier related to lack of data and information on renewable energy that constraints effective policy and decision making in Nigeria.⁷¹ The enabling environment, therefore, needs to be further developed to address key barriers for a successful implementation of relevant technologies and sub-sector development.

7.2.2 Energy demand

The energy demand in Nigeria is expected to rise significantly in the coming years as demand from households, which has the largest share of the energy demand, will increase due to growing population.⁷² Currently in Nigeria, oil, natural gas and biomass constitute the main sources of energy. Over 60 percent of the population depend on fuelwood for cooking and other domestic uses. Use of fuelwood, coupled with wide use of inefficient cooking methods, such as open fire, is deteriorating the current state of energy demand in Nigeria.⁷³

Currently in Nigeria, fuel combustion activities contribute to approximately 65.6 percent of total emissions of the energy sector.⁷⁴ Activities such as deforestation and burning of fuelwood for cooking are significant sources of climate change in Nigeria. As such, effective measures to shift to more sustainable practices will contribute significantly to Nigeria's climate change efforts. Main barriers experienced in this sub-sector is the lack of appropriate and consistent policy implementation and high costs that would promote transition of energy demand to alternative sources.⁷⁵ This will need to be addressed to ensure effective implementation of measures and technologies to transform the sub-sector.

7.2.3 Energy efficiency

Achieving energy efficiency has been identified as part of an effort to achieve cleaner and greener energy and reducing energy related GHG emissions, especially related to electricity generation, transmission, and distribution losses. Energy efficiency is also identified as a key measure to contribute to Nigeria's climate change efforts in its NDC. Currently, Nigeria's residential, commercial and industrial sectors experience inefficient application and use of electrical appliances, such as lighting, refrigeration, and air conditioning, among others.

To date, the Government of Nigeria has prepared NEEAP and NREEEP to support the development in this sub-sector. However, a number of barriers exist in the successful implementation of these policies. These include lack of awareness, affordability, research and development capacity, economic incentives, unreliable supply of electricity, low level of quality control and standard, enforcement, lack of accurate data on customers and lack of availability of energy efficiency products.⁷⁶

⁶⁹ IFC. 2020. A Country Private Sector Diagnostic: Creating Markets in Nigeria – Crowding in the Private Sector: Nigeria's Path to Faster Job Creation and Structural Transformation.

⁷⁰ Adeyanju, G. C., Ajide, O., Osobajo, O. A. and Otitoju, A. 2020. "Exploring the potentials, barriers and option for support in the Nigeria renewable energy industry." *Discovery Sustainability*, 1:7.

⁷¹ Ibid.

⁷² Ibid.

⁷³ Federal Republic of Nigeria. 2003. National Energy Policy.

⁷⁴ Federal Republic of Nigeria. 2020. TNC.

⁷⁵ Adeyanju, G. C., Ajide, O., Osobajo, O. A. and Otitoju, A. 2020. "Exploring the potentials, barriers and option for support in the Nigeria renewable energy industry." *Discovery Sustainability*, 1:7.

⁷⁶ Nigerian Electricity Regulatory Commission. Energy Efficiency in Nigeria: Presentation of R&D Division at the 3rd



7.3 Industry and commerce sector

The industry sector in Nigeria is comprised of four sub-sectors that are considered as “anchor sectors” to drive Nigeria’s industrialization. These subsectors are agribusiness and agro-allied sectors, solid minerals and metals, oil and gas-related manufacturing, and construction, light manufacturing, and services. Information on sub-sectors of the commerce sector is currently limited on the public domain and is not included in the analysis.

7.3.1 Agribusiness and agro-allied sectors

The agribusiness and agro-allied sectors aim to develop Nigeria into a leading agribusiness and agro-allied industrial nation by applying technology in intensifying production across a number of agro products. These sectors include food processing, which cover beverages and packaged foods, sugar, palm oil processing, cocoa processing, leather and leather products, rubber products, and textiles and garments. While some of these sectors may align with Nigeria’s development and industrialization plan, not all identified sectors in scope directly align with climate objectives in Nigeria. For example, beverages and packed goods, leather and leather products, rubber products, and textile and garments may consider improvements to energy efficiency in their production process to support in meeting Nigeria’s climate mitigation and adaptation objectives, but this may be covered under the energy sector in the TNA context. Other sectors such as sugar, palm oil processing and cocoa processing may consider sustainable agriculture measures to increase productivity and production of by-products, and understand that these may lead to additional GHG emissions if not properly managed.

In the agribusiness sectors, barriers such as lack of investment, insufficient and inadequate use of technology in production and processing, unreliable power supply, poor infrastructure, lack of storage facilities, and lack of quality standards have been identified as barriers to enhanced enabling environment.

7.3.2 Solid minerals and metals

Under the solid minerals and metals sub-sector, the focus sectors include cement, auto assembly, basic metals, aluminum, and chemicals. Similar to the agribusiness sector mentioned above, not all sectors in scope directly support climate objectives in Nigeria, such as auto assembly, aluminum, and chemicals. These are energy intensive subsectors which may consider mitigation measures covered under the energy sector. Sectors such as cement and basic metals, including blooms, billets, sheet metal, plates, bars, rods, wire, and structural frames, support the construction industry in which development of affordable housing is needed to support growing population. In addition, according to Nigeria’s BUR1, in 2015, cement and iron and steel sub-sectors in the Industrial Processes and Product Use (IPPU) sector accounted for the most GHG emissions contributing 53.4 percent and 46.4 percent of the aggregated emissions, respectively. This suggests that application of efficient technology in these specific subsectors will reduce both energy use and GHG emissions. This is also in line with climate objectives of Nigeria, as indicated in its NDC, to adopt green technology in the industry sector.

In terms of overall enabling environment, there is a need to improve the current condition which is constrained by barriers, such as unreliable supply of energy, lack of local competition, lack of fiscal incentives, lack of infrastructure, lack of standards and regulations, and lack of political will all hindering the development of this sub-sector.



7.3.3 Oil and gas related industries

Nigeria is endowed with some of the largest oil and gas reserves in the world. While it accounts for over 90 percent of foreign exchange earnings and significant portion of government's revenue, this sub-sector is not supported by CTCN and the GCF, and thus, is out of scope for the TNA. No further analysis was performed for this sub-sector.

7.3.4 Construction, light manufacturing, and services

This sub-sector is built on Nigeria's large population and focuses on three sectors, namely, construction, with emphasis on supply of housing stock, light manufacturing, such as consumer and home goods, and services. While services sector does not directly meet Nigeria's climate objectives, construction and light manufacturing support climate objectives. The construction sector supports the development and sale of affordable housing units which will require the use of solid minerals and metals, such as cement and iron and steel. As mentioned earlier under 7.3.2 on solid minerals and metals, these sectors make up majority of GHG emissions from the IPPU sector, and thus, application of appropriate technology will support in reducing both GHG emissions and energy use. For the light manufacturing sector, these include production of electronics and home appliances, which supports climate objectives related to energy efficiency. By efficiently assembling and producing appliances such as air conditioners and refrigerators, this will support in achieving energy efficiency, an important objective under the energy sector.

Barriers identified for this sector include high cost of building materials, construction costs, access to land, costly bulk infrastructure, inadequate skills and technical capacity, inadequate information such as research and knowledge, and lack of access to raw materials.⁷⁷ The enabling environment that would support these constrains will need to be developed to support the development of this important sub-sector.

7.4 Criteria and scoring

Based on the analysis provided above, each sub-sector was assessed against four criteria. These criteria include, (1) relevance to development priorities; (2) potential for climate change mitigation; (3) potential for climate change adaptation; and (4) overall enabling environment, including regulatory, institutional, financial, and information.

The first criteria on relevance to development priorities will evaluate whether the sub-sector and its objective helps in meeting Nigeria's overall long-term development objectives. The second and third criteria will evaluate whether the sub-sector has the potential to address climate change mitigation and adaptation needs for Nigeria, in alignment with Nigeria's climate policies. Evaluating the sub-sector against these three criteria will ensure that sub-sectors selected and prioritized are in line with meet both Nigeria's development and climate objectives. The fourth criteria will evaluate whether there is an enabling environment that addresses barriers and risks in developing the sub-sector, in relation to regulatory, institutional, financial, and information. This criterion will help assess the barriers that will need to be addressed to scale up development and implementation of technologies.

Based on the criteria above, the consulting team scored each criterion from 0 to 3, with 3 being the highest or highly relevant to the criteria.

- 3: High

⁷⁷ Federal Government of Nigeria. 2014. Nigeria Industrial Revolution Plan.



- 2: Moderate
- 1: Low
- 0: None

The sub-sectors identified have been pre-scored by the consulting team based on desktop review of all relevant documents. Detailed analysis, based on publicly available information, was performed and is detailed earlier in section 7. The scoring result was the outcome of the initial scoring of the sub-sectors to guide the actual selection and prioritization process by the key stakeholders. The scoring was then further revised at the stakeholder validation workshop based on stakeholder feedback and input.

The stakeholders' validation workshop was conducted on June 9th, 2021, and a total of 47 stakeholders participated in the workshop, 26 physical participants and 21 virtual participants. The stakeholders' validation workshop first provided an overview of the subsector prioritization process to the stakeholders, and later was followed by two interactive sessions in which the stakeholders discussed and revisited the assessment and scoring of the subsectors. During the stakeholders' validation workshop, the stakeholders provided valuable inputs or feedbacks including, but not limited to, whether to incorporate the latest political negotiations as well as gender implications in the prioritization process, to add another subsector reflecting the results of agricultural activities, and to change the subsector from "construction, light manufacturing and services" to "construction and manufacturing". Furthermore, as part of the interactive session of the validation workshop, the initial scoring of each subsector was assessed by the stakeholders, mainly taking into account all discussions raised across the criteria, including the potential for climate change mitigation and adaptation, as well as the role of enabling environment. As a result, the prioritized subsectors were confirmed with consensus from the TNA Committee: crop production, livestock production, forestry, energy supply, energy demand, energy efficiency, agribusiness and agro-allied sectors, solid minerals and metals, construction and manufacturing. The proceedings of the workshop are discussed in further detail in the stakeholders' validation workshop report.

Table 9 summarizes the result of final scoring for each sub-sector against the four criteria based on the stakeholders' validation workshop

Table 9 Result of scoring of sub-sectors

Sector	Sub-sector	Potential for climate mitigation (GHG emissions)	Potential for climate change adaptation (vulnerability)	Relevance to development priorities	Overall enabling environment	Total score
Agriculture and land use	Crop production	3	3	3	2	11
	Livestock production	3	3	3	2	11
	Fish production	1	3	3	2	9
	Forestry	3	3	3	2	11
Energy	Electricity supply	3	3	3	3	12
	Energy demand	3	3	3	2	11
	Energy efficiency	3	3	3	1	10
Industry and	Agribusiness and agro-allied sectors	2	2	3	1	8

commerce	Solid minerals and metals	3	1	3	1	8
	Oil and gas-related industries	3	2	3	1	9
	Construction and manufacturing	3	1	3	1	8



7.5 Next steps

As the next step, a preliminary long-list of technologies will be developed by the consulting team for the prioritized subsectors identified in the stakeholders' validation workshop. This will be followed by the mitigation and adaptation TNA reports, which will discuss how the technologies contribute to climate change mitigation or adaptation, the best practices of successful implementation of the technologies, as well as which among them could be applicable to the Nigerian context. The identified technologies will also be assessed and validated through stakeholder consultation, which in turn will serve as the basis for the development of Nigeria's TNA and associated action plan.