REPUBLIC OF THE GAMBIA
FIRST BIENNIAL UPDATE REPORT (BUR1)
DECEMBER 2024






UN environment
United Nations Environment Programme

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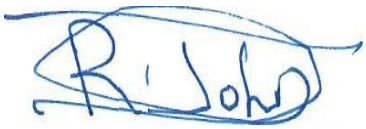
FOREWORD

The submission of The Gambia's first Biennial Update Report (BUR1) is a manifestation of our commitment to The United Nations Framework Convention on Climate Change's (UNFCCC's) efforts to address climate change, and as part of meeting our obligations pursuant to Decision 1/CP.21 as adopted during COP21 in Paris. Furthermore, we have reported on support needed and support received in accordance with Decision 2/CP.17, which outlines the Bali Action Plan and Long-Term Cooperative Action under the UNFCCC.

This submission will serve as a precursor to our transition to Biennial Transparency Report (BTR). Our endeavour as a country to meet our reporting requirements, aligns with our recognition of the implications of Decision 2/CP.17, Paragraph 41(f), vis-à-vis to enhance our transparency, communicate our support needs, build trust by reporting on our national circumstances and facilitate the global stocktake.

We are glad to share that The Gambia has costed its Nationally Determined Contributions (NDC) implementation plan, and we are optimistic that our collaboration with the NDC Partnership will enable us to accurately track and report on the implementation of the plan. We will continue to leverage the support from partners such as U.S.A-EPA, UNFCCC Transparency Division, and CBIT-GSP, to further develop and mainstream capacity through relevant national institutions to ensure sustainability and self-reliance in our future reporting, under Article 13 of the Paris Agreement.

As we work on finalising the BTR, we bear in mind its importance to Articles 6, 9, 10, 11, and 14 of the Paris Agreement. Therefore, we shall rely on this BUR and NatCOMs to fulfil our responsibilities under the convention in the near future. The prospecting BTR will serve as an enabler for The Gambia to develop carbon credit framework and legal instruments for the implementation of Article 6.2 (Cooperative Approaches), 6.4 (PACM) and 6.8 (Non-market Approaches).



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ACKNOWLEDGEMENT

The Ministry of Environment, Climate Change and Natural Resources (MECCNAR), through The National Climate Change Secretariat (NCCS) of the Republic of The Gambia conveys gratitude to all stakeholders, individuals and organizations, that have contributed directly or indirectly to the development of The Gambia's first Biennial Update Report (BUR1).

This report is a result of years of concerted effort, including exertions on data collection and analysis, stakeholder consultations, focus group discussions and seminars. Despite challenges, we were able to strive as a country, with the collaboration of local and international partners to finalize the BUR report.

We would like to express our appreciation to the Global Environment Facility (GEF) for funding the development of the BUR. We sincerely thank the UNFCCC Secretariat, UNEP, U.S.A-EPA and CBIT-GSP for their technical guidance and continued support, which culminates to the finalization of this report.

We would like to acknowledge with gratitude, all the technical assistance received from other international partners and consultants, for their invaluable contributions in the preparation and review the BUR report. We recognize the precious efforts of the local experts, local consultants and thematic/ sectoral technical working group members, who have immensely contributed to the drafting and finalization of this document. We also value the supervision, guidance and support of the senior management of MECCNAR, whose support led to the successful preparsatio of the BUR.

We are confident that the experience gathered in the development of the BUR would be sufficient to speed up the development of our first BTR, which is expected to be submitted by December 2025. Additionally, we hope to train local experts by mainstreaming capacity building activities within relevant institutions, with the aim of achieving self-reliance in our subsequent reports, and ensure sustainability of the built capacity in the short, medium and long term.

To achieve these objectives, we hope to deepen the existing partnership with U.S.A. EPA, CIBIT-GSP and UNEP, as well as build new partnerships to improve the quality and timeliness of our future reports.

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ACRONYMS

AdCOM	Adaptation Communication
AFOLU	Agriculture, Forestry and Other Land Use
ANR	Agriculture and Natural Resources
BIA	Banjul International Airport
BTR	Biennial Transparency Report
BUR	Biennial Update Report
CBD	Convention on Biological Diversity
CCS	Climate Change Secretariat
CFSVA	The Comprehensive Food Security and Vulnerability Analysis
CH_4	Methane
CIAT	Chartered Institute of Architectural Technologists
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxides
CO_2	Carbon Dioxide
CO2eq	Carbon Dioxide Equivalent
CPPP	Community Public Private Partnership
CRR	Central River Region of CRR of The Gambia
DLS	Department of Livestock Services
DOC	Degradable Organic Carbon
DOCF	Degradable Organic Carbon Factor
DoE	Department of Energy
DoP	Department of Planning Services (under MoA)
DPWM	Department of Parks and Wildlife Management
DWR	Department of Water Resources
DWR	Department of Water Resources
EbA	Large-scale Ecosystem based adaptation
ECO	Economic Community of West African States (proposed regional money)
ECOWAS	Economic Community of West African States
ENI	Energy Industry
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organisation
FOLU	Forestry and Other Land Use
GAM	Global Acute Malnutrition
GBA	Greater Banjul Area
GBoS	Gambia Bureau of Statistics
GCAA	Gambia Civil Aviation Authority
GCFT	Africa Continental Free Trade Area
GDP	Gross Domestic Product
GgCO2eq	Gigaton Carbon dioxide Equivalent
GHG	Greenhouse Gases
GMA	Gambia Maritime Administration
GMD	Gambian Dalasi
GNPC	Gambia National Petroleum Commission
GoTG	Government of The Gambia
GPA	Gambia Ports Authority
GRA	Gambia Revenue Authority
GTHI	The Gambia Tourism and Hospitality Institute
GTTI	Gambia Technical Training Institute
GWP	Global Warming Potentials
HF6	Hexafluoride
HFCs	Hydrofluorocarbons
HRT	Hydraulic Retention Time
ICRAF	International Center for Research and Agroforestry
ICRISAT	Stands for the International Crops Research Institute for the Semi-Arid Tropics
IDA	International Development Association
IFAD	International Fund for Agriculture
IFMIS	Integrated Financial Management Information System
IMCC	Inter-ministerial Climate Committee
INDC	Intended Nationally Determined Contributions
IP	Implementing Partners
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
KCA	Key Category Analysis
KMC	Kanifing Municipal Council
KWSP	Kotu Waste Stabilization Ponds
LECRDS	Low Greenhouse Gas Emissions and Climate Resilient Development
LPG	Liquified Petroleum Gas
LTO	Landing/Take-Off
LTS	Long Term Strategy
MAICO	Manufacturing, Industry and Construction

MCF	Methane Correction Factor
MECCNAR	Ministry of Environment, Climate Change and Natural Resources
MoA	Ministry of Agriculture
MoFEA	Ministry of Finance and Economic Affairs
MoFEA	Ministry of Finance and Economic Affairs
MoPE	Ministry of Petroleum and Energy
MoTC	Ministry of Tourism and Culture
MoTWI	Ministry of Transport, Works and Infrastructure
MoUs	Memorandum of Understanding
MPG	Modalities, Procedure and Guidelines
MRC	Medical Research Council
MRV	Measurement Reporting and Verification
MSW	Municipal Solid Waste
MTF	Mitigation Task Force
N_2O	Nitrous Oxide
NaCOM/	National Comminutions /NC
NAMA	National Appropriate Mitigation Action
NAP	National Adaptation Plan
NAPA	National Adaptation Plan of Action
NARI	National Agriculture Research Institute
NASS	National Agriculture Statistics Survey
NAWEC	National Water and Electricity Company
NCAC	National Center for Arts and Culture
NCC	National Climate Committee
NCCP	National Climate Change Policy
NCCS	National Climate Change Secretariat
NDC	Nationally Determined Contribution.
NDP	National Development Plan
NEA	National Environment Agency
NIR	National Inventory
NMVOC	Non-Methane Volatile Organic Compounds
NOx	Nitrogen Oxides
ODS	Ozone Depleting Substances
OX	Oxidation Factor
PCA	Project Cooperation Agreement
PFCs	Perfluorocarbons
QA/QC	Quality Assurance and Quality Control
RAMSAR	Convention on Wetlands of International Importance
SDGs	Sustainable Development Goals
SHS	Solar Home System
SIC	Special Investment Certificate
SOE	State Own Enterprises
SPCR	Strategic Programme for Climate Resilience
SWDS	Solid Waste Disposal Sites
TA	Technical Assistance
TDA	Tourism Development Areas
TDL	Transmission and Distribution Losses
TNC	Third National Communication
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
URR	Upper River Region of The Gambia
US-EPA	United States of America – Environment Protection Agency
WAPP	West Africa Power Pool
WCR	West Coast Region of The Gambia
WFP	World Food Programme
WWTreat	Waste Water Treatment

EXECUTIVE SUMMARY

CHAPTER 1: NATIONAL CIRCUMSTANCES

Republic of The Gambia is the smallest country on mainland Africa. It is bounded by latitudes 13° and 14°N and longitudes 13°40 and 16°50 W. It has a total area of 11,360km^2, of which 10,689km^2 is land area and the remaining is covered with water. The country has a total land boundary of 740km, all of which is shared with the Republic of Senegal in the North, East and South while in the West the country is open to the Atlantic Ocean. The Gambia River is the country's dominant feature, and it flows across a plateau of Miocene-Pliocene sandstone consisting of compacted sediment composed predominantly of quartz grains formed from about 23.7 to 1.6 million years ago.

The population of The Gambia is 2,422,712 and 51% is female and 49% male. The West Coast Region (WCR) is the most populous accounting for 47.5% of the national total population. Kanifing Municipality is the next most populous, accounting for 15.7% of the national population.

In 2021, GDP at **current market prices** is GMD 104.9 billion compared to the revised estimate of GMD 93.3 billion in 2020, representing a growth of 4.3 per cent compared to the 2020. GDP per capita is, therefore, GMD 44, 696 or US$ 867 per person for an estimated population of 2.3 million people at the nominal exchange rate of GMD 51.54 to 1 US Dollars. In terms of percentage contribution to GDP, the Services sector continues to be the major contributor with a share of 57.5 per cent followed by the Agriculture sector (24.1 %) and the Industry sector (18.4 %)**.**

Under the Land and Land-use sector, the forestry sub-sector provides an important natural resource for the country. It contributes at least 1% to GDP while for domestic uses, the subsector provides more than 85% of the domestic energy (fuelwood) and about 17% of the timber needs of the population. The Gambia's total forest area was estimated at 423,000 ha in 2010 as compared with 520,400 ha in 1998. Forest resources — including mangroves — occupy 350,000–505,300 ha (43%) of the country area (GoTG, 2010). The government has declared 222,000 ha as forest reserves, 40,000 ha as forest parks, and 18,000 ha as community forests. The current Forestry Policy (2010–2019) (GoTG, 2009) aims to achieve national forest cover of 30%[1], with 75% of that cover to be sustainably managed by communities and the private sector. In particular, the policy advocates for the transfer of 200,000 ha of forest lands to communities. The Gambia is endowed with a high diversity of plant and animal species which are found in three major ecological systems (a) the marine and coastal zone along the western coast of the country; (b) the area along the River Gambia and related fresh water and estuarian ecosystems; and (c) the territorial ecosystems behind the coastline and to the north and south of the river.

The Gambia has a typical Sudan-Sahelian climate, characterised by a short rainy season (June–October) and a long dry season (November–May). The average temperature is between 29°C and 34°C. The lowest daily temperature of 4°C was recorded in Jenoi (13°28" N, 15°34" W) in 2003, and the highest daily temperature of 49.0°C was recorded in 2001 at Jenoi (Stafford, 2019). Since the 1950s, routine observation also indicates that minimum temperatures across The Gambia have increased steadily at the rate of 0.4 to 0.67°C per decade (GoTG, 2007). Average rainfall in a year varies from 1,000 mm in the South and Southeast to 700 mm in the most northerly part of the country, with 80-85% of rainfall concentrated in the months July, August and September (JAS).

Agricultural land in the Gambia constitutes approximately 54% of the country's total land area (Figure 29). During the last two decades, the area of land under agriculture has increased from 557,000 hectares to 605,000 hectares. At this same period, the total arable land area increased by

[1] This is considered to be sufficient for both ecological health and sustainable development needs

173% (about 8.7% per annum). These increases are at the expense of forests. Livestock is part of the farming systems and a means to accumulate assets, earn cash income, and provide draught power as well as manure for crops, and a source of food and nutrition security. The livestock sub-sector continues to contribute to the livelihood of the rural population, enhancing food security and income, and fulfilling socio-cultural obligations from acquisition, possession and sale of cattle and small ruminants.

The national per capita fish consumption of 28.4kg for The Gambia far outweighs the African average of 8.4kg. It is recognized that fish must be presented in a form, size and shape with the required quality and safety acceptable to the market as prescribed by international standards. Logistical constraints for fresh fish distribution and unaffordability have been cited as crucial drawbacks. Consequently, aquaculture development has gained prominence in developmental discussions as a potential conduit via which food fish and nutrition security could be enhanced especially in the inland thereby alleviating poverty. Aquaculture has also been identified as a viable climate change adaptation measure in The Gambia.

The current demand for energy in the country, in particular electricity, is not matched by a corresponding increase in the supply and this situation has resulted in a significant electricity demand-supply gap. The major challenges in the supply-side have mainly been due to over dependence on fossil fuels particularly rising import bills, price volatility in the global oil market, repair and maintenance of aging generators and plants as well as inadequate investments and financing options. These variables generate direct and indirect financial and capital costs to Government and consumers. Household energy consumption in The Gambia accounts for more than 80% of the energy demand. The household energy sources are mainly derived from wood, which is used for various activities at the household level such as cooking and ironing, and accounts for the largest component of the overall household energy consumption. Government has shifted policy towards the promotion and the use of alternative sources such as Liquefied Petroleum Gas (LPG) in line with the sustainable management of the natural resources base of the country. Government has set energy efficiency TARGETS. It is expected to gradually reach 100% penetration of energy efficient lighting in on and off-grid systems by 2020; Reduce T&D losses to 19.9% by 2020 (from 24.9% in 2013) and to 10% by 2030; Reach 5% of energy savings by 2020 and another 5% by 2030 for the building sector; Reach 40% charcoal production by 2020 and 100% by 2030 using efficient charcoal production technologies. Most of these targets could be met with the full implementation of The Gambia NDC2 Implementation Plan (2022 – 2026).

Major threats to surface and groundwater resources, defined by their magnitude, persistence, and social impacts are identified as: i) depletion of water stock, and ii) pollution of water resources. Single and multiple risks posed by these threats can be summarized as creating scarcity through reduced water resources availability and suitability for multiple purposes, leading to increased development, treatment and delivery costs of water. Estimated demand and trends clearly show that irrigation and domestic water requirements account for more than 90 per cent of total demand nationwide, with irrigation alone accounting for more than 70 per cent. Pumping irrigation water from the River Gambia has a potentially negative impact on the salt front in the river and thus on the environment overall. It has been estimated that if $1m^3/s$ is pumped from the upper river during the dry season, the salt front can move up to 4km upstream.

The Gambia's traditional comparative advantages as a tourism destination are: a close proximity to Europe; year-round favourable tropical weather; an English-speaking populace; cheap prices; friendly and hospitable people;/ peace and stability. Tourism has therefore emerged as one of the success stories of national development endeavours and a major driver of the economy, contributing immensely to employment generation, and has gained prominence in terms of policies, programmes and investments. Destination marketing should be a key instrument in securing a large increase in tourism business and boosting arrivals, especially that climate change assessments for the country have confirmed that the projected climate remains favourable for

increased tourist arrivals in the near future. Priority will be given to increasing market share in established traditional markets and achieve successful entry into new and emerging markets to ensure year-round tourism.

The Gambia's transport system consists of three modes: (i) road transport which is made up of a primary network, inter-urban trunk roads; gravel surfaced secondary roads; urban roads mainly within the Greater Banjul Area (GBA); and gravel/earth surface (rural feeder roads); (ii) air transport system provided by the Banjul International Airport (BIA) at Yundum, and (iii) the maritime and river transport consisting of the Port of Banjul and the river transport system. The role of transport is therefore critical for the efficient functioning of the national economy as it provides vital and essential links between areas of production and markets, and also enhances access to social and economic facilities. For the transport sector to play its expected role in the development of the country, it is important that certain critical factors are recognized and addressed sufficiently by Government. Efforts should be made to adapt the transport sector to climate change, provide higher specifications for existing transport infrastructure; raise awareness of projected impacts of climate change on the transport sector; ensure efficient design of urban areas and their associated transport networks; create and promote new partnerships with government and civil society as well as collaboration with industry and customers to advance policy solutions.

The Climate Change Integrated gender Policy emphasizes an all-embracing (holistic) approach, one that includes ensuring gender equality in access/control over productive resources such as land, labour, technology, capital/finance, and information. Also, the framework establishes efforts towards embarking on affirmative action to rectify errors of the past particularly, as they relate to discrimination against women and reducing gender and geographical disparities in the distribution of national resources. Attention is given to gender mainstreaming strategy, in creating a new order of social justice and equity premised on the inclusion of all hitherto excluded. A series of socio-economic impacts of climate change may (a) reduce educational achievements and the performance of the education system; (b) lead to increased school dropout rates; (c) increase the number of days in which children and teachers do not attend school; (d) reduce availability of portable water, reduce agricultural work and productivity and the increased prevalence of malnutrition in school-going children which will impair concentration, learning capacity, mental development, etc., all of which adversely impact children's performance at school. The gender imbalance in the impacts of climate change is thus closely related to socioeconomic inequality and the persistence of poverty, in the context of an excluding and unsustainable form of growth. The Gender policy also aims to ensure equal access by girls and women, boys and men to quality formal and non-formal education at all levels from early childhood development, basic and secondary education, to vocational and technical training, as well as the university. This goal is a priority under the current and projected changing climate. A series of socio-economic impacts of climate change may (a) reduce educational achievements and the performance of the education system; (b) lead to increased school dropout rates; (c) increase the number of days in which children and teachers do not attend school; (d) reduce availability of portable water, reduce agricultural work and productivity and the increased prevalence of malnutrition in school-going children which will impair concentration, learning capacity, mental development, etc., all of which adversely impact children's performance at school. Therefore, this emphasis that government's commitment to eliminating gender inequalities is the full implementation of its programme of promoting the equal and full empowerment of women in the national development process.

It is Gambia's major commitment to adequately and effectively participate in the UNFCCC processes for the implementation of the Convention, the Kyoto Protocol and the Paris Agreement. Through the 2016 National Climate Change Policy (NCCP), The Gambia is committed to providing a determined and systematic response to the interlinked climate threats to sustainable development, wellbeing and ecological integrity. Accordingly, the long-term vision of the NCCP is to Achieve a climate-resilient society, through systems and strategies that mainstream climate

change, disaster risk reduction, gender and environmental management, for sustainable social, political and economic development. The government thus, developed and submitted three National Communications, a NAPA, three NAMAs (National, Agriculture and Energy), the SPCR, the Intended Nationally Determined and the Nationally Determined Contributions (INDC1 and NDC2), the 2050 VISION and Long-Term Strategy (LTS) to 2050. The Gambia is in the process of developing and submitting her BUR1, BTR1, NC4, NDC3 and NAP.

Since the formulation of the National Climate Change Policy (NCCP) in 2016, The Gambia government's climate change portfolio and policy issues have been entrusted to the Ministry of Environment, Climate Change and Natural Resources (MECCNAR). The NCCP sets in place a number of national-level institutional arrangements to promote climate change mainstreaming and implementation of climate-resilient development activities. Some of these are new, while others entail a modification of existing structures. They include: the National Climate Change Council, the Inter-ministerial Climate Committee (IMCC), a National Climate Committee (NCC), a Climate Change Secretariat, and a formal network of Climate Change Focal Points. The Focal Points are located within the departments of each sectoral Ministry.

CHAPTER 2: NATIONAL GREENHOUSE GAS (GHG) INVENTORY

As required by decision 17/CP.8 and using the IPCC 2006 Guidelines (version 2.69), estimates of emissions and removals have been provided for Carbon Dioxide (CO2), methane (CH_4) and nitrous oxide (N_2O) by sources and removals by sinks due to human activities. Where activity data is available, information on anthropogenic emissions by sources of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hexafluoride (SF6). Nitrogen oxides (NOx) and Carbon Monoxide (CO) are also provided. Using Global Warming Potential (GWP) values in IPCC[2] AR5 WGI, Carbon Dioxide Equivalent (CO2eq) values were calculated for all the gases reported in this 2020 Inventory of GHG emissions from The Gambia.

The GHG Inventory Task Force (GHGI-TF) of the National Climate Committee (NCC) is responsible for the assessment and development of the National Inventory (NIR) and Greenhouse Gas Mitigation assessment. This Technical Team has representation from the Ministry of Environment Climate Change and Natural Resources (MECCNAR); the Ministry of Finance and Economic Affairs (MoFEA); the Ministry of Petroleum and Energy (MoPE); the Ministry of Agriculture (MoA); the Ministry of Transport, Works and Infrastructure (MoTWI); and the Ministry of Lands, Local Government and Religious Affairs

The Gambia does not have a QA/QC protocol. For this Greenhouse Gas Inventory cycle QC activities were undertaken by national experts and the QA exercises were undertaken by external entities that included the UNFCCC Secretariat, US-EPA and UNEP. These interventions resulted in an improved National Inventory of Greenhouse Gases for the Republic of The Gambia. For future national inventories of GHG emissions a QA/QC plan will be developed, and an independent national entity will be identified to conduct the QA analysis, internally.

The greenhouse gas (GHG) data verification process is a third-party assessment that confirms the accuracy and completeness of the GHG emissions inventory, identifies areas for improvement and strengths weaknesses. Except for the involvement of UNFCCC and UNEP consultants, the verification was limited to the personal involvement of GHG Category compilers.

Results of the greenhouse gas emissions assessment for 2020 show that the total GHG emissions from The Gambia in 2020, considering only direct greenhouse gases based on Decision 17 COP8, was 2,678GgCO_2eq distributed as 60% (1,645CO_2eq) of CO2, 30% (805GgCO_2eq) for CH4, 6%

[2] https://www.ipcc.ch/report/ar5/wg1/

(153GgCO_2eq) for HFCs and about 3% (45GgCO_2eq) as combination of N2O, PFCs and SF6. Considering both direct and indirect gases, the total greenhouse gas emissions for 2020 were about 3,542GgCO_2e. About 46% (1645GgCO_2eq) is CO2, 23% (805GgCO_2eq) is CH4, 22% (774GgCO_2eq) is NOx and the remaining 9% (318GgCO_2eq) are N2O, HFC, PFC, SF6 and CO.

The AFOLU Category is the biggest emitter of greenhouse gases in The Gambia in 2020. AFOLU pumped 2,221GgCO2eq into the atmosphere, followed by Energy with 857GgCO_2eq (24%), Waste with 271GgCO_2eq (8%) and IPPU with 193GgCO_2eq (5%). The trend analysis for the period 2011 to 2020, shows that the emissions continue to increase from 2,679GgCO_2eq in 2011 to 3,542GgCO_2eq in 2020, representing an annual increase of about 86GgCO_2eq per year.

Gambia has completed a key category analysis of its GHG inventory using Approach 1 Level and Trend assessment. The methods used for the identification of the key categories were level assessments for 2011 and 2020, and trend assessment for 2020 using 2020 as base year. For the year 2020, the sum of the total emissions for the key categories amounted to 2488.223 Gg CO2eq. For the National GHG inventory, 2020 level assessment key categories for Carbon dioxide are Land Converted to Cropland which constitute the highest; followed by Road Transportation, Land converted to Wetland and Land converted to other land.

For the Gambia, the uncertainty assessment was based on the gaps on the activity data collection and the emission factor used for the estimations. The emission factors used for estimating emissions for the GHG inventory are the default Emission factors from IPCC emission factor database. The assessments show a Total Emissions of 3,758.82GgCO2eq as compared to 3.542GgCO2eq for 2020. Average uncertainty in Activity Data is 8%, in Emission Factors is 33% and the Combined uncertainty is 37%. The Total uncertainty is given as 0.71

In 2020, the Energy Category emitted 857GgCO2eq. The major emitted gas was CO_2 which accounted for about 95% of the total emissions of the category, followed by CH_4 with 3% and N_2O with 2% of the emissions. The biggest emitter within the energy sector is Transport, which in 2020 emitted about 546.4 Gg/CO2 from 291.72 Gg/CO2 in 2011. Emissions of GHG from the Energy Category has increased from 567.2GgCO2eq in 2011 to 856.6 GgCO2eq in 2020, representing and annual increase of about 29 GgCO2eq per year. The second largest emitter in the energy sector was electricity generation.

The IPPU category of emissions produced 193GgCO2eq in 2020 and 79% of these emissions was HFCs. The other 21% of the emissions from the category were CO2 (8%), SF6 (7%), CH4 (4%) and PFCs (2%). Emissions from the IPPU category have been increasing from 140 GgCO2eq in 2011 to 193 GgCO2eq in 2020. In 2020, about 14 GgCO2 were emitted from some sub-categories of the IPPU category. The bulk of the emissions from the Non-Energy Products from Fuels and Solvent Use (about 10 GgCO_2) that include the use of Lubricants (8.517 GgCO_2) and Paraffin Wax (1.443 GgCO_2). Methane emissions from the IPPU category was 0.282 GgCH_4 which is equivalent to 7.9 GgCO_2eq. 90% of the emissions are HFCs and the remaining 10% are PPC (4 GgCO2eq) and SF_6 (14 GgCO_2eq). SF_6 emissions come from sub-category 2.G.1 electrical equipment.

The AFOLU Category emitted a total of 21,682GgCO2eq for the period 2011 to 2020. The emissions ranged from1,957GgCO2eq in 2011 to 2,221GgCO2eq in 2020. The AFOLU category emitted 2,221GgCO2eq in 2020 and 36% (813GgCO2eq) were CO2, 23% (503.5GgCO2eq) were CH4 and 2% were N2O (40.5GgCO2eq). Of the indirect GHG gases, carbon monoxide (CO) emissions (89.8GgCO2eq) represented 4%. The net CO2 emission of 813GgCO2eq is broken into about 834GgCO2 from the Land sub-category, negative 22GgCO2 due to wood harvesting and 1GgCO2 aggregate emissions by urea applications. Livestock sub-category is the major emitter of Methane under the AFOLU category. The sub-category emitted 70% (12.6GgCH4 or 351.6GgCO2eq) of the total AFOLU methane emissions of 18GgCH4 or 503.5GgCO2eq. Livestock emission is further broken down to 337.4GgCO2eq from enteric fermentation and 14.1

GgCO2eq from manure management. Rice cultivation emitted 21% (3.8GgCH4 or 105.1GgCO2eq) and Biomass burning emitted 9% (1.7GgCH4 or 46.8GgCO2eq) of the total methane emissions from AFOLU. The Biomass Burning sub-category 904.1GgCO2eq. N2O emissions were 40.5GgCO2eq (4%), PFC emissions of 773.9GgCO2eq (86%) and 89.8GgCO2eq (10%).

The bulk of the emissions from the Waste Category is Methane (268.5 Gg CO2eq, 98.9%). CO2 and N2O emissions constitute about 3.0 Gg CO2eq (1.1%). Generally, the Trend analysis shows that emissions continue to increase from about 15 Gg CO2eq in 2011 to about 271 Gg CO2eq in 2020. About 9.59GgCH_4 or 268.5GgCO2eq were emitted by waste management in 2020, Solid Waste Disposal emitted the most methane (96%). Waste Water Treatment (WWTreat), Composting, Incineration and Open Burning (IOB) of waste contributed to the remaining 4% of the emissions (11.91GgCO2eq).

CHAPTER 3: CLIMATE CHANGE MITIGATION AND ACTION PLAN

The following mitigation measures are proposed for implementation in The Gambia:

ENERGY CATEGORY:

- Harmonize the NAWEC, KarPowerShip and the River Gambia Development Authority (with French acronym OMVG) electricity supply networks
- Development and operationalization of grid-connected wind power as a GHG mitigation measure.
- Reduced Transmission and Distribution Losses of Electricity and Water Systems
- Switches All HFO-powered Heating and Lighting Systems to Solar PV and Battery-based power mini-grids
- Establishment and operationalization of Solar home systems
- Establish and operationalize Solar water heating systems
- Establishment of Solar rooftop PV Systems for institutions
- Decarbonization of Transport Sector is proposed through downsizing the carbon footprint of Gambia's transport sector.

IPPU CATEGORY

- Using Fuel Substitution to reduce consumption of HFCs
- Adopt and promote energy efficiency as an important mitigation strategy both for process and system-wide technologies and measures in less energy intensive industries in The Gambia.
- Support and upscale current efforts of recycling as a greenhouse gas mitigation option in less energy intensive industries of The Gambia.
- Promote the use of food products more intensively and avoid food waste to reduce emissions of greenhouse gases.

AFOLU CATEGORY

- Climate Smart Agriculture [CSA] is adopted and implemented.
- Design, adoption and application mitigation measures in Full Food Value Chain of The Gambia.
- Livestock Productivity is improved through effective GHG Mitigation measures.
- Restoration of degraded landscapes (including protected forests.
- Promotion and upscaling Fuel-efficient and cleaner cookstoves.
- Adoption, promotion, and implementation of Multi-strata agroforestry.
- Sustainable Fire Management.

WASTE CATEGORY

- The design, establishment and promotion of Integrated Waste Management.

CHAPTER 4: CONSTRAINTS AND GAPS ON TECHNOLOGY, FINANCE AND CAPACITY-BUILDING NEEDS AND SUPPORT RECEIVED

Several systemic and circumstantial problems impede the timely publication of a comprehensive report. These problems include the compounding effects of poor institutional memory, weak organisational frameworks and task-related capacity gaps. Crucially, activities involving pooling, analysis and packaging of relevant information were continually challenged by poor institutional memory, task-related capacity gaps, and weak perception of country-ownership, reflected in delivery schedules, and quality of intermediate outputs. In effect, failure to provide specific details along with inventory information, or a full re-analysis of 1990 and 2000 inventory data, failure to provide an overview of institutional arrangements for GHG inventories, and absence of reporting on Quality Assessment/Quality Control (QA/QC) and uncertainty analyses, are considered as important gaps.

Other gaps relevant to comprehensiveness of documents are briefly listed as follows:

- Harmonised socioeconomic scenarios to be used in sectoral assessments and mitigation analysis.
- Information on the institutional framework for implementation of the Convention, legal frameworks for stakeholder participation and public access to information, stakeholder engagement processes, level of involvement, and outcomes.
- Information on scope and areas of The Gambia's participation in the global research and observation systems and information networks.
- Information on the status of activities and level of participation in South-South cooperation, including capacity building activities for building resilience.
- Information on the status of activities related to coordination and sustainability of capacity-building activities, and level of public awareness and understanding of climate change issues.
- Specific (sectoral) mitigation and adaptation policies and measures and where relevant, linkages to the country's Nationally Appropriate Mitigation Actions (NAMA), Nationally Determined Contributions (NDC), National Adaptation Programme of Action (NAPA), NAP, and Sustainable development Goals (SDGs).
- Measures relating to enhancing the enabling environment for the development and transfer of technologies.

Capacity building outcomes (with support from development partners) continues to lag behind actual needs. Indeed, leadership training of public sector employees and competency gaps in the fields of project management; environmental, ecological and economic modelling; engineering; and data science, remains a top priority at sectoral and at different administrative levels. In this regard, greater effort should be expended in developing the country's South-South cooperation in the field of climate risk management.

A sustained drive to train media professionals, extension workers, and community groups, and the recent publication of a glossary of key terms and concepts into major local languages could be seen as a significant step towards greater public enlightenment and engagement on climate change issues.

The Ministry of Environment, Climate Change and Natural Resources (MECCNAR), and other relevant stakeholder government agencies and partners need to establish stronger cooperative framework. International partners are required to provide targeted capacity building support and technology transfer through relevant convention bodies/mechanisms, or bilateral arrangements. The allocation of resources commensurate with expected outputs would eliminate some major shortcomings in the dissemination of diverse genres of information generated within the climate change stakeholder community.

MECCNAR and relevant government agencies need to urgently address some of the problems identified in this report, through:

- Initial framing of issues and expectations relating to the establishment of formalised GHGI system (under the NSS coordinated by the Gambia Bureau of Statistics), climate risk management coordination mechanism (including role definition and MOUs if required) and system audit to assess deficiencies, should follow the publication of this report. UTG should lead discussions around the establishment of an NCCRC, criteria for affiliation and modalities for deciding upon research priorities.
- Joint development of key messages for various audiences to ensure coherence between GOTG Education & Awareness Programme, and its Research Programme.
- Take advantage of UNFCCC Biennial Update Reviews (BURs) to implement imperative structural and management reforms.
- Measurement and reduction of their GHG footprint (additional to the INDC), as a sign of leadership by example.

On support required, The Gambia's plans and commitments to reduce GHG emissions are clearly indicated in the Second Nationally Determined Contribution (NDC), which estimates the needed support of approximately USD324.10 million for five (5) year. This is to cover the USD268.2 million required to implement the necessary greenhouse gas mitigation activities and an additional USD55.9 million for implementation of climate change adaptation options. The Gambia Long-Term Strategy (LTS) is costed at USD4.0 billion at today`s prices. Therefore, it will require an average of USD138 million per annum in funding, between now and 2050 in order to achieve its target of net-zero emissions by mid-century.

On support received, The Government of The Gambia received funding from GEF to prepare and submit its first BUR to the UNFCCC. Some support received from 2013-2022 relevant to climate change amounts to USD380.68 million from development partners.

CHAPTER 1: NATIONAL CIRCUMSTANCES

1.1. GENERAL INFORMATION

1.1.1 Location

Republic of The Gambia is the smallest country on the African mainland. It is bounded by latitudes 13° and 14°N and longitudes 13°40 and 16°50 W (see Figure 1 below). It has a total area of 11,360km^2, of which 10,689km^2 is land area and the remaining is covered with water. The country has a total land boundary of 740km, all of which is shared with the Republic of Senegal in the North, East and South while in the West the country is open to the Atlantic Ocean.

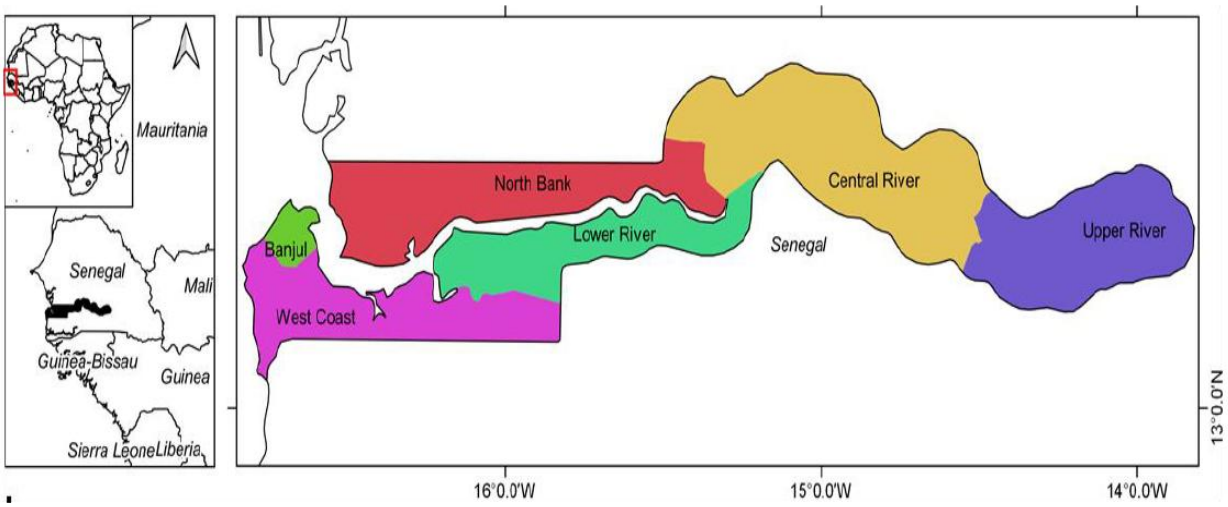


Fig: 1 Administrative Regions of The Gambia

1.1.2 Topography

The topography of The Gambia is predominately characterized by dissected plateaus with sandy hills, sandstone plateaus and valleys. According to Jaiteh and Sarr (2011) this topography is useful for both agriculture and human habitation purposes; however, it is still vulnerable to the effects of climate variability. The Gambia River is the country's dominant feature, and it flows across a plateau of Miocene-Pliocene sandstone consisting of compacted sediment composed predominantly of quartz grains formed from about 23.7 to 1.6 million years ago. In the east, narrow valleys are separated by broad interfluves or flattish hills. In the west, lower and smaller sand hills alternate with depressions filled in with sand to form a flat plain. The vegetation pattern of the Gambia River Basin varies from its mouth to its source. Mangrove forests stretch inland for about 97 kilometres from the mouth of the river. The middle of the course of the river supports freshwater swamps and salt flats, and these serve as ideal breeding places for a large number of insects. Salt

mud flats, Sudano-Guinean riverine forests, and tall grasslands are also found along the course of the river.

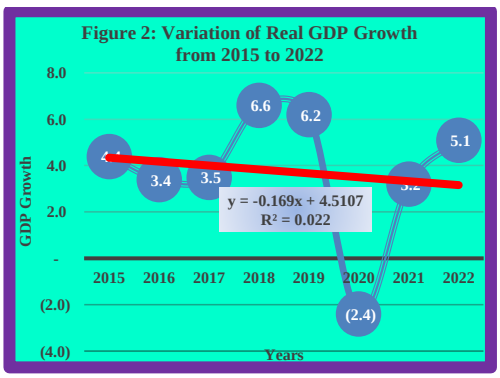
1.2 DEMOGRAPHIC AND ECONOMIC TRENDS

1.2.1 Population

According to the 2013 Population and Housing Census (GBOS, 2013) projections, the population is estimated to be at 2.2 million in 2019 (WB) and 2.4 million in 2020, 50.7% are females with annual growth rate of 3.1 %. The population size is set to reach 2.8 million in 2025 (GoTG/MoHSW, 2021). The crude birth rate is 46 per 1000 population while the total fertility rate is 4.4 births per woman (MICS 2018). Nearly 37% of the population is below 15 years and 19% between the ages 15 to 24. Average life expectancy at birth is 61.5 years overall with females constituting 62.3 and males 59.6 years (GBoS, 2013). The Gambia is also one of Africa's most densely populated countries with a population density of 217 per Km^2 and projected to rise to about 449 by 2085 and 2090 before starting to decline from 2095. The ethnic groups are Mandinka, Fullah, Wolof, Jola, Sarahuleh, Serere and Manjago. The population is overwhelmingly Muslim with 96% regarded as Muslims, 3.8% as Christians, and 0.1% as followers of ancestral African religions (GBoS, 2013).

1.2.2 GDP Growth and GDP Per Capita

Following the 2016 political transition, GDP growth accelerated from 3.4 in 2016 to 3.5 in 2017 and 6.6% in 2018 (Figure 2 adjacent). It then fell to 6.2% in 2019 and an estimated 2.4% in 2020, 3.2 in 2021 and 5.1 in 2022. Real GDP per capita varied from 0.2% in 2017 to 3.6% in 2018, 3.3% in 2019 and contracted to 5.6% (-5.6%) in 2020. GDP per capita (Figure 3 adjacent) is projected to expand by 0.2% in 2021 and 2.2% in 2022 led by agriculture, tourism, increased external financing for energy and roads, and trade boosted by the recent opening of the Trans-Gambia Bridge. As a small, highly open economy, Gambia could benefit from greater regional trade integration from the Africa Continental Free Trade Area (GCFT) and the adoption of a future regional single currency (ECO). Investments in modernizing the Port of Banjul are crucial to generate revenues from transit trade and new business opportunities in transporting imported liquefied fuel products to the Sahelian hinterland.



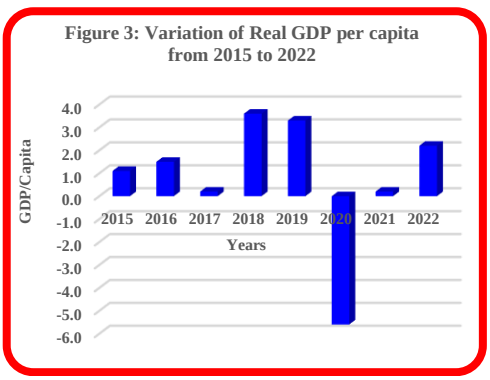
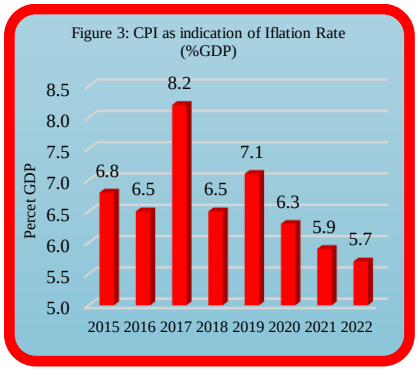


Fig: 2 Variation of GDP Growth

1.2.3 Inflation and Exchange Rate

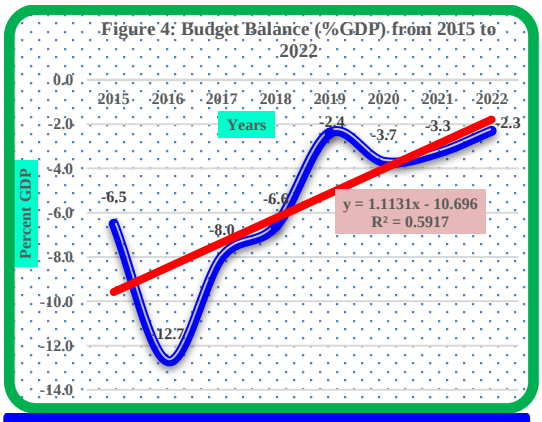
Inflation subsided owing to a stable exchange rate, which depreciated by only 3.2% since September 2018, strong food supply, and declining commodity prices. Gambia's dependence on food and fuel imports widened the current account deficit during 2015–2018, but improvements in net services, private capital flows, and remittances from the diaspora mitigated the deficit in 2019.

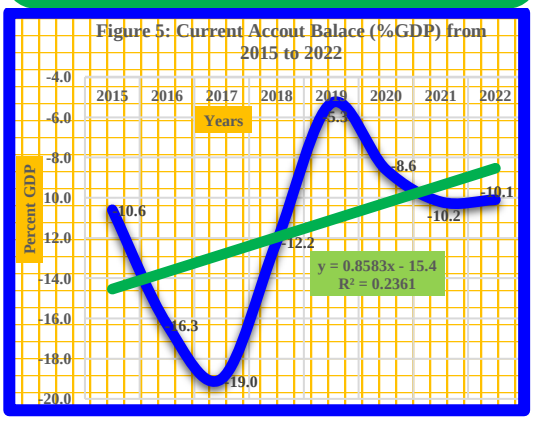
On the supply side, the tourism and trade sectors were the most affected, while on the demand side, subdued domestic and external demand hurt the economy. The government responded with expansionary fiscal policy—health spending increased by 0.5% of GDP and food assistance increased by 0.7% of GDP. Monetary and financial policies were also eased—the policy rate was cut by 200 basis points to 10% to boost liquidity. Subdued aggregate demand pushed down inflation to an expected 6.3% in 2020 from 7.1% in 2019 as represented in the adjacent chart.



1.2.4 Fiscal Deficit (Budget Balance and Current Account)

The fiscal deficit widened to 3.7% of GDP in 2020 from 2.4% in 2019 (Figure 4 adjacent) because of increased spending amid a shortfall in revenue collections. The decline in remittances and tourism receipts widened the current account deficit to 8.6% of GDP in 2020 from 5.3% in 2019 (Figure 5 adjacent). The foreign exchange rate stabilized at GMD 51 to the US dollar throughout 2020. Public debt increased to 83.1% of GDP in 2020 from 81% in 2019—because of large fiscal deficits and government efforts to prop up state-owned enterprises (SOEs). The financial sector remains vulnerable to spill-over effects of the pandemic and on the ability of firms in the tourism, trade, and real estate sectors to service their loans. These three sectors account for 54% of total credit and one-third of non-performing loans. The pandemic has hurt social indicators. An estimated 20,000 jobs were lost in 2020, the unemployment rate was about 40%, and the poverty level was estimated at 48.6%.





1.3 LAND USE

1.3.1 Forests and Other Land Use

The forestry sub-sector provides an important natural resource for the country. It contributes at least 1% to GDP while for domestic uses, the subsector provides more than 85% of the domestic energy (fuelwood) and about 17% of the timber needs of the population. The Gambia's total forest area was estimated at 423,000 ha in 2010 as compared with 520,400 ha in 1998.

Forest resources — including mangroves — occupy 350,000–505,300 ha (43%) of the country area (GoTG, 2010). The government has declared 222,000 ha as forest reserves, 40,000 ha as forest parks, and 18,000 ha as community forests. The current Forestry Policy (2010–2019) (GoTG, 2009) aims to achieve national forest cover of 30%[3], with 75% of that cover to be sustainably managed by communities and the private sector. In particular, the policy advocates for the transfer of 200,000 ha of forest lands to communities.

As of 2000, 0.43% of Gambia was under tree cover (4,560kha) and 99.6% was under non-Forest (1,060,000 ha). In Gambia, as of 2010, the top 6 regions represent 100% of all tree cover (Figure 6 below). Tree Cover is defined as all vegetation taller than 5 meters in height and it is the biophysical presence of trees and may take the form of natural forests or plantations existing over a range of canopy densities. The tree cover data set is a collaboration of the University of Maryland, Google, USGS, and NASA, and uses Landsat satellite images to map tree cover globally for the years 2000 and 2010 at 30*30-meter resolution[4]. According to Figure 7 below, West Coast Region had the most tree cover at 2,520ha compared to an average of 3,890ha, followed by North Bank Region with 970ha; Lower River Region with 256ha; Greater Banjul Area with 121ha, Upper River Region with 11ha.

[3] This is considered to be sufficient for both ecological health and sustainable development needs

[4] Global Forest Watch. "Tree cover in Gambia". Accessed on 18/04/2021 from www.globalforestwatch.org. [https://glad.umd.edu/dataset/global-2010-tree-cover-30-m) Hansen/UMD/Google/USGS/NASA

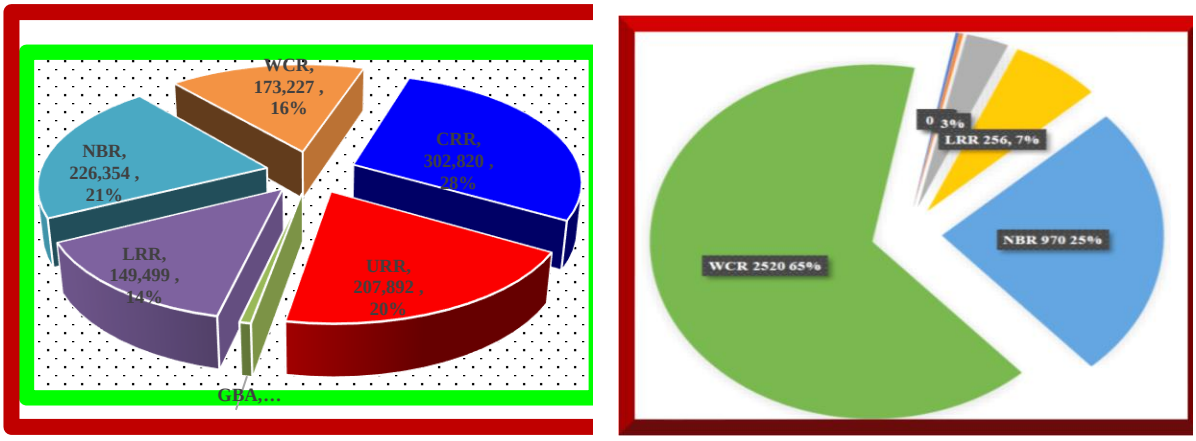


Fig: 3 Left: Land Areas in ha, right Regional Vegetation Cover

According to Global Forest Watch, The Gambia had 3,890ha of tree cover in 2010, extending over 0.36% of its land area. In 2019, it lost 20.1 ha of tree cover (equivalent to 3.11kt of CO_2 of emissions). The biomass loss between 2001 till 2020 constitutes a total of 109kt of CO_2 as a result of tree cover loss in Gambia (equivalent to 5.71kt 11kt of CO_2 of emissions per year).[5]

1.3.2 Parks and Wildlife

The Gambia is endowed with a high diversity of plant and animal species which are found in three major ecological systems (a) the marine and coastal zone along the western coast of the country; (b) the area along the River Gambia and related fresh water and estuarian ecosystems; and (c) the territorial ecosystems behind the coastline and to the north and south of the river.

The Gambia is a signatory and a Party to various regional and international treaties and agreements which are related to or affect biodiversity. These include:

1. The Convention on Biological Diversity (CBD)
2. Convention on International Trade in Endangered Species (CITES)
3. Convention on Wetlands of International Importance, (RAMSAR)
4. Convention Covering the Protection of the World Cultural and Natural Heritage

Parks and Wildlife are an integral part of the forest eco-system as forest provide habitat for wild animals. Currently there are 22 Wildlife Protected Areas, occupying a total area of 76,064 hectares, approximately 6.4% of Gambia's total surface area. Only 0.16% of the terrestrial and inland water is protected while 7.4% of the marine and coastal areas are under formal protection. Eight of these Protected Areas are reserves and national parks

[5] www.globalforestwatch.org

while 14 are community-based conservation areas under the mandate of the Department of Parks and Wildlife (DPWM).

The challenges and gaps in managing wildlife and biodiversity resources of The Gambia vary and range from insufficient financing, low human capital, intellectual capacity, demotivating staff remuneration, insufficient park facilities and infrastructure and non-decentralized system.

1.4 CLIMATE AND CLIMATE CHANGE

1.4.1Climate of The Gambia

The Gambia has a typical Sudan-Sahelian climate, characterised by a short rainy season (June–October) and a long dry season (November–May). The average temperature is between 29°C and 34°C. The lowest daily temperature of 4°C was recorded in Jenoi (13°28" N, 15°34" W) in 2003, and the highest daily temperature of 49.0°C was recorded in 2001 at Jenoi (Stafford, 2019). Since the 1950s, routine observation also indicates that minimum temperatures across The Gambia have increased steadily at the rate of 0.4 to 0.67°C per decade (GoTG, 2007). Average rainfall in a year varies from 1,000 mm in the South and Southeast to 700 mm in the most northerly part of the country, with 80-85% of rainfall concentrated in the months July, August and September (JAS).

1.4.2 Temperatures

Figures 8(a) – (d) shows plots of the variation of the average temperature over The Gambia for the period 2001 to 2020. According to Figure 8(c) averaged Mean Temperature **[(maximum + minimum)/2]** is about 28^{O}C and varies from an average minimum of about 21^{O}C to an average maximum of 35^{O}C. The Trend plot of the averaged Mean Temperature shows a marked decrease from 2008, the cause of which is evident in similar decrease in the averaged Minimum Temperature (Figure 8d) but not in the averaged Maximum Temperature (Figure 8b) The coldest months of the year are December, January and February while the hottest months are March, April and May.

Figure 8(a): Average Monthly Temperatures of The Gambia for the Period 2001 to 2020

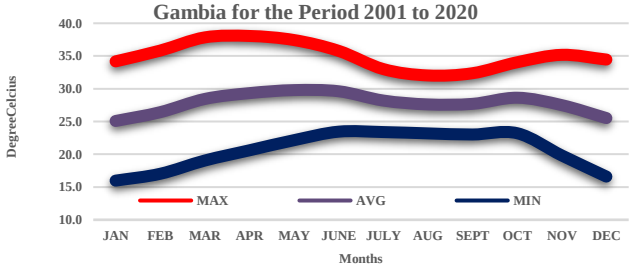
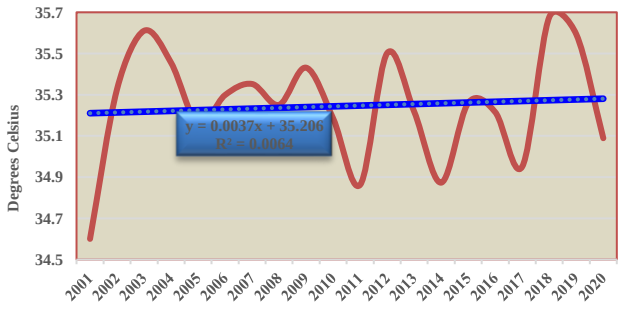
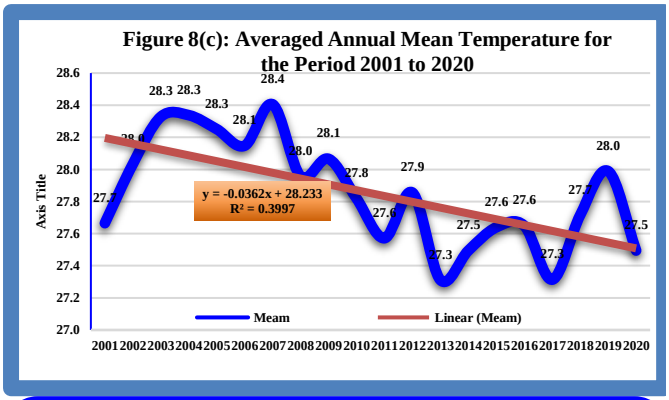


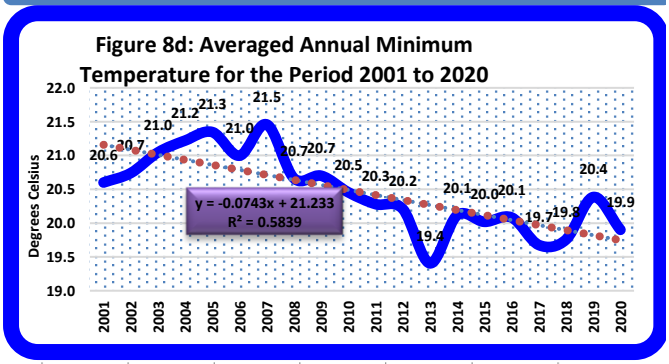
Figure 8(b): Variation of Averaged Annual Maximum Temperature over The Gambia from 2001 to 2020



Due to the influence of the Atlantic Ocean, temperatures are being modified such that coastal and near-

coastal areas experience mild to moderate temperatures as compared to the inland areas where the difference in annual temperature ranges are large during the hot and cold seasons. Temperatures in The Gambia tends to increase inland from the coast, with the exception of the wet season when all regions experience similar temperatures. Average temperatures range from 18 –30°C during the dry season and 23 – 33°C during the wet season (see Figure 9 below). Inter-annual variations in temperature occur as a result of the effects of the El Niño Southern Oscillation (ENSO) across West Africa.





According to McSweeney et al (2010), temperatures across The Gambia have increased in recent years, with estimates indicating an increasing trend of between 0.21°C per decade and 0.5°C per decade. The rate of increase is most rapid in the October–December period, at 0.32°C per decade. As well as an overall increase in temperature, available data indicate that the average number of hot nights per year increased by 7.8% (28 nights) between 1960–2003.

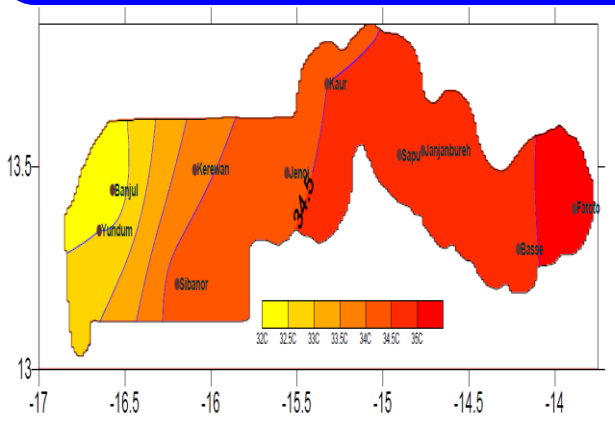
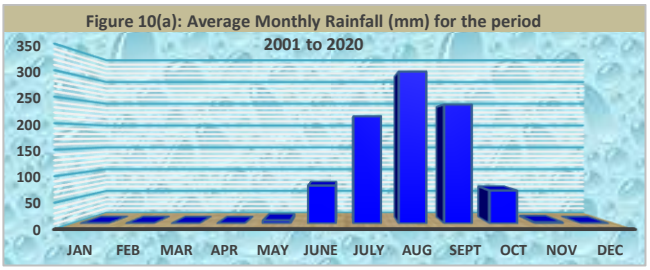


Fig: 4 Average Monthly Temperature of the Gambia (DWR/Climate Unit, (2019))

1.4.3 Rainfall

Mean monthly wet-season rainfall (June to October) varies between 150–300 mm. According to Figure 10(a) and for the period 2001 to 2020, highest average monthly wet-season rainfall of 305 mm was recorded in



August and the lowest (66mm) was recorded for the month of October. As shown in Figure 10(b) below, the years with the lowest annual rainfall were 2004 (623mm) and 2016 (237mm), while 2012 recorded the highest rainfall of 1140mm.

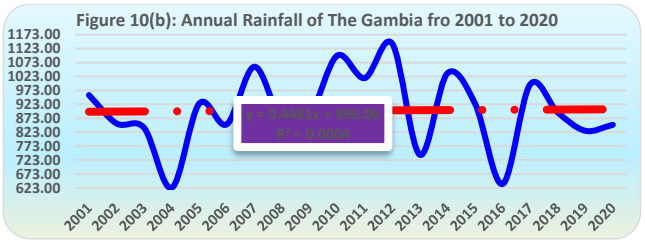


Fig: 5 Monthly Average Rainfall (mm) and Annual Rainfall from 2001 to 2020

The Long Term Seasonal and JAS rainfall average (Figures 10(c) and 10(d) below) is based on the forty-four years mean from 1975 to 2018 data. The average annual rainfall amount varies enormously over the country from about 700mm to 920mm with the wettest areas been over the southwestern sectors (WCR) of the country and driest to the north (CRR North).

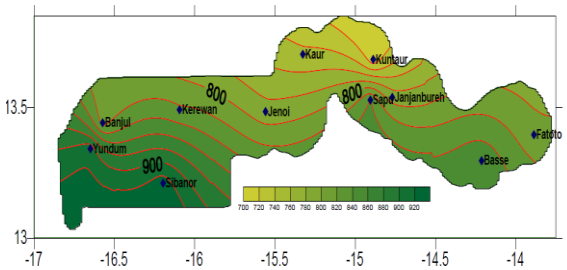


Fig: 6 Long-term (44 years) seasonal rainfall (mm) in The Gambia

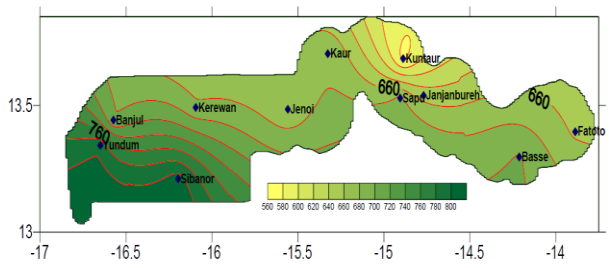


Fig: 7 44 years July - September Average Rainfall (mm) of The Gambia

Figures 11(a) and (b) show that about 80% of the seasonal rainfall occurs in the months of July, August and September (JAS) with a peak in August. However, in the western part of the country (Yundum) a double peak (July and September) is observed for the Highest Daily Rainfall.

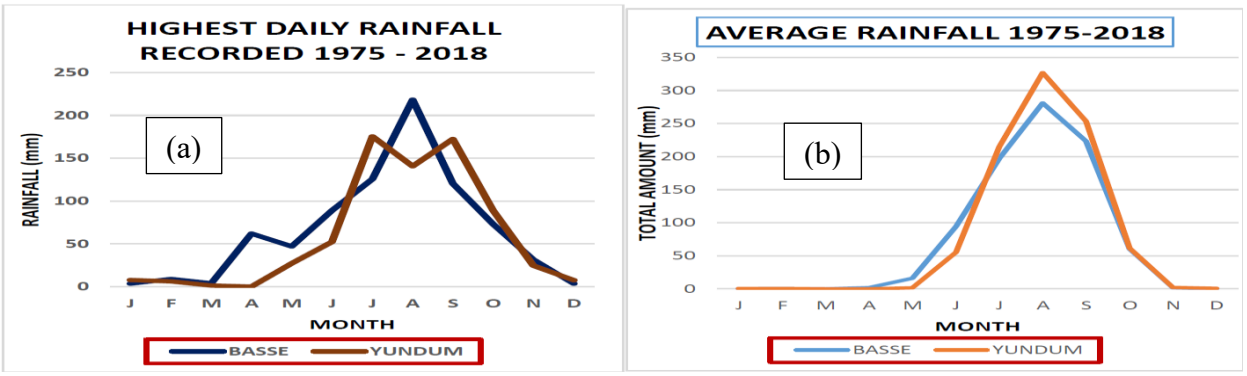
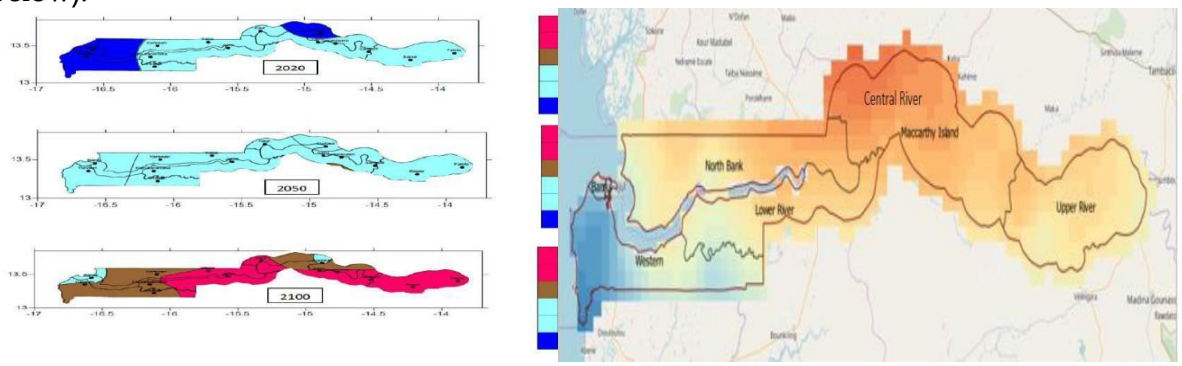


Fig: 8 a) Highest Daily Rainfall, b) Average Monthly Rainfall (1975 - 2018)

1.4.4 Temperature Changes

Figures 12(a)-(c) show temperature variations from three studies. Publication of the Climate Unit of the Department of Water Resources show that temperatures will increase from 2020 to 2100 (Figure 12a). ICRAF, (2018) projected that with climate change,

temperatures of The Gambia will be relatively cooler in the coastal areas but warmer in the interior. The central areas of the Central River Region will be hottest (Figure 12b) below).

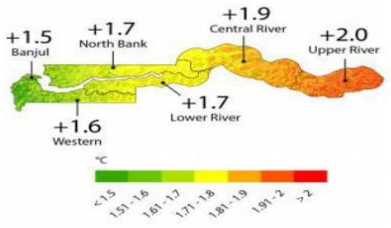


a) b)

Fig: 9 a)Temperature Variation in The Gambia, b) Projected Temperature of The Gambia

The Food and Agriculture Organization (FAO, 2017) also used downscaling methods and found that the future temperature for The Gambia will change by 2030. Figure 12c shows projected changes (increase) in annual average temperature across the length and breadth of The Gambia, with Banjul registering a +1.5°C increase and the Upper River Region registering +2°C during the period 2030 to 2070. These projections are a real threat to agriculture and food security in the country in the future, thus illustrating the imminent dangers of climate change on human livelihoods.

Figure 12(c): Changes in Annual Mean Temperature in The Gambia (FAO, 2017)



1.4.5 Rainfall Changes

The projections from the TNC have indicated that changes in annual precipitation range from - 23% to +18% by the 2090s[12] and that rainfall will generally decrease from about 860mm in 2000 to 579mm in 2100 in The Gambia (see Figures 13a adjacent). The size of the area with average summer rainfall (cumulative July-August-September) (JAS) of less than 800 mm has increased from 36% in 1965 to 93% of the country (GoTG/NAPA, 2007). The decline in rainfall is spatially variable across the country, with greater changes in the western half of the country (GoTG/NAPA, 2007). Projected future

Figure 13(a): Rainfall trends in The Gambia show that the country will be dried by 2100

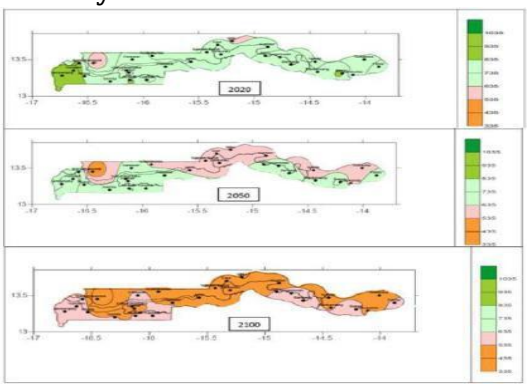
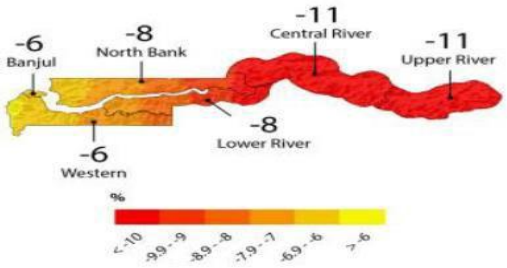


Fig: 10 Rainfall Project (decrement from 2010 to 2100, from 860mm to 570mm respectively

precipitation for The Gambia is shown to change by 2030 (FAO, 2017). Figure 13(b) shows projected changes (decrease) in total percentage precipitation across The Gambia with Banjul registering a -6% (decrease) and the Upper River Region registering -11% during the period 2030 to 2070. These projections are a real threat to agriculture and food security in the country in the future, thus illustrating the imminent dangers of climate change on human livelihoods.



1.4.6 Climate Change and Adaptation Measures

Projected climate change will present both short- and long-term challenges to development efforts in The Gambia. In the short-term, extreme climate events — such as windstorms, rainstorms, droughts and dust storms — will become more frequent and will have increased severity. Land use and land cover change, sea level rise, and coastal erosion present significant long-term challenges. Adverse impacts in agriculture, forestry, fishing, construction and real estate sectors, and the Gambian tourism industry, are amplified and/or accelerated by losses in productivity of land resources (arable land, grassland, forests); water, nutrient and sediment fluxes, and scarcity of sand for building purposes. Some parts of the country are expected to experience lower rates of groundwater renewal and higher runoff reflecting differences in rainfall and surface geology.

1.4.7 Climate Change Policy framework

The Ministry of Environment, Climate Change and Natural Resources (MECCNAR) is the political and policy arm of the management of climate change and related issues in The Gambia. MECCNAR houses the UNFCCC Focal Point and the National Climate Change Secretariat (NCCS). The Ministry of Fisheries and Water Resources (MoFWR) manage the science and technical issues of climate change. MoFWR houses the Focal Point and secretariat of the Intergovernmental Panel on Climate Change. These institutions are bound by national laws, regulations and policies and they develop strategies and plans to implement the UNFCCC and the IPCC activities at the national and regional levels.

The GoTG has legislative and policy instruments in place to address climate change. A host of new policy and strategic guidance documents have been developed. Current thinking and orientation at the highest levels of policy- and decision-making is aligned with the Paris Agreement of 2015, which puts the economy on a 'green growth' pathway. This new paradigm is reflected in the 2050 Climate Vision, the NDP and the NCCP. Related SDGs are accorded the highest priority. The climate policy and management frameworks provide an opportunity for capacity building and investments.

The 2016 National Climate Change Policy (NCCP) represents The Gambia's determined and systematic response to the interlinked climate threats to sustainable development, wellbeing and ecological integrity. Accordingly, the Policy defines the following long-term vision for The Gambia: Achieve a climate-resilient society, through systems and strategies that mainstream climate change, disaster risk reduction, gender and environmental management, for sustainable social, political and economic development. The NCCP emphasizes that an effective Gambian climate change response requires economic, social and environmental interventions that integrate mitigation and adaptation elements within a developmental framework. It therefore establishes the goal of achieving the mainstreaming of climate change into national planning, budgeting, decision-making, and program implementation through effective institutional mechanisms, coordinated financial resources and enhanced human resources capacity by 2025. The government has initiated the development of a Climate and Climate Change Act to be completed and enacted in 2025.

Since the formulation of the NCCP in 2016, The Gambia government's climate change portfolio and policy issues have been entrusted to the Ministry of Environment, Climate Change and Natural Resources (MECCNAR). Within the Ministry of Fisheries and Water Resources, the Department of Water Resources (DWR) retained leadership of technical issues related to climate variability and change and serves as the organizational 'home' of the IPCC Focal Point. The DWR's mission is to "regulate and manage the sustainable utilization of water resources, coordinate related policies and provide timely and accurate weather and climate data and information to safeguard population and promote food security through effective participation, monitoring and awareness creation for overall socio-economic development of The Gambia".

Through the DWR, The Gambia established an ad hoc, although standing, National Climate Committee (NCC), comprising a wide array of stakeholders representing public, private and voluntary sector interests. NCC members are subdivided into thematic Task Forces on GHG Inventories; Mitigation of GHG emissions and concentrations; Vulnerability, Impacts and Adaptation Assessment; and Cross-cutting issues (Finance, Technology, Capacity Building, Research and Systematic Observation). The National Environment Agency serves as secretary to the NCC.

However, the NCCP sets in place a number of national-level institutional arrangements to promote climate change mainstreaming and implementation of climate-resilient development activities. Some of these are new, while others entail a modification of existing structures.

The National Climate Change Council has a membership that includes the Minsters from Environment, Climate Change and Natural Resources (as Chair); Finance and Economic Planning (as co-Chair); Foreign Affairs; Fisheries and Water Resources; Health;

Gender, Children and Social Welfare; Basic and Secondary Education; Higher Education; Agriculture and Food Security; Petroleum and Energy; Lands and Local Governance; Trade, Industry and Employment; and Youth and Sports. In addition, representatives from Local Governments and stakeholder groups, including expert representatives from non-governmental organisations and the private sector, are included in this Council. The Council meets bi-annually. It is responsible for:

- Governing the Gambian Climate Change Fund,
- Overseeing the further development, implementation and regular review of the National Climate Change Policy, inter alia to ensure it is acceptable across the sectors.
- Ensuring coherence with national development goals and strategies.
- Monitoring overall progress and making mid-course corrections where necessary.

Inter-ministerial Climate Committee (IMCC), made up of the Permanent Secretaries and Directors of the line ministries represented in the Council, is formed to assist the Council in carrying out its functions. The Committee is co-chaired by the Permanent Secretaries from MECCNAR and MoFEA. The Committee meets once every three months, to compile advice and reports on progress in each of their sectors for consideration by the Council. Specific responsibilities of the Committee include:

- Calling on all key institutions in relevant sectors to consider the impact of this Policy, and of climate change in general, on their policies, strategies and action plans, and initiating a process to integrate responses to these impacts within a fixed deadline.
- Setting clear short- and medium-term goals, through the National Climate Change Response Strategy and Action Plan, to achieve the long-term goal and vision set out in this Policy, and clear targets and time frames.
- Creating incentives and disincentives in case of non-compliance or absence of accountability.
- Ensuring adherence to reporting requirements. Expert Thematic Groups working in collaboration with the Climate Change Secretariat established under this Policy shall advise the IMCC on specific climate related issues, via the National Climate Committee.

A multi-stakeholder **National Climate Committee (NCC)** is formed with expert representatives of farmers, women, the scientific, research and technological community, children's and youth groups, communities, workers and trade unions, business and industry, non-governmental organisations, and local authorities, to advise the **Climate Change Secretariat** on general and specific climate change-related questions and to provide its views on complementary and related issues. To ensure efficiency of operations, the number of members of the NCC is strictly limited, preferably to between 12 and 15 people, from relevant organisations.

A **Climate Change Secretariat** is formed, with the mandate of working with sectors and institutions on integrating climate change into the national and sub-national plans and coordinating the implementation of the National Climate Change Policy. The Secretariat is housed within the MECCNAR and shall work closely with the Ministry of Finance and Economic Affairs in carrying out its functions. The key roles and responsibilities of this Secretariat include the following:

- Facilitation of climate change policy development, including the incorporation of climate change considerations into new and existing policies, in consultation with all sectors. The Secretariat will be responsible for establishing procedures to integrate and mainstream climate change in all relevant national policies and programmes (such as screening programmes and projects or developing sector wide guidelines); and procedures for including climate considerations in government and administrative processes, procedures and systems (such as budget call circulars, public expenditure reviews, and monitoring processes).
- Development of initial draft of terms of reference (ToRs) and draft rules of procedure and initiate a call for nominations for the multistakeholder National Climate Committee; and facilitate activities leading to its formal establishment and signing of a Memorandum of Understanding with the Secretariat.
- Development of a formal network of Climate Change Focal Points in each sectoral ministry.
- Development of adaptation- and mitigation-specific policy measures that are not under the mandate of other sectoral ministries.
- Management of strategic information and knowledge, in particular information on the risks, costs and benefits of climate change, to promote constructive engagement with other sectors regarding the need to integrate climate concerns (such as impact, vulnerability and adaptation assessments, and socio-economic analysis).
- Along with the Ministry of Finance and Economic Affairs and the MECCNAR, represent the interests of The Gambia in international climate negotiations and funds.
- Build capacity on climate change across all sectors and at all administrative levels, while taking steps to institutionalise and retain this capacity.
- Promote research and technical cooperation between national, regional and international institutions; and support The University of The Gambia to develop and implement the National Research Framework on Climate Change.
- Continue to assess and determine technological requirements to implement the UNFCCC and this Policy, and develop, seek funding for and implement, with other sectors, the Climate Change Technology Development and Transfer Action Plan.

- Development and implementation of a National Climate Change Communication Strategy and Awareness Campaign, to sensitise and solicit the support of relevant stakeholders and the general public for implementation of the National Climate Change Policy.
- Along with other sectoral ministries, plan, implement and monitor effective activities to promote public education.
- Regularly track progress in mitigation and adaptation using participatory monitoring and evaluation methods.
- Development and promotion of accountability measures that empower local communities.
- Further develop the existing network of Expert Thematic Groups, which includes the National Greenhouse Gas Inventory Team, the National Vulnerability and Adaptation Team, etc., to provide technical advice and support. The Expert Thematic Groups shall report regularly to the National Climate Committee.

A formal **network of Climate Change Focal Points**, located within the departments of each sectoral ministry, is developed. These focal points will be responsible for ensuring that climate change considerations are taken into account in the implementation of their existing sectoral policies, and in the development of new ones. This will expand upon and institutionalise the current ad hoc situation of climate change focal points within key ministries.

1.4.8 Gender and Climate Change

The Climate Change Integrated gender Policy emphasizes an all-embracing (holistic) approach, one that includes ensuring gender equality in access/control over productive resources such as land, labour, technology, capital/finance, and information. Also, the framework establishes efforts towards embarking on affirmative action to rectify errors of the past particularly, as they relate to discrimination against women and reducing gender and geographical disparities in the distribution of national resources. Attention is given to gender mainstreaming strategy, in creating a new order of social justice and equity premised on the inclusion of all hitherto excluded.

While the multilateral climate change debate and process have focused on economic and social issues, the situation of women and the gender inequalities that are reproduced and strengthened by this process have been treated as a side issue. The gender imbalance in the impacts of climate change is thus closely related to socioeconomic inequality and the persistence of poverty, in the context of an excluding and unsustainable form of growth.

The impacts of climate change could deepen the sexual division of labour and the unfair social organization of care. Climate change has direct impacts on natural resources that are essential for daily life, such as water, fishery resources, available energy sources, and

biodiversity. When these resources become scarce or hard to access, there can be serious gender and time-use implications. Women, especially rural women, have the main responsibility for feeding their families and for collecting basic resources needed for household subsistence, such as water and firewood. These culturally assigned duties represent unpaid and uneconomic work done by girls and women; and the scarcity of these essential resources can mean it takes longer to gather them, thus deepening the structural challenges of inequality.

Structural factors of national circumstances and capabilities (e.g., economic, and natural endowments, political systems and cultural factors and gender considerations) affect the breadth and depth of climate governance. A series of socio-economic impacts of climate change may (a) reduce educational achievements and the performance of the education system; (b) lead to increased school dropout rates; (c) increase the number of days in which children and teachers do not attend school; (d) reduce availability of portable water, reduce agricultural work and productivity and the increased prevalence of malnutrition in school-going children which will impair concentration, learning capacity, mental development, etc., all of which adversely impact children's performance at school.

The Gender policy also aims to ensure equal access by girls and women, boys and men to quality formal and non-formal education at all levels from early childhood development, basic and secondary education, to vocational and technical training, as well as the university. This goal is a priority under the current and projected changing climate. A series of socio-economic impacts of climate change may (a) reduce educational achievements and the performance of the education system; (b) lead to increased school dropout rates; (c) increase the number of days in which children and teachers do not attend school; (d) reduce availability of portable water, reduce agricultural work and productivity and the increased prevalence of malnutrition in school-going children which will impair concentration, learning capacity, mental development, etc., all of which adversely impact children's performance at school.

Ensuring the effective mainstreaming of gender perspectives in emerging / crises issues such as climate change, food, fuel and economic crises, environmental, humanitarian emergencies and disaster management considers the adoption and implementation of social safety nets that support climate change adaptation that have strong co-benefits with development goals such as education, poverty alleviation, gender inclusion and food security.

Gender equality is an integral part of national development processes and reinforces the overall development objectives in the country. Gender inequality is still a concern in our country. Under the current and projected climate change, women are more likely than men to be seriously impacted by climate risks and disasters. According to UNDP (2016), 80% of people displaced by climate change are women. Women do not have easy and

adequate access to funds to cover weather-related losses or adaptation technologies. Morbidity and mortality are projected to increase and populations at highest risk include older adults, children, women, those with chronic diseases, and people taking certain medications. Poverty, along with socio-economic and political marginalization, cumulatively put women, children and the elderly in a disadvantaged position in coping with the effects of climate change. The contextual vulnerability of women is higher due to their differentiated relative power, roles, and responsibilities at the household and community levels. They often have a higher reliance on subsistence agriculture, which will be severely impacted by climate change. Therefore, this emphasis that government's commitment to eliminating gender inequalities is the full implementation of its programme of promoting the equal and full empowerment of women in the national development process.

1.4.9 Country Commitments

Through the 2016 National Climate Change Policy (NCCP), The Gambia is committed to providing a determined and systematic response to the interlinked climate threats to sustainable development, wellbeing and ecological integrity. Accordingly, the long-term vision of the NCCP is to Achieve a climate-resilient society, through systems and strategies that mainstream climate change, disaster risk reduction, gender and environmental management, for sustainable social, political and economic development. The NCCP emphasizes that an effective Gambian climate change response requires economic, social and environmental interventions that integrate mitigation and adaptation elements within a developmental framework. It therefore establishes the goal of achieving the mainstreaming of climate change into national planning, budgeting, decision-making, and program implementation through effective institutional mechanisms, coordinated financial resources and enhanced human resources capacity by 2025.

It is Gambia's major commitment to adequately and effectively participate in the UNFCCC processes for the implementation of the Convention, the Kyoto Protocol and the Paris Agreement. The government thus, developed and submitted three National Communications, a NAPA, three NAMAs (National, Agriculture and Energy), the SPCR, the Intended Nationally Determined and the Nationally Determined Contributions (INDC1 and NDC2), the 2050 VISION and Long-Term Strategy (LTS) to 2050. The Gambia is in the process of developing and submitting her BUR1, BTR1, NC4, NDC3 and NAP.

The National Communications support the achievement of Gambia's commitment by providing (a) quantitative assessment and outcomes of greenhouse gas emissions from the major economic sectors and activities of the country, (b) GHG mitigation measures to reduce emissions; (c) plausible projections of climate change scenarios for assessment of the potential impacts of the projected climate change on some key sectors of the national

economy; (d) the impacts of climate change; and (e) potential adaptation measures to address the adverse impacts on the economy. The is committed more than ever to participating in different regional and international activities on climate change.

The 2050 Climate Vision of The Gambia provides a roadmap for national efforts aimed at addressing climate change and to inform short- and medium-term actions with a view to providing guidance and stability. The Vision underpins the country's Long-Term Strategy (LTS) for Low Greenhouse Gas Emissions and Climate Resilient Development (LECRDS, 2017). The LECRDS is supplemented the NDC and the SPCR in developing a strategic approach for addressing climate change in a holistic and inclusive manner. Together, these strategies identify several priority actions to support the transition of the country to a low-emission and climate-resilient economy, categorized into administrative and cross-cutting actions, GHG mitigation actions, and adaptation actions for climate-resilient development.

1.5 AGRICULTURE, LIVESTOCK AND FISHERIES

1.5.1 Agriculture in The Gambia

Agriculture is a major economic activity in the Gambia contributing 25% (Figure 14a) of the gross domestic product (GDP) and employing about 70% of the labour force with 32% into active primary agricultural production (FAO; ICRISAT; CIAT. 2018). The GDP contribution of 25% by Agriculture to the Gambian economy compares slightly with the 29% contribution of Agriculture to the West African economy. Agriculture is the main source of income for about 72% of the extremely poor rural households. From Figure 14b, the sector is characterized by small-scale, subsistence rain-fed crop production (mainly groundnuts, coarse grains, rice, and cassava), traditional livestock rearing, semi-commercial groundnut and horticultural production, small-scale cotton farming and a large artisanal fisheries sub-sector.

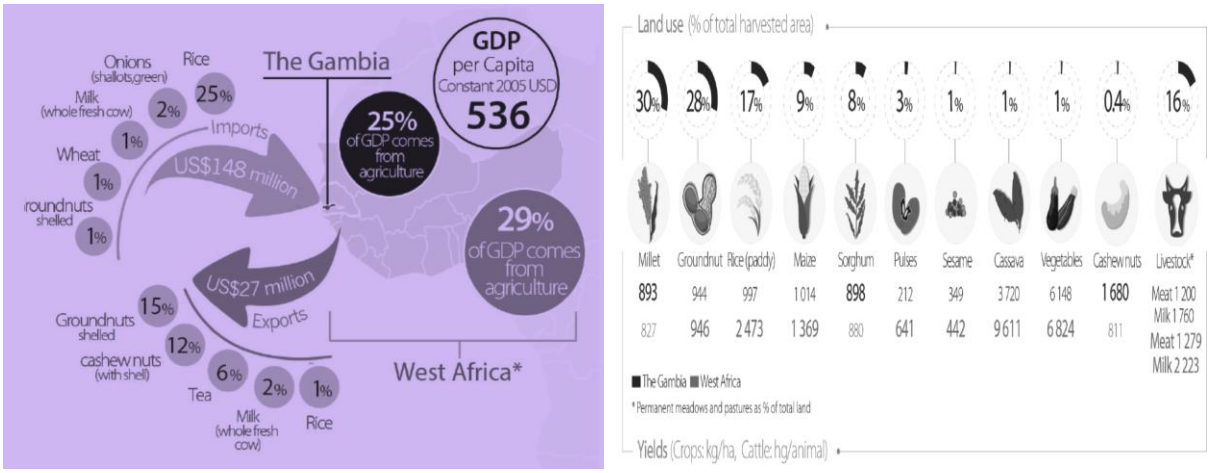


Fig: 11 On the Left, Economic Relevance of Agriculture in The Gambia; On the right, Crop Production System in The Gambia

Agricultural land in the Gambia constitutes approximately 54% of the country's total land area (Figure 29). During the last two decades, the area of land under agriculture has increased from 557,000 hectares to 605,000 hectares. At this same period, the total arable land area increased by 173% (about 8.7% per annum). These increases are at the expense of forests.

1.5.2 Crop Production Sub-sector

The Crop production sub-sector of The Gambia is largely dependent on rainfall with only 5% of land under cultivation equipped with irrigation. Production systems generally have low input of fertilizers and pesticides. Fertilizer consumption per unit of arable land is about 5.95 kg per hectare which is about two times lower than the West Africa regional average. Farmlands are generally small scale with dominant production of millet, groundnut, rice, maize and sorghum which covers approximately 24%, 23%, 15%, 8% and 7% respectively of the total land under cultivation in the Gambia. Pulses and vegetables occupy less than one percent of the total agriculture area. Meanwhile, groundnut remains a major cash crop for the Gambia with about 5% contribution to the national GDP. Rice, sorghum, millet and maize are generally produced for subsistent purposes. With the exception of millet, yields of the major food crops are generally lower than the West Africa regional average. Compared with the regional average, current estimates show yield gap of 88 kg/ha, 982 kg/ha, 817 kg/ha and 8 kg/ha for groundnut, rice, maize and sorghum respectively. However, there is opportunity for closing the gaps through investments in irrigation and promotion of best soil fertility management approaches, the lack of which reportedly impedes crop production in the Gambia.

The Gambia is classified as a 'low income' and 'food deficit' country with about 48% of the population living under the poverty line. One in ten members of the population is food insecure whilst one in three Gambians is vulnerable to food insecurity. The Comprehensive Food Security and Vulnerability Analysis (CFSVA) report of 2016 (WFP.

2016) revealed that 148,458 persons (8%) of the population in 4 regions of the country (Basse in URR, Janjangbureh in CRR-South, Kuntaur in CRR-North and Mansa Konko in LRR) are food insecure and or highly vulnerable to food insecurity. In these 4 regions, food insecurity has surged between 12% and 18% in five years (2011-2016). Chronic food insecurity has resulted to high malnutrition rates as evidenced by an increase of 10.3% in 2015 of the prevalence-rate of the Global Acute Malnutrition (GAM), marking an increase of 0.4% since 2012 (WFP, 2016). The same source indicates that the national stunting rates were recorded at a critical high of 24.9% in the four regions of the assessment in 2016. Ameliorating food insecurity and nutrition gaps will require increased and improved production of nutritive food crops through appropriate food chain mechanisms. Interventions must also focus on relevant value addition systems with special emphasis on nutrition-based processing. Also important is to ensure increased access and ownership of productive land for women and other vulnerable groups with a view to enhancing their livelihoods systems. This will enhance effective and participatory land use planning as well as ensure diversification on farming systems and crop production.

1.5.3 Livestock and Animal Husbandry

Livestock is part of the farming systems and a means to accumulate assets, earn cash income, and provide draught power as well as manure for crops, and a source of food and nutrition security. The livestock species kept in The Gambia are cattle, sheep and goats (small ruminants), chickens, pigs, horses and donkeys. The livestock sub-sector continues to contribute to the livelihood of the rural population, enhancing food security and income, and fulfilling socio-cultural obligations from acquisition, possession and sale of cattle and small ruminants.

The livestock sub-sector continuous to be challenged by increased incidence of emerging and re-emerging animal diseases, deficiencies in animal feed both in quality and quantity, low genetic potential of the indigenous breeds, inadequate infrastructure and financing, weak public sector institutions for animal health delivery, extension, research and technology dissemination, ineffective, inefficient and uncompetitive value chains. All these challenges are compounded by the impacts of climate change. To address these challenges, appropriate policies need to be put in place; in addition, large amounts of resources are needed in order to capitalize on the strengths that give the sub-sector potential for growth and higher levels of productivity.

1.5.4 Fisheries and Aquaculture

Although the national per caput fish consumption of 28.4kg for The Gambia far outweighs the African average of 8.4kg, the difference between coastal per caput fish consumption and that of the hinterland (of about 9kg) has always attracted the attention of policy makers. Logistical constraints for fresh fish distribution and unaffordability have been cited as crucial drawbacks. Consequently, aquaculture development has resurfaced and gained prominence in developmental discussions as a potential conduit via which food

fish and nutrition security could be enhanced especially in the inland thereby alleviating poverty. This is so because, the aquaculture potential cannot be overstated given The Gambia endowment of natural capital in the form of suitable ecosystems for commercial aquaculture in The Gambia Basin. Aquaculture has also been identified as a viable climate change adaptation measure in The Gambia.

It is recognized that fish must be presented in a form, size and shape with the required quality and safety acceptable to the market as prescribed by international standards. The demands made by the market must be addressed by developing the capacity of the industry to respond. Although the total economic value of the Fisheries of The Gambia has not been determined which would allow the estimation of economic rent, it is discernable that the Fisheries of the Gambia is very important in the economic development of the country. Challenges include a lack of basic and sector–specific infrastructure to respond to market demands, lack of investments and minimal private sector incentives.

Provision of sector specific infrastructure would enhance MCS and improve landing statistics. Such infrastructure would reduce post-harvest losses and increase shelf-life of fisheries products; ensure adequate supply of fish and fish products by applying effective and sustainable preservation, processing and storage methods; ensure prevalence of internationally accepted standards in infrastructure and operations of fish processing establishments; and improve the quality of fish and fishery products and ensure compliance with international standards and quality assurance.

1.6 ENERGY AND INDUSTRY

1.6.1 The Energy Sector of The Gambia

The current demand for energy in the country in particular electricity is not matched by a corresponding increase in the supply and this situation has resulted in a significant electricity demand-supply gap. The major challenges in the supply-side have mainly been due to over dependence on fossil fuels particularly rising import bills, price volatility in the global oil market, repair and maintenance of aging generators and plants as well as inadequate investments and financing options. These variables generate direct and indirect financial and capital costs to Government and consumers.

Statistics from NAWEC show that sent-out energy grew at an average rate of 11% per year from 2010 to 2018, reaching 341 GWh in 2018. Peak demand grew from 45 MW in 2017 to 65 MW in 2018. Historical energy and peak demand were constrained by generation and network shortages or outages. (Road Map 2020). The main electricity provider, NAWEC, spends about 70% of its annual revenue on fuel and spare-parts thus unable to adequately finance its operations and meet other financial obligations. The plan is

cognisant of developments in the sector and in the economy at large and is reflective of recent investment decisions and the Road Map and especially planned investments in transmission, distribution, interconnection, IMS and service support.

According to projections, in the baseline model total as of recent Road Map update, sent-out energy grows at an average rate of 6.2% per year, rising from 588 GWh in 2020 to 1,153 GWh in 2030 and 1,949 GWh in 2040. Peak demand in the base case grows at an average rate of 5.5% per year from 117 MW in 2020 to 216 MW in 2030, reaching 336 MW in 2040.

Household energy consumption in The Gambia accounts for more than 80% of the energy demand. The household energy sources are mainly derived from wood, which is used for various activities at the household level such as cooking and ironing, and accounts for the largest component of the overall household energy consumption. Another source of household fuel energy is groundnut shells currently being compressed into briquettes and sold with a special stove. A study conducted by NARI in 2008 estimated that 477,476 tons of fuel wood is consumed annually. Government has shifted policy towards the promotion and the use of alternative sources such as Liquefied Petroleum Gas (LPG) in line with the sustainable management of the natural resources base of the country.

Clean energy transition means shifting energy production away from sources that release a lot of greenhouse gases (GHG), such as fossil fuels, to those that release little to no greenhouse gases. Hydro, wind and solar are some of these clean sources. The direction of the global transition to clean energy was agreed in the Paris Agreement, an international deal between over 180 countries that are part of the United Nations Framework Convention on Climate Change (UNFCCC). In order to remedy the energy situation, a proactive approach needs to be taken to boost the energy mix through the renewables namely Solar, Wind, Biomass, Hydro etc. This will enhance sustainability and security of supplies and curb negative impacts on the environment.

Government has set energy efficiency targets. It is expected to gradually phase out incandescent bulbs; Reach 100% penetration of energy efficient lighting in on and off-grid systems by 2020; Reduce T&D losses to 19.9% by 2020 (from 24.9% in 2013) and to 10% by 2030; Reach 5% of energy savings by 2020 and another 5% by 2030 for the building sector; Reach 40% charcoal production by 2020 and 100% by 2030 using efficient charcoal production technologies. Most of these targets could be met with the full implementation of The Gambia NDC2 Implementation Plan (2022 – 2026)

The Energy Sector in The Gambia has experienced significant challenges in the past two decades. Foremost among these is the dramatic rise in demand for energy as a result of population growth and urbanization, expansion of infrastructure and social services, growth in small and medium size industries, and expansion in the tourism and hospitality

sector. As a result, there is an urgent need for investment to modernize and replace the aging electricity facilities.

1.7 WATER RESOURCES

Major threats to surface and groundwater resources, defined by their magnitude, persistence, and social impacts are identified as: i) depletion of water stock, and ii) pollution of water resources. Single and multiple risks posed by these threats can be summarized as creating scarcity through reduced water resources availability and suitability for multiple purposes, leading to increased development, treatment and delivery costs of water.

Water abstractions for rice irrigation and plantation crops in the Upper River Region (URR) could alter the dynamics of saline intrusion in the River Gambia. Risks of groundwater depletion owe a lot to increasing demand associated with population growth, but are equally amplified by urbanization, the latter having the double effect of concentrating demand and reducing groundwater recharge. In urban areas within the Kombos, where threats to groundwater quality are greatest, potential sources of pollution include: 1) quarries/surface mines, 2) leaky sanitary soak-aways at public standpipes, 3) on-site sanitation systems, 4) solid waste tips/landfills, 5) unlined drainage ditches, and 6) underground storage tanks.

The largest water user is agriculture with 21.3 million m^3/year (67 per cent), followed by the municipal sector with 6.9 million m^3/year (22 per cent) and industry with 3.6 million m^3/year (11 per cent). The potable water demand for urban areas, tourism, industry, irrigation and livestock watering is supplied by groundwater sources. The introduction of irrigation saw women as the major participants in irrigation at field level, however there is only scant evidence that they participate significantly in water management or policy decisions at system, regional or national levels. Estimated demand and trends clearly show that irrigation and domestic water requirements account for more than 90 per cent of total demand nationwide, with irrigation alone accounting for more than 70 per cent. Demand is growing fastest in the livestock and domestic sectors. In the Kombo Peninsula, comprising coastal catchments and south bank areas close to the mouth of the Gambia estuary, where groundwater is the only source of freshwater, domestic water demand accounts for more than 50 per cent of the total and is expected to reach 80 per cent by 2050. Pumping irrigation water from the River Gambia has a potentially negative impact on the salt front in the river and thus on the environment overall. It has been estimated that if 1m^3/s is pumped from the upper river during the dry season, the salt front can move up to 4km upstream.

1.8 TOURISM

The Gambia's tourism sector has registered a number of significant achievements. These include

(a) a steady growth in tourist arrivals, which except for shocks related to financial crises and health-related pandemics, has resulted in progressive increases, peaking at over 230,000 arrivals registered in 2018/19 tourist season;
(b) Diversified and improving tourism products – introduction of several new products

and initiatives aimed at complementing the 3Ss (sun, sea and sand) such as the Roots Festival and Kankurang Festival in Janjangbureh;

(c) Marketing and promotion of 'Destination Gambia' – a series of marketing and promotional activities were undertaken to increase the destination's footprint on new and old source markets. Many tourists arrive from the United Kingdom and the Netherlands with new markets emerging from countries such as Germany, Poland, Russia, Portugal and Turkey;

(d) Investment Promotion – several initiatives were undertaken to attract more investors including free land allocation within the tourism development area (TDA); Special Investment Certificates (SICs) such as tax holidays and the organization of an international investment forum. New state of the art establishments has been added to the sector as well as an International Conference Centre;

(e) Product Quality and Services – the Quality and Enforcement department continues to tighten regulatory standards;

(f) Institutional and Human Resources development with the establishment of the Gambia Tourism (G.T.) Board to spearhead the sector, The Gambia Tourism & Hospitality Institute (GTHI), which is pursuing a regional centre of excellence status, continued to provide human capacity building for the tourism industry, and National Center for Arts and Culture (NCAC), promoting and facilitating the integration of culture into tourism;

(g) Government commitment and leadership through the MoTC which is sparing no efforts to ensure adequate policy, strategy and operational support to the sector- the allocation for example, of capital development funds to GTHI and NCAC has resulted in significant upgrading of infrastructure and facilities managed by these institutions.

The Gambia's traditional comparative advantages as a tourism destination are: a close proximity to Europe; year-round favourable tropical weather; an English-speaking populace; cheap prices; friendly and hospitable people;/ peace and stability. Tourism has therefore emerged as one of the success stories of national development endeavours and a major driver of the economy, contributing immensely to employment generation, and has gained prominence in terms of policies, programmes and investments.

However, destination Gambia, is also increasingly facing stiff competition from other destinations that offer higher quality infrastructure, a more diversified product mix and lower prices. These challenges have been exacerbated by global warming and climate change, particularly temperature increases of about 1^{O}C. The MoTC will continue its efforts to ensure coordination and partnership with various sectors that have a bearing on tourism, at all levels, national, international, regional, even local councils and at the level of the individual providers of infrastructure and services that impinge on tourism development. Specifically, MoTC will pursue efforts to strengthen inter-sectoral linkages through the following six strategies, namely: enhancing the linkages between horticulture and the tourism sector; supporting poultry production to meet local demands by the tourism sector; enhancing meat production from ruminants to meet demands of the

sector; strengthening the role of Gambia's Diplomatic Missions in marketing destination Gambia and facilitating investments; working with the Ministry of Trade and Regional Integration to facilitate regional tourism, and fully collaborate with the Ministry of Environment, Climate Change and Natural Resources on enhancing the scientific evidence on the climate change and ecosystem-based adaption through research and knowledge generation on climate change as it relates to green/ecotourism, cultural heritage tourism, nature-based tourism and other thematic areas.

Destination marketing should be a key instrument in securing a large increase in tourism business and boosting arrivals, especially that climate change assessments for the country have confirmed that the projected climate remains favourable for increased tourist arrivals in the near future. Priority will be given to increasing market share in established traditional markets and achieve successful entry into new and emerging markets to ensure year-round tourism.

1.9 TRANSPORT

The Gambia's transport system consists of three modes: (i) road transport which is made up of a primary network, inter-urban trunk roads; gravel surfaced secondary roads; urban roads mainly within the Greater Banjul Area (GBA); and gravel/earth surface (rural feeder roads); (ii) air transport system provided by the Banjul International Airport (BIA) at Yundum, and (iii) the maritime and river transport consisting of the Port of Banjul and the river transport system.

Despite facing funding challenges, the sector has made significant progress in constructing new roads and maintaining existing ones over the past years. According to the NRA's June 2021 network survey, 27.5% of the total road network is paved, while 72.5% remains unpaved. To improve connectivity within the country and across borders, several road projects have been launched in recent years. These projects include the Bertil Harding Highway, 50KM urban roads, Nationwide EPC roads, Niumi Hakalang Roads, North Bank Roads (Lot 1 and Lot 2), Kiang West Roads, and the pavement strengthening of the Senegambia corridor. These efforts aim to reduce high costs of transportation and travel time for passengers and goods.

The role of transport is therefore critical for the efficient functioning of the national economy as it provides vital and essential links between areas of production and markets, and also enhances access to social and economic facilities. This is better illustrated by the fact that the country's spatial geography of being divided into two by the River Gambia continues to be an important factor in any transport development program. This geography imposes not only the imperative to connect the country's north and south banks for national integration, but also to use its transport system for the integration of Senegal, which is also divided into two parts by the River Gambia.

For the transport sector to play its expected role in the development of the country, it is important that certain critical factors are recognized and addressed sufficiently by Government; these include policy issues on institutional reform, and mechanisms for coordinated planning and sector regulation. Government should invest in transportation infrastructure, such as highways, airways, and waterways, for all modes in which governments own and operate the transportation infrastructure to make operations more efficient in terms of energy use and greenhouse gas emissions. It also has to encourage sustainable economic, social, environmental development and climate change responsiveness by mitigating emissions in transport, and adapting businesses and destinations to changing climate conditions, and new technology.

Efforts should be made to adapt the transport sector to climate change, provide higher specifications for existing transport infrastructure; raise awareness of projected impacts of climate change on the transport sector; ensure efficient design of urban areas and their associated transport networks; create and promote new partnerships with government and civil society as well as collaboration with industry and customers to advance policy solutions. Raise the Companies' understanding and quantification of risks to infrastructure to justify capital investment and assess supply-chain risk and build resilience. Intermodal coordination and integrated planning of investment proposals, covering all transport modes, is indispensable. Through coordinated planning and decision making, the Government will assure that optimal solutions will be selected for implementation.

For efficiency, Government should use sustainable options for demand management, materials efficiency, and circular material flows as well as new production technologies to reduce greenhouse gas emissions from the industry, energy and transport sectors. The Transport systems expose people to a certain risk, but that the only acceptable safety goal (whether in aviation, maritime or road transport) is the elimination of fatalities and serious injuries. Fatalities and serious injuries in the transport sector are generating significant social and economic losses and should be addressed in a holistic manner. It is imperative to ensure safety through interventions such as improved and climate proofed highways and power plants; climate-resilient housing and improved aviation, maritime and water infrastructure, etc. Aviation and maritime safety benefit from strong connections with international regulatory bodies, and Gambia shall draw upon international good practice to strengthen its safety response.

The Equity Principle of the Tourism Policy includes Government's commitment to support programs and efforts directed toward the promotion of equality in serving the needs and requirements of both women, men and differently abled people equally. Inclusive governance that prioritizes equity and justice in adaptation planning and implementation leads to more effective and sustainable adaptation outcomes. Adaptation and resilience to climate change risks are often reduced through carefully designed and implemented

laws, policies, processes, and interventions that address context specific inequities such as based on disability, age, location and income. These approaches focus on adaptative capacity-building, and meaningful participation of the most vulnerable and marginalized groups (people with disability, older persons and rural communities), and their access to key transportation systems. Adaptivity is lower in locations with poverty, governance challenges and limited access to basic services and resources (roads), and high levels of climate-sensitive livelihoods (e.g., smallholder peasant communities).

CHAPTER 2: NATIONAL GREENHOUSE GAS (GHG) INVENTORY

2.1 INTRODUCTION

2.1.1 Background Information

Climate change is caused by both natural and human induced activities. Here, we are concerned with the human induced activities that are causing build-up of the concentration of greenhouse gases into the atmosphere, which are causing radiative forcing through the reflection or absorption of solar radiation, or the absorption or emission of terrestrial radiation. In this national greenhouse gas inventory of The Gambia, attempt is made to estimate and report on the quantities of national greenhouse gas emissions and removals.

As required by decision 17/CP.8 and using the IPCC 2006 Guidelines (version 2.69), estimates of emissions and removals have been provided for Carbon Dioxide (CO2), methane (CH_4) and nitrous oxide (N_2O) by sources and removals by sinks due to human activities. Where activity data is available, information on anthropogenic emissions by sources of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hexafluoride (SF6). Nitrogen oxides (NOx) and Carbon Monoxide (CO) are also provided. Using Global Warming Potential (GWP) values in IPCC [6]WGI, Carbon Dioxide Equivalent (CO2eq) values were calculated for all the gases reported in this 2020 Inventory of GHG emissions from The Gambia.

The first GHG inventory in the Gambia reported emissions for 1993 and was led by Department of Water Resources and it was funded by the United States Country Study Programme in 1993. The result of the inventory was used in the First National Communication of the Gambia that was submitted to UNFCCC in 2003.

The Gambia conducted a second GHG inventory in 2010 for input in the Second National Communication that was submitted in 2013. The 2010 inventory of GHG emissions was reported in The Gambia's Third National Communications submitted to the UNFCCC in 2020.

The Gambia has been working on it first Biennial Update Report (BUR) since 2015 and has been collecting activity data for a ten-year GHG inventory from 2011 to 2020. However, the development of the report has been protracted by challenges including inadequate technical capacity, challenging institutional arrangement and inadequate regulatory and policy instruments to support the inventory processes. These challenges

[6] https://www.ipcc.ch/report/ar5/wg1/

have been largely resolved and will facilitate the preparation of subsequent GHG inventories.

2.1.2 Institutional Arrangements for Management of the GHG Inventory Process

The GHG Inventory Task Force (GHGI-TF) of the National Climate Committee (NCC) is responsible for the assessment and development of the National Inventory (NIR) and Greenhouse Gas Mitigation assessment.

No	Key Institution	Subsidiary Institutions
1	Ministry of Environment Climate Change and Natural Resources (MECCNAR)	The Climate Change Secretariat
		Department of Forestry
		National Environment Agency),
2	Ministry of Petroleum and Energy (MoPE)	Department of Energy (DoE)
		National Water and Electricity Company (NAWEC)
3	Ministry of Agriculture (MoA)	National Agriculture Research Institute (NARI)
		Department of Planning Services Unit
		Department of Livestock Services
4	Ministry of Transport, Works and Infrastructure (MoTWI)	Directorate of Transport
		National Roads Authority
		Gambia Civil Aviation Authority (GCAA)
5	Ministry of Lands, Local Government and Religious Affairs	Municipalities
		Area Councils

Table 1 Institutional Arrangement for GHG Inventory Management

2.1.3 QA/QC Plan

The Gambia does not have a QA/QC protocol. The greenhouse gas (QA/QC) plan is expected to organize and implement activities to ensure that the quality of a greenhouse gas inventory is transparent, accurate, consistent, comparable, and complete. For this Greenhouse Gas Inventory cycle QC activities were undertaken by national experts and the QA exercises were undertaken by external entities. entities include the UNFCCC Secretariat, US-EPA and UNEP. These interventions resulted in an improved National Inventory of Greenhouse Gases for the Republic of The Gambia. For future national inventories of GHG emissions a QA/QC plan will be developed, and an independent national entity will be identified to conduct the QA analysis, internally.

2.1.4 Data Verification

The greenhouse gas (GHG) verification process is a third-party assessment that confirms the accuracy and completeness of an organization's GHG emissions inventory. The process also identifies areas for improvement and strengths and weaknesses. Except for the involvement of UNFCCC and UNEP consultants, the verification was limited to the personal involvement of GHG Category compilers.

2.1.5 Total 2020 National Emissions (GgCO2eq)

The total greenhouse gas emissions for 2020 were about 3,542GgCO2eq. Figure 2.1a shows the distribution of the emissions by gas. About 46% (1645GgCO2eq) is CO2, 23% (805GgCO2eq) is CH4, 22% (774GeCO2eq) is NOx and the remaining 9% (318GgCO2eq) are N_2O, HFC, PFC, SF_6 and CO.

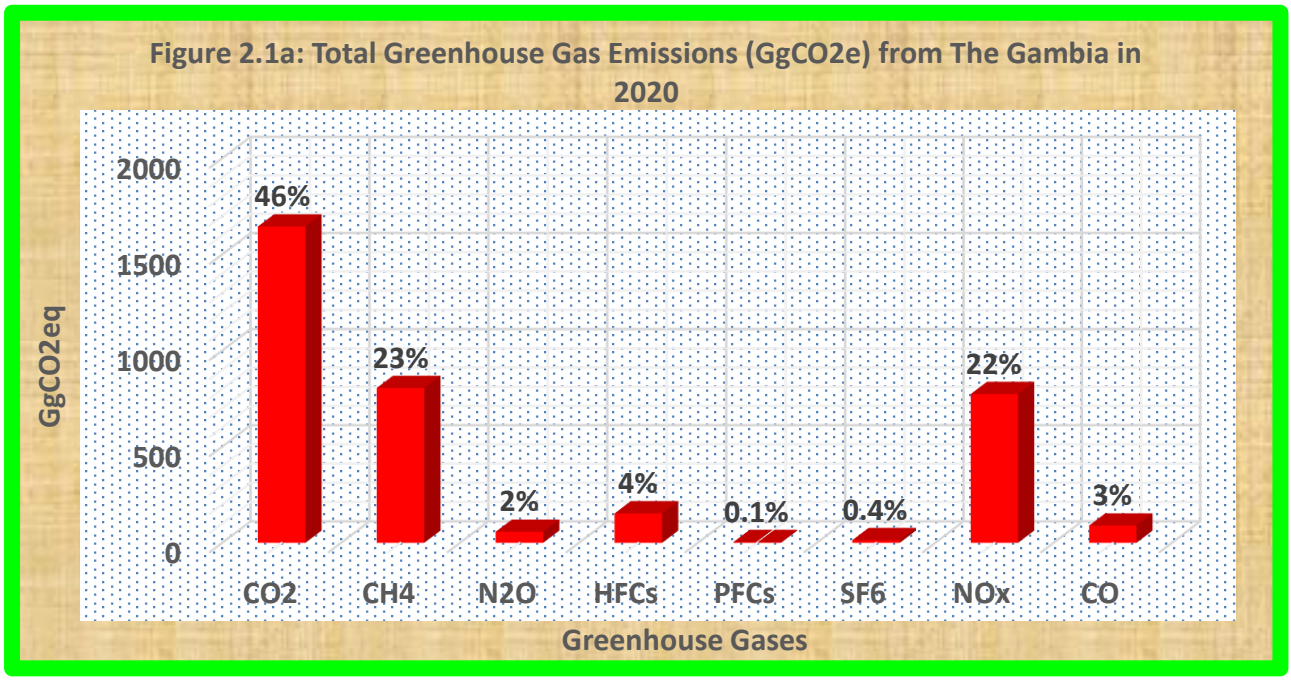


Fig: 12 Total Greenhouse Gas Emissions (GgCO2e)In The Gambia from 2020

From **Figure 2.1b** below, the AFOLU Category is the biggest emitter of greenhouse gases in The Gambia in 2020. AFOLU released 2,221GgCO2eq into the atmosphere, followed by Energy with 857GgCO2eq (24%), Waste with 271GgCO2eq (8%) and IPPU with 193GGCO2eq (5%).

Fig: 13 Total Emissions (GgCO2e) per Category in 2020

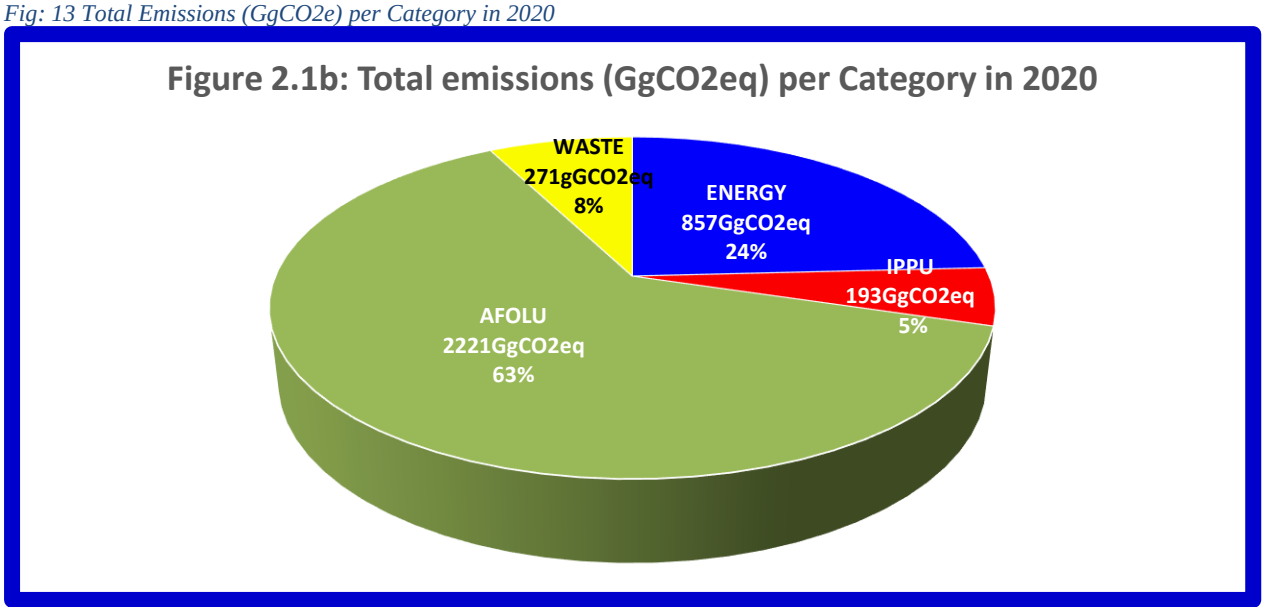


Figure 2.1c shows the 10-year emissions trend from 2011 to 2020. The emissions continue to increase from 2,679GgCO2eq in 2011 to 3,542GgCO2eq in 2020, representing about 86GgCO2eq per year.

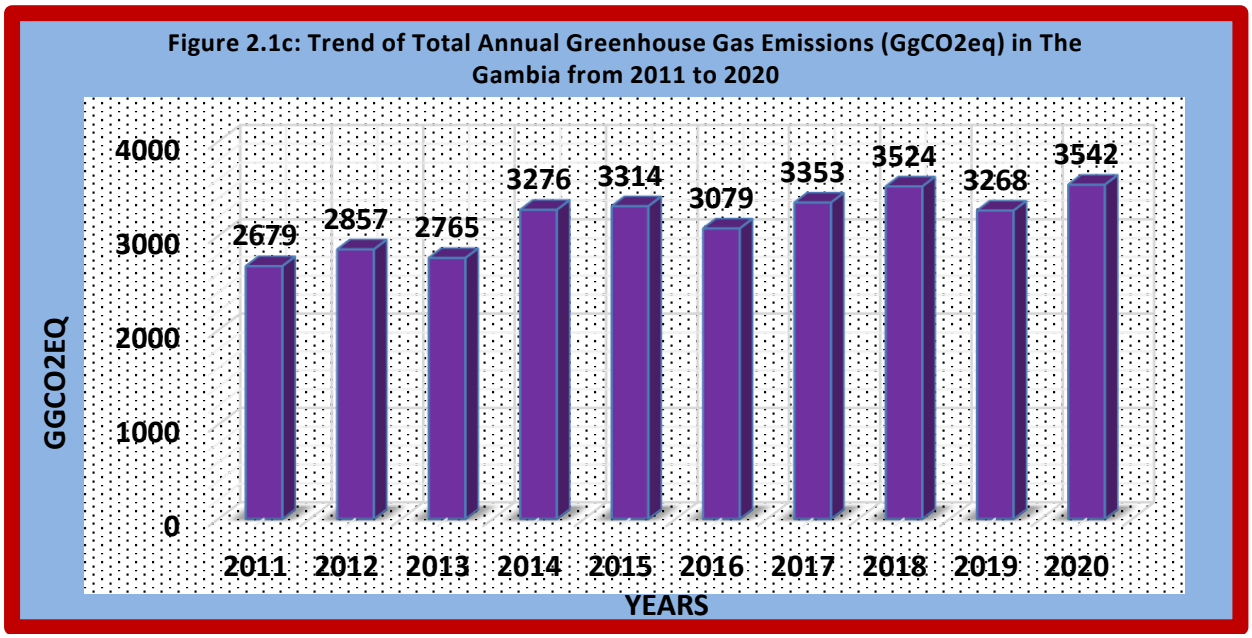


Fig: 14 Trend of Total Annual Greenhouse Gas Emission (GgCo2e) in The Gambia from 2011 to 2020

2.1.6 Key Category Analysis

Gambia has completed a key category analysis of its GHG inventory. A key category analysis highlights sources that have a significant influence on a country's total inventory of greenhouse gases in terms of absolute level of emissions or removals, the trend in emission or both. The IPCC 2006 Guidelines provide guidance for the identification of key categories. The key categories were identified using Approach 1 Level and Trend assessment. The methods used for the identification of the key categories were level assessments for 2011 and 2020, and trend assessment for 2020 using 2020 as base year.

Key categories are identified using the level assessment (Table 1 below) approach for 2020, indicates Carbon Dioxide (CO2) emission/ from land converted to Cropland as the highest as a result of expansion of agricultural fields for crop cultivation. This is followed by road transport due to importation second hand cars which are not fuel efficient. Land converted to wetland due salt intrusions into the low land areas as a result of sea level rise and followed by other land which emits 369.62 Gg CO2eq.

Fluxes resulting directly from anthropogenic activity are dominated by CO2 fluxes, primarily emissions due to expansion of Agricultural activities but also uptake due to reforestation/regrowth. Non-CO2 greenhouse gas emissions primarily arise from biomass burning from forest and energy industry biomass which is mainly Methane (CH_4), and Nitrous oxide (N_2O).

Methane emissions mainly come from enteric fermentation constitute the highest which is followed by solid waste disposal and rice production respectively. Biomass burning as a result of recurrent forest fires also produces Methane as well as energy industries – biomass and manure management. Biomass burning, energy industry biomass and wastewater treatment also produces Nitrous oxide. Land converted to forest land is in the negatives. For the year 2020, the sum of the total emissions for the key categories amounted to 2488.223 Gg CO2eq.

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	Greenhouse gas	2020 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
3.B.2.b	Land Converted to Cropland	Carbon Dioxide (CO2)	1742.13	1742.13	0.28	0.57
1.A.3.b	Road Transportation	Carbon Dioxide (CO2)	536.14	536.14	0.09	0.66
3.B.4.b	Land Converted to Wetlands	Carbon Dioxide (CO2)	479.19	479.19	0.08	0.73
3.B.6.b	Land Converted to Other land	Carbon Dioxide (CO2)	369.63	369.63	0.06	0.79
3.A.1	Enteric Fermentation	METHANE (CH4)	253.08	253.08	0.04	0.83
4.A	Solid Waste Disposal	METHANE (CH4)	192.41	192.41	0.03	0.86
1.A.1	Energy Industries - Liquid Fuels	Carbon Dioxide (CO2)	156.43	156.43	0.02	0.89
3.B.5.b	Land Converted to Settlements	Carbon Dioxide (CO2)	127.52	127.52	0.02	0.91
2.F.4	Aerosols	HFCs, PFCs	103.48	103.48	0.02	0.92
3.C.7	Rice cultivation	METHANE (CH4)	78.83	78.83	0.01	0.93
1.A.4	Other Sectors - Liquid Fuels	Carbon Dioxide (CO2)	73.64	73.64	0.01	0.95
3.C.1	Emissions from biomass burning	NITROUS OXIDE (N2O)	47.32	47.32	0.01	0.95

Table 2 Key Category (KC) Analysis Using Level Assessment in 2020

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	Greenhouse gas	2011 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F

3.B.2.b	Land Converted to Cropland	Carbon Dioxide (CO2)	1742.13	1742.13	0.28	0.64
3.B.4.b	Land Converted to Wetlands	Carbon Dioxide (CO2)	479.19	479.19	0.08	0.72
3.B.6.b	Land Converted to Other land	Carbon Dioxide (CO2)	369.63	369.63	0.06	0.78
3.A.1	Enteric Fermentation	METHANE (CH4)	316.63	316.63	0.05	0.83
1.A.3.b	Road Transportation	Carbon Dioxide (CO2)	286.00	286.00	0.05	0.88
1.A.1	Energy Industries - Liquid Fuels	Carbon Dioxide (CO2)	189.98	189.98	0.03	0.91
3.B.5.b	Land Converted to Settlements	Carbon Dioxide (CO2)	127.52	127.52	0.02	0.93
2.F.4	Aerosols	HFCs, PFCs	76.05	76.05	0.01	0.94
3.C.1	Emissions from biomass burning	NITROUS OXIDE (N2O)	53.13	53.13	0.01	0.95
3.C.7	Rice cultivation	METHANE (CH4)	49.97	49.97	0.01	0.96

Table 3 KCA Using Level Assessment in 2011

A	B	C	D	E	F	G	H
IPCC Category code	IPCC Category	Greenhouse gas	2011 Year Estimate Ex0 (Gg CO2 Eq)	2020 Year Estimate Ext (Gg CO2 Eq)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
3.B.2.b	Land Converted to Cropland	Carbon Dioxide (CO2)	1742.13	1742.13	0.16	0.30	0.30
3.B.1.a	Forest land Remaining Forest land	Carbon Dioxide (CO2)	-2276.61	-1851.47	0.14	0.27	0.57
3.B.4.b	Land Converted to Wetlands	Carbon Dioxide (CO2)	479.19	479.19	0.04	0.08	0.66
3.A.1	Enteric Fermentation	METHANE (CH4)	316.63	253.08	0.04	0.07	0.73
3.B.6.b	Land Converted to Other land	Carbon Dioxide (CO2)	369.63	369.63	0.03	0.06	0.79
4.A	Solid Waste Disposal	METHANE (CH4)	0.00	192.41	0.03	0.06	0.85
1.A.1	Energy Industries - Liquid Fuels	Carbon Dioxide (CO2)	189.98	156.43	0.02	0.04	0.90
1.A.3.b	Road Transportation	Carbon Dioxide (CO2)	286.00	536.14	0.01	0.02	0.92
3.B.5.b	Land Converted to Settlements	Carbon Dioxide (CO2)	127.52	127.52	0.01	0.02	0.94

A	B	C	D	E	F	G	H
IPCC Category code	IPCC Category	Greenhouse gas	2011 Year Estimate Ex0 (Gg CO2 Eq)	2020 Year Estimate Ext (Gg CO2 Eq)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
3.C.1	Emissions from biomass burning	NITROUS OXIDE (N2O)	53.13	47.32	0.01	0.01	0.95

Table 4 Identified KCA Using Trend Assessment for Period 2011 to 2020

A	B	C	Key source assessment	Key source assessment
IPCC Category code	IPCC Category	Greenhouse gas	(Level assessment) LA	(Trend assessment TA)
3.B.2.b	Land Converted to Cropland	Carbon Dioxide (CO2)	2020	2011 - 2020
3.B.4.b	Land Converted to Wetlands	Carbon Dioxide (CO2)	2020	2011 - 2020
3.B.6.b	Land Converted to Other land	Carbon Dioxide (CO2)	2020	2011 - 2020
3.B.5.b	Land Converted to Settlements	Carbon Dioxide (CO2)	2020	2011 - 2020
3.C.1	Emissions from biomass burning	NITROUS OXIDE (N2O)	2020	2011 - 2020
3.C.1	Emissions from biomass burning	METHANE (CH4)	2020	2011 - 2020

Table 5 KCA for the FOLU Sector

For the National GHG inventory, 2020 level assessment produced the following key categories for Carbon dioxide, Land Converted to Cropland which constitute the highest. Followed by Road Transportation, Land converted to Wetland and Land converted to other land. Methane is mainly produced form enteric fermentation, solid waste disposal and rice cultivation. Biomass burning from forest biomass burning and energy industries biomass burning produces Nitrous oxide. Recurrent forest fires resulted to forest biomass burning.

2.1.7 Uncertainty Assessment

An uncertainty assessment (Table 2.2 below) of greenhouse gas (GHG) inventories is crucial for ensuring the accuracy and reliability of the data reported. Here are some key points to consider. It can arise from various sources, including measurement errors, estimation methods, and data gaps. For the Gambia, the uncertainty assessment was based on the gaps on the activity data collection and the emission factor used for the estimations. The emission factors used for estimating emissions for the GHG inventory is the default Emission factors from IPCC emission factor database.

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T
1 - Energy						
1.A.1 - Energy Industries - Liquid Fuels	CO2	156.43	7.07	8.68	11.19	0.00
1.A.1 - Energy Industries - Liquid Fuels	CH4	0.12	7.07	323.55	323.63	0.00
1.A.1 - Energy Industries - Liquid Fuels	N2O	0.35	7.07	323.55	323.63	0.00
1.A.1 - Energy Industries - Biomass	CO2	512.11	5.00	18.69	19.35	0.00
1.A.1 - Energy Industries - Biomass	CH4	18.12	5.00	245.45	245.51	0.00
1.A.1 - Energy Industries - Biomass	N2O	5.67	5.00	304.55	304.59	0.00
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	CO2	40.48	5.00	6.14	7.92	0.00
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	CH4	0.03	5.00	228.79	228.84	0.00
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	N2O	0.10	5.00	228.79	228.84	0.00
1.A.3.a - Civil Aviation - Liquid Fuels	CO2	26.50	5.00	4.17	6.51	0.00
1.A.3.a - Civil Aviation - Liquid Fuels	CH4	0.00	5.00	100.00	100.12	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
1.A.3.a - Civil Aviation - Liquid Fuels	N2O	0.23	5.00	150.00	150.08	0.00
1.A.3.b - Road Transportation - Liquid Fuels	CO2	536.14	8.66	6.62	10.90	0.00
1.A.3.b - Road Transportation - Liquid Fuels	CH4	0.60	8.66	346.08	346.19	0.00
1.A.3.b - Road Transportation - Liquid Fuels	N2O	10.20	8.66	296.94	297.06	0.00
1.A.3.b - Road Transportation	CO2	0.00	0.00	0.00	0.00	0.00
1.A.3.d - Water-borne Navigation - Liquid Fuels	CO2	10.22	5.00	4.30	6.60	0.00
1.A.3.d - Water-borne Navigation - Liquid Fuels	CH4	0.02	5.00	50.00	50.25	0.00
1.A.3.d - Water-borne Navigation - Liquid Fuels	N2O	0.09	5.00	140.00	140.09	0.00
1.A.4 - Other Sectors - Liquid Fuels	CO2	73.64	11.18	13.72	17.70	0.00
1.A.4 - Other Sectors - Liquid Fuels	CH4	0.22	11.18	447.21	447.35	0.00
1.A.4 - Other Sectors - Liquid Fuels	N2O	0.20	11.18	525.18	525.30	0.00
1.B.1 - Solid Fuels	CO2	0.00	5.00	0.00	5.00	0.00
1.B.1 - Solid Fuels	CH4	0.00	7.07	0.00	7.07	0.00
1.C - Carbon dioxide Transport and Storage	CO2	0.00	0.00	0.00	0.00	0.00
2 - Industrial Processes and Product Use						
2.A.1 - Cement production	CO2	0.00	35.00	0.00	35.00	0.00
2.A.2 - Lime production	CO2	1.35	4.00	2.00	4.47	0.00
2.A.3 - Glass Production	CO2	0.00	5.00	0.00	5.00	0.00
2.A.4 - Other Process Uses of Carbonates	CO2	2.11	17.40	0.00	17.40	0.00
2.B.1 - Ammonia Production	CO2	0.00	5.00	0.00	5.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
2.B.2 - Nitric Acid Production	N2O	0.00	2.00	0.00	2.00	0.00
2.B.3 - Adipic Acid Production	N2O	0.00	5.00	0.00	5.00	0.00
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O	0.00	10.00	0.00	10.00	0.00
2.B.5 - Carbide Production	CO2	0.00	5.00	10.00	11.18	0.00
2.B.5 - Carbide Production	CH4	0.00	5.00	10.00	11.18	0.00
2.B.6 - Titanium Dioxide Production	CO2	0.00	5.00	0.00	5.00	0.00
2.B.7 - Soda Ash Production	CO2	0.00	5.00	0.00	5.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	CO2	0.00	24.49	0.00	24.49	0.00
2.B.8 - Petrochemical and Carbon Black Production	CH4	0.00	24.49	0.00	24.49	0.00
2.B.9 - Fluorochemical Production	CHF3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CH2F2	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CH3F	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CF3CHFCHFCF2CF3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CHF2CF3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CHF2CHF2	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CH2FCF3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CH3CHF2	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CHF2CH2F	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CF3CH3	0.00	1.00	0.00	1.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
2.B.9 - Fluorochemical Production	CF3CHFCF3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CF3CH2CF3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CH2FCF2CHF2	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CF4	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	C2F6	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	C3F8	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	C4F10	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	c-C4F8	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	C5F12	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	C6F14	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	SF6	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CHCl3	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CH2Cl2	0.00	1.00	0.00	1.00	0.00
2.B.9 - Fluorochemical Production	CF3 I	0.00	1.00	0.00	1.00	0.00
2.C.1 - Iron and Steel Production	CO2	0.01	0.00	10.00	10.00	0.00
2.C.1 - Iron and Steel Production	CH4	0.00	0.00	400.00	400.00	0.00
2.C.2 - Ferroalloys Production	CO2	0.00	5.00	0.00	5.00	0.00
2.C.2 - Ferroalloys Production	CH4	0.00	5.00	0.00	5.00	0.00
2.C.3 - Aluminium production	CO2	0.00	2.00	0.00	2.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
2.C.3 - Aluminium production	CF4	0.00	2.00	0.00	2.00	0.00
2.C.3 - Aluminium production	C2F6	0.00	2.00	0.00	2.00	0.00
2.C.4 - Magnesium production	CO2	0.00	5.00	0.00	5.00	0.00
2.C.4 - Magnesium production	SF6	0.00	5.00	0.00	5.00	0.00
2.C.5 - Lead Production	CO2	0.00	10.00	0.00	10.00	0.00
2.C.6 - Zinc Production	CO2	0.00	10.00	0.00	10.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	CO2	9.99	21.21	122.47	124.30	0.08
2.E - Electronics Industry	C2F6	0.00	14.14	0.00	14.14	0.00
2.E - Electronics Industry	CF4	0.00	17.32	0.00	17.32	0.00
2.E - Electronics Industry	CHF3	0.00	10.00	0.00	10.00	0.00
2.E - Electronics Industry	C3F8	0.00	10.00	0.00	10.00	0.00
2.E - Electronics Industry	SF6	0.00	14.14	0.00	14.14	0.00
2.E - Electronics Industry	C6F14	0.00	10.00	0.00	10.00	0.00
2.F.1 - Refrigeration and Air Conditioning	CH2FCF3	37.81	13.93	13.00	19.05	0.00
2.F.2 - Foam Blowing Agents	CH2FCF3	0.00	0.00	0.00	0.00	0.00
2.F.3 - Fire Protection	CH2FCF3	11.69	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CH2FCF3	103.48	10.00	10.00	14.14	0.85
2.F.4 - Aerosols	CH3CHF2	0.00	10.00	10.00	14.14	0.00
2.F.4 - Aerosols	CF3CHFCF3	0.00	10.00	10.00	14.14	0.00
2.F.4 - Aerosols	CF3CHFCHFCF2CF3	0.00	10.00	10.00	14.14	0.00
2.F.5 - Solvents	CF3CHFCHFCF2CF3	0.00	10.00	50.00	50.99	0.00
2.F.5 - Solvents	C6F14	0.00	10.00	50.00	50.99	0.00
2.F.6 - Other Applications (please specify)	CHF3	0.00	10.00	0.00	10.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
2.F.6 - Other Applications (please specify)	CH2F2	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CH3F	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCHFCF2CF3	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CF3	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHF2	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF3	0.00	10.00	50.00	50.99	0.00
2.F.6 - Other Applications (please specify)	CH3CHF2	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2F	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications r(please specify)	CF3CH3	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCF3	0.00	10.00	50.00	50.99	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF3	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CHF2	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	CF4	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	C2F6	0.00	10.00	50.00	50.99	0.00
2.F.6 - Other Applications (please specify)	C3F8	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	C4F10	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	c-C4F8	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	C5F12	0.00	10.00	0.00	10.00	0.00
2.F.6 - Other Applications (please specify)	C6F14	0.00	10.00	0.00	10.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
2.G - Other Product Manufacture and Use	SF6	13.88	60.00	58.31	83.67	0.14
2.G - Other Product Manufacture and Use	CF4	3.84	60.00	58.31	83.67	0.01
2.G - Other Product Manufacture and Use	C2F6	0.00	60.00	58.31	83.67	0.00
2.G - Other Product Manufacture and Use	C3F8	0.00	60.00	58.31	83.67	0.00
2.G - Other Product Manufacture and Use	C4F10	0.00	60.00	58.31	83.67	0.00
2.G - Other Product Manufacture and Use	c-C4F8	0.00	60.00	58.31	83.67	0.00
2.G - Other Product Manufacture and Use	C5F12	0.00	60.00	58.31	83.67	0.00
2.G - Other Product Manufacture and Use	C6F14	0.00	60.00	58.31	83.67	0.00
2.G - Other Product Manufacture and Use	N2O	0.00	0.00	0.00	0.00	0.00
2.H - Other	CO2	2.51	0.00	0.00	0.00	0.00
2.H - Other	CH4	5.92	0.00	0.00	0.00	0.00
3 - Agriculture, Forestry, and Other Land Use						
3.A.1 - Enteric Fermentation	CH4	253.08	0.00	0.00	0.00	0.00
3.A.2 - Manure Management	CH4	10.59	0.00	0.00	0.00	0.00
3.A.2 - Manure Management	N2O	0.00	0.00	0.00	0.00	0.00
3.B.1.a - Forest land Remaining Forest land	CO2	-1851.47	0.00	0.00	0.00	0.00
3.B.1.b - Land Converted to Forest land	CO2	-32.95	0.00	0.00	0.00	0.00
3.B.2.a - Cropland Remaining Cropland	CO2	0.00	0.00	0.00	0.00	0.00
3.B.2.b - Land Converted to Cropland	CO2	1742.13	0.00	0.00	0.00	0.00
3.B.3.a - Grassland Remaining Grassland	CO2	0.00	0.00	0.00	0.00	0.00
3.B.3.b - Land Converted to Grassland	CO2	0.23	0.00	0.00	0.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
3.B.4.a.i - Peatlands remaining peatlands	CO2	0.00	0.00	0.00	0.00	0.00
3.B.4.a.i - Peatlands remaining peatlands	N2O	0.00	0.00	0.00	0.00	0.00
3.B.4.b - Land Converted to Wetlands	N2O	0.00	0.00	0.00	0.00	0.00
3.B.4.b - Land Converted to Wetlands	CO2	479.19	0.00	0.00	0.00	0.00
3.B.5.a - Settlements Remaining Settlements	CO2	0.00	0.00	0.00	0.00	0.00
3.B.5.b - Land Converted to Settlements	CO2	127.52	0.00	0.00	0.00	0.00
3.B.6.b - Land Converted to Other land	CO2	369.63	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning	CH4	35.11	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning	N2O	47.32	0.00	0.00	0.00	0.00
3.C.2 - Liming	CO2	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	CO2	0.79	0.00	0.00	0.00	0.00
3.C.4 - Direct N2O Emissions from managed soils	N2O	0.00	0.00	0.00	0.00	0.00
3.C.5 - Indirect N2O Emissions from managed soils	N2O	0.00	0.00	0.00	0.00	0.00
3.C.6 - Indirect N2O Emissions from manure management	N2O	0.00	0.00	0.00	0.00	0.00
3.C.7 - Rice cultivation	CH4	78.83	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	CO2	-21.71	0.00	0.00	0.00	0.00
4 - Waste						
4.A - Solid Waste Disposal	CH4	192.41	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	CH4	0.73	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	N2O	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	CO2	0.27	0.00	0.00	0.00	0.00

Base year for assessment of uncertainty in trend: 2020, Year T: 2020						
4.C - Incineration and Open Burning of Waste	CH4	1.79	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	N2O	0.35	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	CH4	6.41	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	N2O	2.77	0.00	0.00	0.00	0.00
5 - Other						

Table 6 Uncertainty Analysis of the National GHG Inventory

Sum(C): 3027.07	Sum(H): 1.08
	Uncertainty in total inventory: 1.04

2.2 EMISSIONS FROM THE ENERGY CATEGORY

In general, emissions of each greenhouse gas from stationary sources are calculated by multiplying fuel consumption by the corresponding emission factor. In the Sectoral Approach, "Fuel Consumption" is estimated from energy statistics and is measured in terajoules. Fuel consumption data in mass or volume units must first be converted into the energy content of these fuels. All tiers described below use the amount of fuel combusted as the activity data. Tier 1 method has been used throughout in estimating the GHG emissions based on the fact that sufficient data could not be found. Detailed information on fuel type, and operating conditions were not available and the Gambia is yet to establish country specific emission factors. The 2006 IPCC inventory software has been used to calculate Carbon Dioxide (CO2), Methane (CH_4) and Nitrous (N_2O) emissions.

2.2.1 Data Sources

In the Sectoral Approach fuel consumption measured in terajoules is estimated from energy statistics contained in the National Petroleum Information System (NPIS)[7] . Fuel consumption data in mass or volume units must first be converted into the energy content (TJ). In this inventory chapter of the BUR, the amount of fuel combusted is used as the activity data. Tier 1 methodology has been used throughout in estimating the GHG emissions, given that sufficiently disaggregated data were not obtained. Detailed information on fuel type, and operating conditions were not available, and the Gambia is yet to establish country specific emission factors. The 2006 IPCC inventory software has been used to calculate Carbon Dioxide (CO2), Methane (CH_4) and Nitrous (N_2O) emissions.

[7] Website link: www.mope.gm

2.2.2 Emission Factor for Energy Sector

Default Emission Factors for Stationary Combustion in the Energy Industries, Combustion in Manufacturing Industries and Construction, the Commercial/Institutional Category, and the Residential and Agriculture/Forestry/Fishing/Fishing Farms categories and measure kg of greenhouse gas per TJ on a Net Calorific Basis.

2.2.3 Emission trends Factor for Energy Sector

As shown in Figure **2.2a** below, emissions of GHG from the Energy Category has increased from 567.2GgCO2eq in 2011 to 856.6 GgCO2eq in 2020, representing and annual increase of about 29 GgCO2eq per annum.

The biggest emitter within the energy sector is Transport, which in 2020 emitted about 546.4 Gg/CO2 from 291.72 Gg/CO2 in 2011. The average annual growth in GHG emissions from 2011 to 2020 has been 3.4%, with a few occasional slight drops and rises due to economic sluggishness and growth. However, from 2017 to 2018 an annual drop in emissions was observed (from 14% in 2017 to -4% in 2018) due to reduced economic activities during the political impasse in 2017. In 2018 to 2019, there was a significant increase in economic activities as result of the new political dispensation. Then between 2019 and 2020, there was a significant reduction in emissions from 19% in 2019 t in 2020 due to the external shocks of Covid-19 that has led to significant slowdown of economic activities in the country. The second largest emitter in the energy sector was electricity generation.

Fig: 15 Energy Emissions (GgCO2eq) Trend from 2022 to 2020

2.2.4 GHG emissions expressed as CO2eq

In 2020, the Energy Category emitted 857GgCO2eq. From Figure 2.2b, the major emitted gas was CO2 which accounted for about 95% of the total emissions of the category, followed by CH_4 with 3% and N_2O with 2% of the emissions.

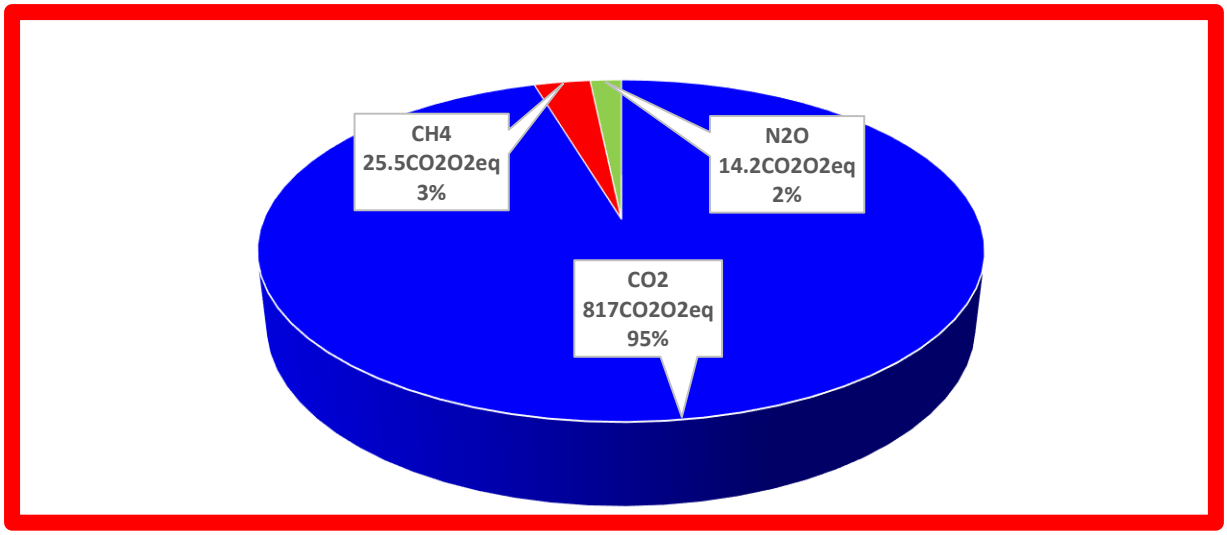


Fig: 16 Total Emissions (GgCO2eq) from Energy Category in 2020

2.2.5 CO2 Emissions Factor for Energy Sector

Total emissions of the Carbon Dioxide (CO2) gas from the Energy Category came from the Fuel Combustion Activities sub-category and Figure 2.2c shows the value and percentage distribution of the emissions among the activities. Transport activity is the biggest emitter in the Energy Category representing 67% of the emissions from Fuel Combustion and, thus the Energy Category emissions. The Transport activity emissions is followed by the Energy Industries (ENI) activities (19%), OTHER activities (9%) and the Manufacturing, Industry and Construction (MAICO) activities (5%).

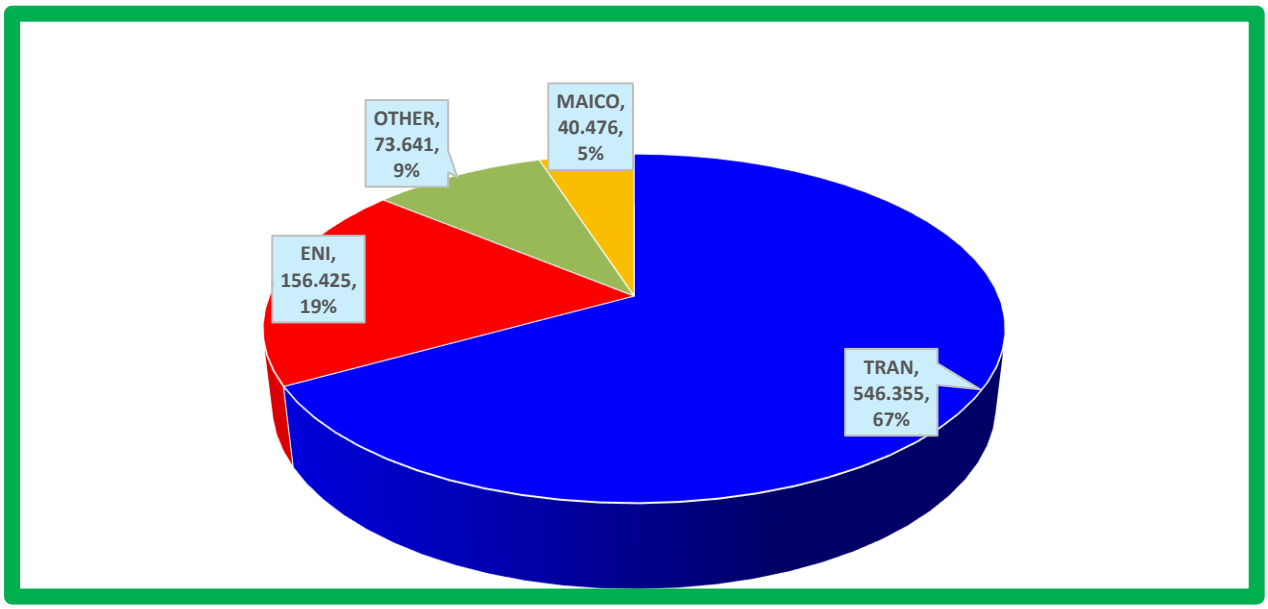


Fig: 17 Carbon Dioxide (CO2) emissions (GgCO2eq) from the Energy Category in 2020

2.2.6 CH4 Emissions Factor for Energy Sector

In 2020, a total of 0.910GgCH4 (25.5GgCO2eq) were emitted from the Fuel Combustion Activities sub-category of the Energy Category. The biggest emitter is the Energy Industry (ENI) (Figure 2.2d) that emitted 96% ((0.869GgCH4 or 24.323GgCO2eq) of the total emissions. The is followed by the Transport activities (3%).

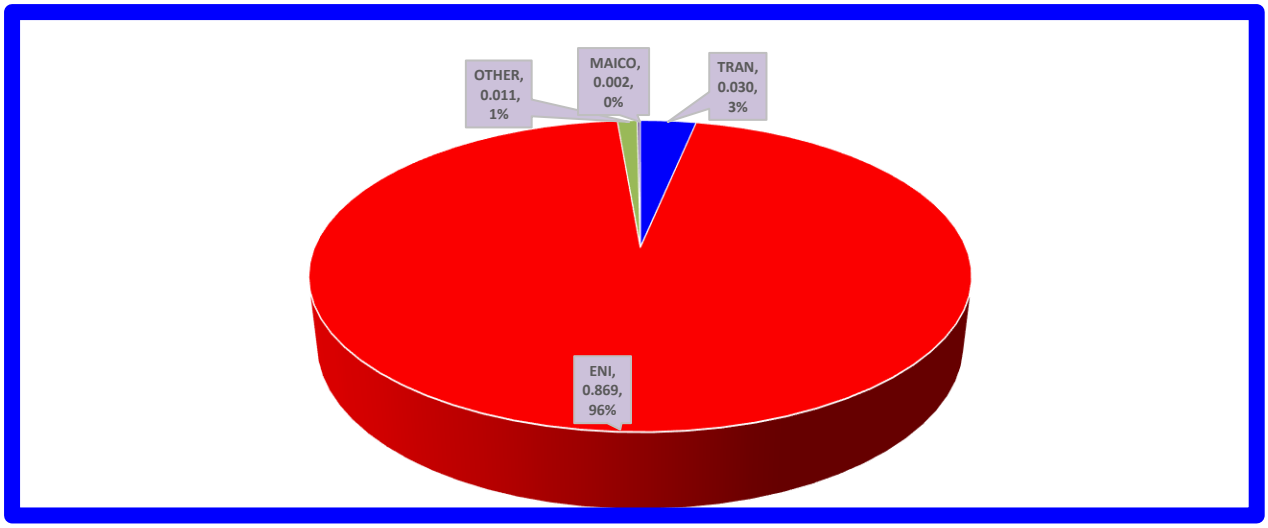


Fig: 18 Methane (CO2) Emissions (GgCo2eq) from Energy Category in 2020

2.2.7 N2O Emissions Factors for Energy Sector

From Figure 2.2e below, the Transport activities contribute about 62% of the N2O emissions (0.033GgN2O or 0.924GgCO2eq) from the Energy Category; followed by ENI that contributed about 35% (0.019GgN2O or 0.532GgCO2eq), and the rest contributed about 3% (0.0013GgN2o or 0.037GgCO2eq) of the N2O emissions from the Energy Category.

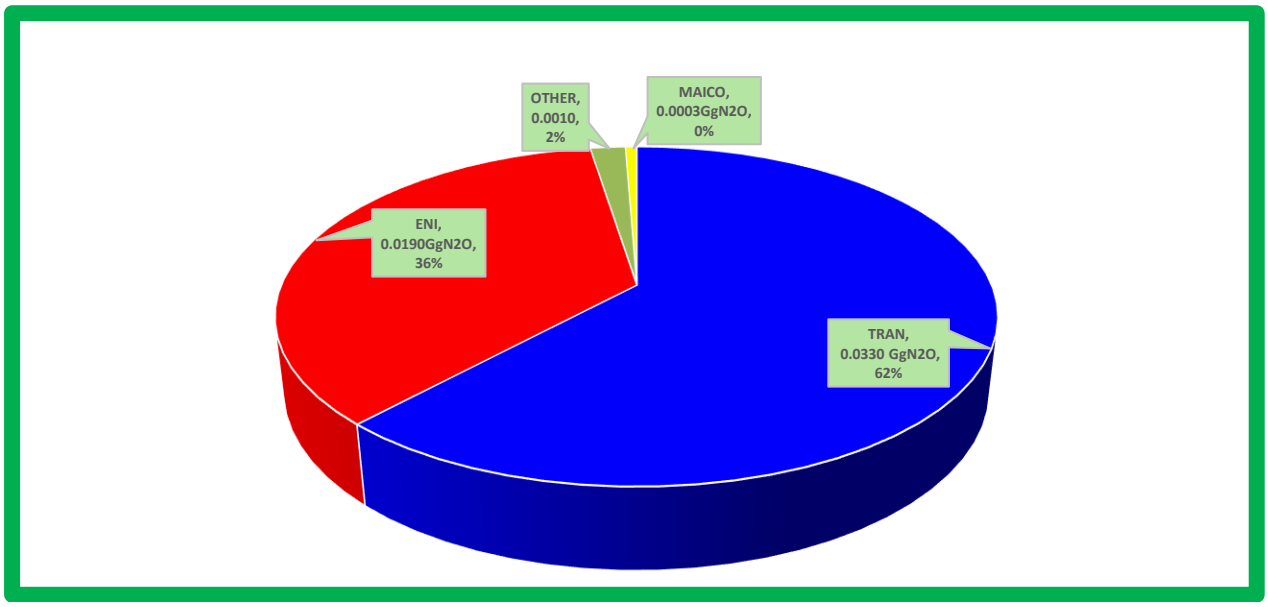


Fig: 19 Nitrous Oxide (N2O) CO2 Emissions (GgN20) From the Energy Category in 2020

2.2.8 Activity Data Factors for Energy Sector

The Tier 1 approach calculates CO2 emissions by multiplying estimated fuel sold (Activity data) with a default CO2 emission factor. The CO2 emission factor takes account of all the carbon in the fuel including that emitted as CO2, CH_4, CO, NMVOC and particulate matter.

For the mobile categories (both road and off-road), fuel consumed is collected from the fuel marketing companies such as GNPC, STAR, Jah Oil, etc. Populations of different vehicle types and their different pollution control technologies are obtained from vehicle import and registration records at the Gambia Revenue Authority and Gambia Police Force through personal communications.

For water-borne navigation, the fuel consumption data (e.g., gasoline/diesel oil used for navigation) are obtained from the Gambia Ports Authority, Gambia Maritime Agency, Fish Landing Sites, etc. For aviation purposes, activity data is mostly jet fuel (jet kerosene and jet gasoline) and aviation gasoline; the number and type of aircraft operations; the types and efficiency of the aircraft engines; the fuel used; the length of flight; the power setting; the time spent at each stage of flight; and, to a lesser degree, the altitude at which exhaust gases are emitted. The data is obtained from the Gambia Civil Aviation Authority.

2.2.9 Emission Factors

As Gambia has not developed national specific emission factors, the Default Emission Factors from the IPCC Software Data Base are used throughout this inventory. The default values are selected by taking into consideration the fuel economy values that are used for unit conversions and then representative vehicle categories that were used as the basis of the default factors. The selected default emission factors are assumed to best represent local fuel quality/composition and combustion or emission control technology. Default carbon dioxide emission factors are based on the fuel type and carbon content and take account of the fraction of carbon oxidized (100 percent).

For aviation purposes, the Tier 1 method is based on an aggregate quantity of fuel consumption data for aviation (Landing/Take-Off (LTOs) and cruise) multiplied by average emission factors. Therefore, Tier 1 and its default emission factors are used for aviation gasoline. The emission factors are obtained from the IPCC GHG Inventory Software.

Table 7 Uncertainty Assessment in The Energy Sector

Table 2.3: STRATEGIES FOR DEALING WITH DIFFERENT CAUSES OF UNCERTAINTIES

	Strategy			
Causes of Uncertainty	**Evaluated Conceptualizations and Model Formulation**	**Empirical and Statistical**	**Expert judgement**	**Comments**
Lack of completeness			✓	Not occurring due to national circumstances (refer to annex 3, section 1)
Model (bias and random errors)				
Lack of data	✓	✓	✓	• Biomass Data – Data was collected for 2020 which was used to obtain data for the preceding years

				• Domestic Water Borne Navigation – Number of non-conventional vessels under-reported • Transport – Lack of segregated data on types of vehicles / Lack of proper record keeping on vehicles • Construction – Inadequate records keeping of fuel inventory data
Statistical random sampling error		✓		Biomass – Estimation of data values for the preceding years before 2020
Measurement error: random component		✓		Biomass – A measuring scale was used to weigh different quantities of biomasses during data collection
Missing data		✓	✓	Transport – within the inventory period a two-year data gap existed

2.2.10 QA/QC Protocol for Energy Sector

As highlighted in the data collection methodology and sources of data, the data obtained are satisfactorily vetted by Energy division under the Ministry of Petroleum, Energy and Mines, Ministry of Transport, Works and Infrastructure. Alongside that, expert judgment was also used to obtained additional data and information. The quality assurance was conducted by UNFCCC Secretariat, UNEP, and US EPA. In essence the overall report proved to be satisfactory in the context of the team's experience in conducting and executing National Greenhouse Gas inventories in the Energy sector.

2.3 Emissions From Industrial Processes And Product Use (IPPU)

Under the IPPU category, greenhouse gases often are used in products such as refrigerators, foams or aerosol cans. HFCs are used as alternatives to ozone depleting substances (ODS) in various types of product applications. Similarly, Sulphur hexafluoride (SF_6) is used in electrical equipment, N_2O is used as a propellant in aerosol products primarily in food industry).

As The Gambia is a non-industrialized and least developed country, this assessment covers greenhouse gas emissions from selected Industrial Processes and Product Use (IPPU) sub-categories applicable in The Gambia. It covers selected gases which are released in certain industrial processes and also gases which are released during the usage of certain industrial products. Table 3.1 below shows the major categories and sub-categories under the IPPU that are applicable in The Gambia and used in the development of this inventory. In preceding inventories (NIR1, NIR2 and NIR3), Lime Production sub-category was highlighted as a relatively significant application in The Gambia. However, the QA/QC analysis conducted during the review of this 2020 NIR of The Gambia, this

production of lime has been declared as non-scientific and hence, the use of the sub-category has been discontinued. This is because in The Gambia, the exact composition of the lime produced by artisanal means is unknown.

Table 2.4: Sub-categories of the IPPU Category used in this 2020 National Inventory of Greenhouse Gases					
	Emissions (Gg)		Emissions CO2 Equivalents (Gg)		
Categories	CO2	CH4	HFCs	PFCs	SF6
2 - Industrial Processes and Product Use					
2.A - Mineral Industry					
2.A.4 - Other Process Uses of Carbonates					
2.B - Chemical Industry					
2.C - Metal Industry					
2.C.1 - Iron and Steel Production					
2.D - Non-Energy Products from Fuels and Solvent Use					
2.D.1 - Lubricant Use					
2.D.2 - Paraffin Wax Use					
2.D.4 - Other (please specify)					
2.F - Product Uses as Substitutes for Ozone Depleting Substances					
2.F.1 - Refrigeration and Air Conditioning					
2.F.3 - Fire Protection					
2.F.4 – Aerosols					
2.G - Other Product Manufacture and Use					
2.G.1 - Electrical Equipment					
2.H – Other					
2.H.2 - Food and Beverages Industry					

Table 8 Sub-categories of the IPPU Category used in 2020 National of GHGs

Soda ash is used in soap and detergent production. Soda ash production and consumption (including sodium carbonate Na_2CO_3) release CO2. The sample survey conducted for this GHG inventory reveals that a number of establishments or industrial firms use soda ash as a raw material in the production of soap and detergents. Other establishments or industrial firms use soda ash in providing services, such as, water treatment and cleaning of bottles in mineral factories.

Production and use of Mineral Water and Soft Drinks are also considered. Carbonated water (also known as soda water, sparkling water, water with gas) is water containing dissolved carbon dioxide gas, either artificially injected under pressure or occurring due to natural geological processes. Carbonated water is a key ingredient in soft drinks, beverages that typically consist of carbonated water, a sweetener, and a flavouring such as cola, ginger, or citrus. Plain carbonated water or sparkling mineral water is often consumed as an alternative to soft drinks. Various carbonated waters are sold in bottles and cans, with some also produced on demand by commercial carbonation systems in bars and restaurants or made at home using a carbon dioxide cartridge.

2.3.1 Data Sources

The principal process by which calcination-related emissions are released is similar among the source categories in the mineral industry. In addition to this source category, this chapter considers emissions resulting from the consumption of carbonates in a variety of other mineral industries including Other Uses of Soda Ash (e.g., manufacture of Soaps in The Gambia).

2.3.2 Sources of Activity Data for The IPPU Category

Lubricants and paraffin waxes are not produced in The Gambia. Import data (in Terajoules) on lubricants and paraffin waxes consumed in The Gambia in 2020 as non-energy products used in IPPU category, are obtained from the Gambia Revenue Authority (GRA) through personal communication.

Activity Data on imported chemicals used in refrigeration and stationary air conditioning is collected from customs statistics at the GRA, and importers and distributors. Equipment charge is recorded from the imported agent in new equipment, retired equipment banked agents. In 2020, the activity data consisted of 18 tons used in refrigeration, 5.24 tons released from retired equipment and 118.44 tons of retired banked agents. Similarly, for the Mobile Air Conditioning sub-category, four (4) tons of imported agents, 1,569 tons of agent in retirement and thus released, and about 30.062 tons were in bank.

The activity data needed to develop emission estimates from foam blowing for The Gambia is the amount of chemical contained in foam imported, bulk chemicals used in the foam blowing industry, the amount HFCs imported is obtained from the domestic chemical sales and distribution agencies and from the Gambia Revenue Authority. customs officials. In 2020, there was 129 tons consumed, and 1405.112 tons banked agents.

As The Gambia does not produce fire protection agents or systems, the inventory team used the activity data on the number of equipment and agents contained in them (7 tons of import in 2020) in the country. The sources of the data included the GRA and consist of the number of extinguishers imported and the quantity of charge in them. For installed fire protection equipment in buildings, vehicles, etc., the Inventory Team conducted a survey and visits to these installations, to count the number of the equipment and also record the charge contained the equipment.

Activity Data on Aerosols is the total quantity of each relevant chemical contained in all aerosol products imported and consumed within the Gambia for the GHG Inventory cycle. As The Gambia imports 100% of aerosol products, activity data are equal to imports. The import statistics are obtained from the GRA.

The estimation of emissions of Sulphur hexafluoride (SF_6) and perfluorocarbons (PFCs) are conducted for the manufacture and use of electrical equipment. Emissions of SF_6 from electrical equipment can be estimated in a variety of ways with varying degrees of complexity

and data intensity. The activity data necessary to carry out the various estimation methods was obtained from the Gambia Technical Training Institute (GTTI) as the equipment user.

Emissions from the Beverage Industry are classified into two categories:(a) the direct GHG emissions resulting from company operations including generation of electricity, heat, or steam; physical or chemical processing and fugitive emissions; and (b) indirect emissions from directly purchased utilities such as electricity, steam, chilled water, refrigeration, or compressed air used at company-owned or controlled facilities; and emissions from indirectly purchased utilities at controlled facilities, such as the energy used to run leased buildings and operations within them. The activity data is obtained from hotels, restaurants, and food vendors

2.3.3 Emission Trends

The emission trended has been compiled in CO2eq after using the GWP for the gases other than HFCs, PFCs and SF6, as these are already provided by the Software in CO2eq. From Figure 2.3a below, results suggest that emissions from the IPPU category have been increasing from 140GgCO2eq in 2011 to 193GgCO2eq in 2020.

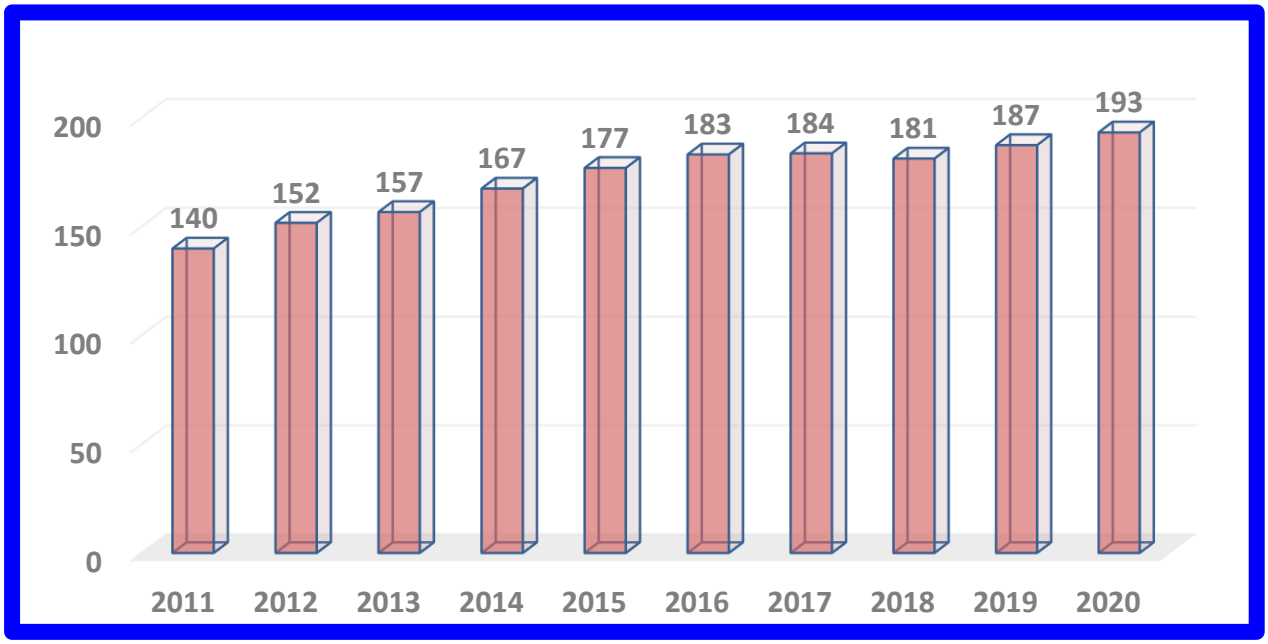


Fig: 20 IPPU GHG Emissions (GgCO2eq) Trend from 2011 to 2020

2.3.4 GHG Emissions Expressed as CO2eq.

The IPPU category of emissions produced 193GgCO2eq in 2020 and 79% of these emissions was HFCs (Figure 2.3b) below. The other 21% of the emissions from the category were CO2 (8%), SF6 (7%), CH4 (4%) and PFCs (2%).

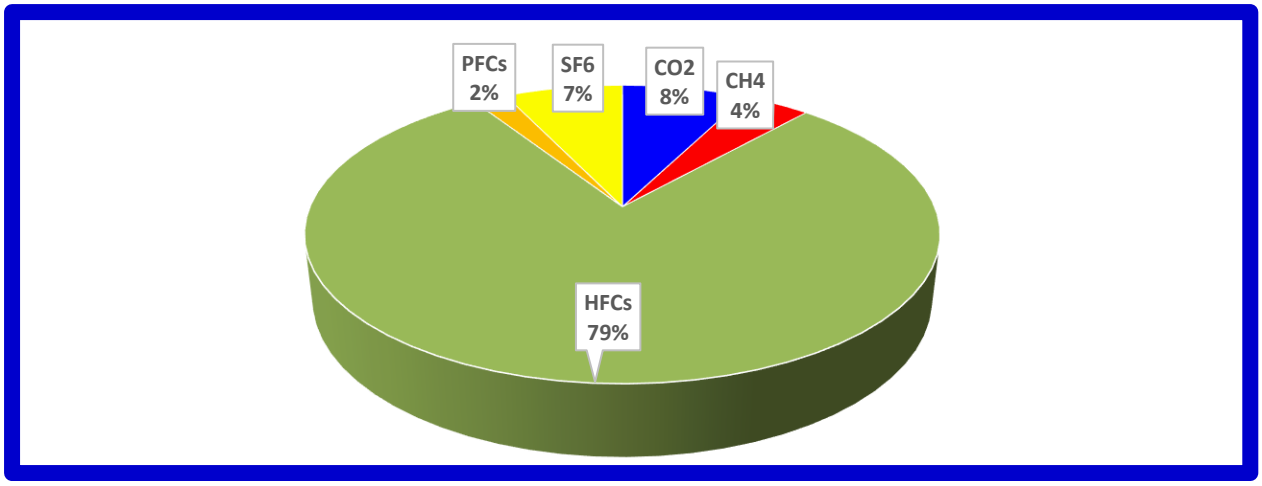


Fig: 21 Emissions (GgCO2eq) from the IPPU Category in 2020

2.3.5 CO2 Emissions

In 2020, about 14 GgCO2 were emitted from some sub-categories of the IPPU category. The bulk of the emissions from the Non-Energy Products from Fuels and Solvent Use (about 10GgCO2) (Figure 2.3c below) that include the use of Lubricants (8.517GgCO2) and Paraffin Wax (1.443GgCO2).

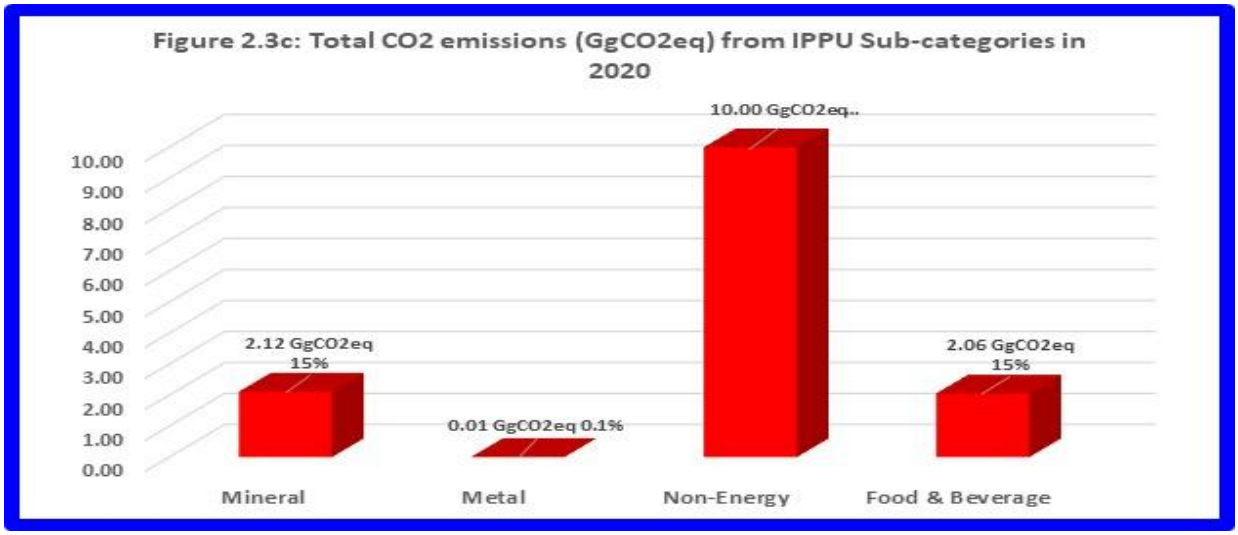


Fig: 22 Total CO2 Emission (GgCO2eq) from IPPU Sub-categories 2020

2.3.6 CH4 Emissions

Methane emissions from the IPPU category was 0.282GgCH_4 which is equivalent to 7.9Gg$CO2_{eq}$. The emissions were produced by the Food and beverage sub-category of the IPPU.

2.3.7 Emissions of PFC, SF6 and HFC

As shown in Figure 2.3d below, 90% of the emissions are HFCs and the remaining 10% are PPC (4Gg CO2eq) and SF_6 (14Gg CO2eq). SF_6 emissions are coming from sub category 2.G.1 electrical equipment.

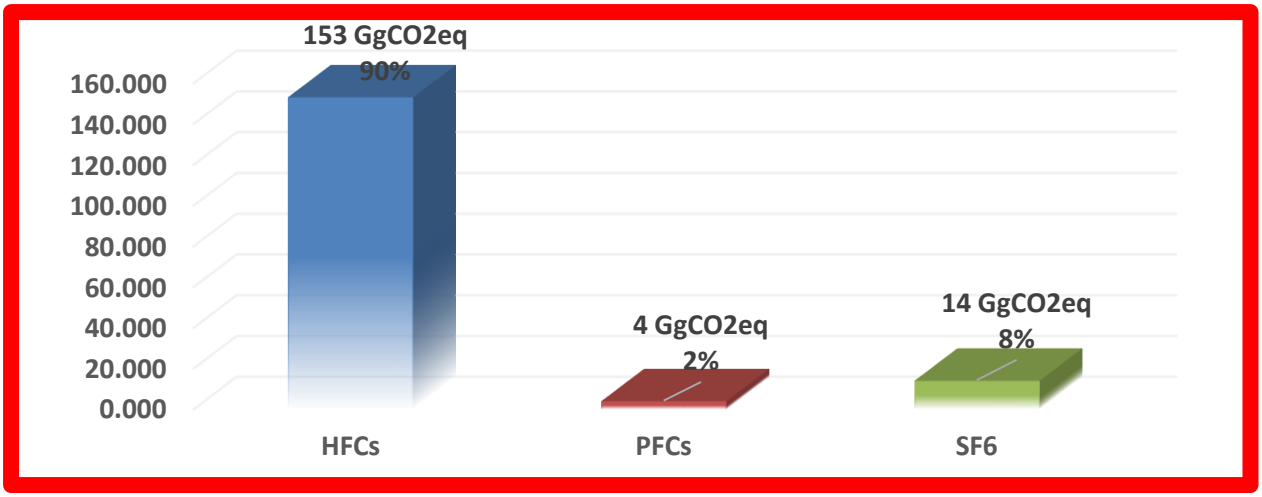


Fig: 23 Emissions of HFCs, PFCs and SF6 (GgCO2eq) by the IPPU Category in 2020

2.3.8 Activity Indicators and Emission Factors

Based on a Sample Survey conducted by the IPPU Team and covering a number of establishments or industrial firms that use soda ash as a raw material in the production of soap and detergents and food and beverages, about ninety-five (95) tons of carbonate (Sodium carbonate or soda ash - Na2CO3) were consumed in 2020 to produce soft drinks in The Gambia. In the IPCC methodology, the Formula Weight of 106.0685 and Emission Factor of 0.41492 tonsCO2/ton carbonate were used in the calculation of emissions. Under 2.2.1.b – use of electrical equipment, closed-pressure and sealed-pressure 57.5 tons of CF_4 were installed under this sub-category.

Table 2.5: UNCERTAINTIES IN THE IPPU CATEGORY

2006 IPCC Categories	Gas	Base Year (GgCO2 eq)	Year T (GgC O2 eq)	Activity Data (%)	Emission Factor (%)	Combined (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
2.A - Mineral Industry												
2.A.4.b - Other Uses of Soda Ash	CO2	3.3	2.1	-	-	-	-	0.0	0.0	-	-	-
2.A.4.d - Other (please specify)	CO2	0.0	0.0	-	-	-	-	0.0	0.0	-	-	-
2.B - Chemical Industry												
2.B.1 - Ammonia Production	CO2	-	-	5.0	-	5.0	-	-	0.0	0.0	-	0.0
2.B.2 - Nitric Acid Production	N2O	-	-	2.0	-	2.0	-	-	0.0	0.2	0.0	0.0
2.B.3 - Adipic Acid Production	N2O	-	-	2.0	-	2.0	-	-	0.0	0.0	0.0	0.0
2.C - Metal Industry												

Table 2.5: UNCERTAINTIES IN THE IPPU CATEGORY

2006 IPCC Categories	Gas	Base Year (GgCO2 eq)	Year T (GgCO2 eq)	Activity Data (%)	Emission Factor (%)	Combined (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
2.C.1 - Iron and Steel Production	CO2	-	0.0	-	14.1	14.1	0.0	0.0	-	-	-	-
2.C.1 - Iron and Steel Production	CH4	-	0.0	-	566.0	566.0	0.0	0.0	-	-	-	-
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	CO2	3.3	8.5	3.0	50.0	50.1	0.1	0.0	-	-	-	-
2.D.2 - Paraffin Wax Use	CO2	0.6	1.4	19.8	100.0	101.9	0.0	0.0	-	-	-	-
2.D.4 - Other (please specify)	CO2	0.0	-	7.0	50.0	50.5	0.0	0.0	-	-	-	-
2.D.4 - Other (please specify)	CH4	-	-	7.0	-	7.0	-	-	-	-	-	-
2.D.4 - Other (please specify)	N2O	-	-	7.0	-	7.0	-	-	-	-	-	-
2.E - Electronics Industry												
2.E.1 - Integrated Circuit or Semiconductor	SF6	-	-	10.0	-	10.0	-	-	-	-	-	-
2.E.2 - TFT Flat Panel Display	SF6	-	-	10.0	-	10.0	-	-	-	-	-	-
2.F - Product Uses as Substitutes for Ozone Depleting Substances												
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	27.3	26.0	13.0	13.0	18.4	0.1	0.0	-	-	-	-
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH3CHF2	-	-	13.0	-	13.0	-	-	0.0	-	0.1	0.0
2.F.1.b - Mobile Air Conditioning	CH2FCF3	8.2	6.9	5.0	-	5.0	0.0	0.0	-	-	-	-
2.F.2 - Foam Blowing Agents	CH2FCF3	260.7	243.6	-	-	-	-	0.2	-	-	-	-
2.F.3 - Fire Protection	CH2FCF3	12.3	10.0	-	-	-	-	0.0	-	-	-	-
2.F.3 - Fire Protection	CH3CHF2	-	-	-	-	-	-	-	-	-	-	-
2.F.4 - Aerosols	CH2FCF3	8.6	103.5	10.0	10.0	14.1	0.9	0.1	-	-	-	-
2.G - Electrical Equipment												

Table 2.5: UNCERTAINTIES IN THE IPPU CATEGORY												
2006 IPCC Categories	**Gas**	**Base Year (GgCO2 eq)**	**Year T (GgCO2 eq)**	**Activity Data (%)**	**Emission Factor (%)**	**Combined (%)**	**Contribution to Variance by Category in Year T**	**Type A Sensitivity (%)**	**Type B Sensitivity (%)**	**Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)**	**Uncertainty in trend in national emissions introduced by activity data uncertainty (%)**	**Uncertainty introduced into the trend in total national emissions (%)**
2.G.1.a - Manufacture of Electrical Equipment	SF6	-	-	30.0	30.0	42.4	-	-	-	-	-	-
2.G.1.b - Use of Electrical Equipment	SF6	10.5	13.9	30.0	30.0	42.4	0.2	0.0	-	-	-	-
2.G.1.c - Disposal of Electrical Equipment	SF6	-	-	40.0	40.0	56.6	-	-	-	-	-	-
2.H - Other												
2.H.2 - Food and Beverages Industry	CO2	1.9	2.5	-	-	-	-	0.0	-	-	-	-
		Sum (C): 336.8	**Sum (D): 418.5**	**9 AVG**	**36 AVG**	**41 AVG**	**Sum(H): 1.28**	**0.013 AVG**	**0.001 AVG**	**0.009 AVG**	**0.005 AVG**	**Sum(M): 14.995**
							Uncertainty in total inventory: 2.089					**Trend uncertainty: 3.872**

Table 9 Uncertainty Assessment in Industrial Processes and Product Use

2.4 EMISSIONS FROM AGRICULTURE, FORESTRY AND LAND USE (AFOLU)

Agricultural activities contribute directly to emissions of greenhouse gases through a variety of different processes. These include methane emissions from enteric fermentation in domestic animals, animal waste management, rice production, nitrous oxide from agricultural soils and manure deposited by grazing animals, and nitrous oxide and other non-CO2 emissions from savannah burning and field burning of agricultural wastes.

Methods, regional default data, emission coefficients and conversion factors were used from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and its 2019 IPCC Refinement for estimation of agriculture sector emissions. Tier 1 methods were used to estimate emissions from enteric fermentation from other cattle as due to

population and diet limitations on activity data which prevented estimation of cattle emissions at the Tier 2 level. In The Gambia, no cattle are dedicated solely to dairy production and therefore only other cattle emissions are estimated. Other livestock categories include sheep, goats, horses, swine and poultry (chickens) and Tier 1 methods were also used for other livestock. Due to population and animal waste management data limitations, Tier 1 methods were also used for estimating CH4 and N2O from manure management.

In the 2010 National Forest Assessment, 152 permanent tracts with plots were established nation-wide. In order to obtained reliable, accurate and up to date data, the team conducted a field survey of 139 permanent tracts to determine the land use change pattern for this inventory. Data of the land areas and the visual map of 2010 were used for comparison with past and present to analyze land use changes. The provided information/data was cross checked with the 2010 inventory field data and vice-versa. Eventually a countrywide land use/ land cover classes was compiled, indicating the diverse land use classes.

The global warming potential (GWP) values from the IPCC 5th assessment Report (AR5) were used for conversion of non-CO2 gases to their CO2 equivalent (CO2 eq.) amounts. For methane, the AR5 GWP is 28 for non-fossil sources of emissions (all biogenic agriculture sector sources), and for nitrous oxide, the AR5 GWP is 265, for NOx GWP is 273, for CO the value is 1.9.

2.4.1 Data Sources

Numerous strategies of data acquisition and interpretation were put together to get to the appropriate data that was used to run the IPCC software.

2.4.2 Agriculture:

The data used for the agriculture sector inventory were obtained from diverse sources as outlined in the table 3.2 below:

Table 2.6a: Overview of the Agriculture categories, data and data source

Categories	IPCC Code	Sub-categories	Data type	Data source	Main data providers
3.A Livestock	3.A1	Enteric Fermentation	Animal population (cattle, goats, sheep, swine, horses)	National Agricultural Sample Survey Reports, National Livestock Census Report	Ministry of Agriculture - Department of Planning and Department of Livestock Services
	3.A2	Manure Management	Animal population (cattle, goats, sheep,	National Agricultural Sample Survey Reports,	Ministry of Agriculture - Department of Planning and Department of Livestock Services

Categories	IPCC Code	Sub-categories	Data type	Data source	Main data providers
			swine, poultry, horse)	National Livestock Census Report	
3.C Aggregated and non-CO2 emissions on land	3.C3	Urea Application	Annual urea imports	Annual Import Fact Sheet	Ministry of Trade - Statistics Department, FAOSTATS, GGC and the Ministry of Agriculture
	3.C4	Direct N_2O emissions from managed soils	Annual crop production in tons per annum	National Agricultural Sample Survey Reports	Ministry of Agriculture-Department of Planning
	3.C5	Indirect N_2O emissions from managed soils	Annual crop production in tons per annum	National Agricultural Sample Survey Reports	Ministry of Agriculture - Department of Planning
	3.C6	Indirect N_2O emissions from manure management	Animal population (cattle, goats, sheep, swine, poultry, horse)	National Agricultural Sample Survey Reports, National Livestock Census Report	Ministry of Agriculture - Department of Planning and Department of Livestock Services
	3.C7	Rice cultivation	Annual rice production areas in hectares per annum	National Agricultural Sample Survey Reports	Ministry of Agriculture - Department of Planning

Table 10 Overview of the Agriculture Category Data Source

Sub-Sector	Sub-category	Kind of data	Type of emission	Methodology	EF	Source of data
Livestock	3.A1. Enteric fermentation	Livestock number per type (Other cattle, Sheep, Goat, swine, horses)	CH_4	Tier 1 /IPCC 2006	D	Agricultural Statistical Yearbooks (2011-2020), National Livestock Census Report 2016
	3.A2. Manure management	Manure production per livestock type (Other cattle, Sheep, Goat, swine, horses, chicken)	CH_4	Tier 1/IPCC 2006	D	Agricultural Statistical Yearbooks (2011-2020), National Livestock Census Reports 2016
			N_20	Tier 1/IPCC 2006	D	Agricultural Statistical Yearbooks (2011-

Sub-Sector	Sub-category	Kind of data	Type of emission	Methodology	EF	Source of data
						2020), National Livestock Census Reports 2016 Expert judgment
3.C Aggregated and non-CO2 emissions on land	3.C.2. Liming	Lime production in metric tons	CO2	Tier 1/IPCC 2006	D	Department of Planning, Ministry of Agriculture
	3.C.3. Urea Application	Annual urea importation figures	CO2	Tier 1/IPCC 2006	D	Statistics Department - Ministry of Trade , FAO, GGC and the Ministry of Agriculture
	3.C.7. Rice	Annual rice production areas in hectares per annum	CH4	Tier 1/IPCC 2006	D	Agricultural Statistical Yearbooks (2011-2020), Department of Planning, Ministry of Agriculture

Table 11 Overview of the General Methodology Applied in the Agriculture Categories

Table 2.7a: FOLU categories, data and data source

IPCC Code	**Sub category**	**Data type**	**Data source**	**Institution providing the data**
3B Forestry and other Land Use (FOLU				
3B1	Forest land	Land Use Map Land Use Change Map	Updated National Forest assessment report 2010	Department of Forestry
		Biomass estimation for the 5 IPCC Carbon pools (AGB, BGB, Deadwood, Herbs, litter and soils		
		Climate zones, Soil stratification and ecological zone maps	IPCC Database	IPCC
		Industrial wood	Data on export import	Department of Forestry
		Areas affected by fires	Annual forest fires report	Department of Forestry
		Forest product extraction data	Annual forest product extraction data	Department of forestry
3B2	Crop land	Land Use Map Land Use Change Map	Updated National forest assessment report 2010	Department of Planning Department of Forestry
		Biomass estimation for the 5 IPCC Carbon pools (AGB, BGB, Deadwood, Herbs, litter and soils		
		Climate zones, Soil stratification and ecological zone maps	IPCC Database	IPCC

IPCC Code	**Sub category**	**Data type**	**Data source**	**Institution providing the data**
3B Forestry and other Land Use (FOLU				
3B3	Grass land	Land Use Map Land Use Change Map	Updated National forest assessment report 2010	Department of Forestry
		Biomass estimation for the 5 IPCC Carbon pools (AGB, BGB, Deadwood, Herbs, litter and soils		
		Climate zones, Soil stratification and ecological zone maps	IPCC Database	IPCC
		Areas affected by fire	Annual forest fires report	Department of forestry
3B4	Wetland	Land Use Map Land Use Change Map	Updated National forest assessment report 2010 IPCC Database	Department of Forestry IPCC
		Biomass estimation for the 5 IPCC Carbon pools (AGB, BGB, Deadwood, Herbs, litter and soils		
		Climate zones, Soil stratification and ecological zone maps	IPCC Database	IPCC
3B5	Settlements	Land Use Map Land Use Change Map	Updated National forest assessment report 2010	Department of Forestry
3B6	Others	Land Use Map Land Use Change Map	Updated National forest assessment report 2010	Department of Forestry
3C1	Emissions from biomass burning	Area affected by fire in cropland, forest land and Grass land mass fuel available for burning	Data on annual forest fires	Department of Forestry
3D	Harvested wood product	Data on Harvested wood product	Annual data on harvested wood products /export and import data	Department of Forestry

Table 12 FOLU Categories, Data and Data Source

IPCC Code	**subcategory**	**Types of Data**	**Types of Emissions**	**methodology**	**EF**	**Source of Data**
3B1	forestland	Land Use Change Matrix	CO2	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database
3B2	Cropland	Land Use Change Matrix	CO2	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010

IPCC Code	subcategory	Types of Data	Types of Emissions	methodology	EF	Source of Data
						IPCC emission factor Database
3B3	Grassland	Land Use Change Matrix	CO2	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database
3B4	Wetland	Land Use Change Matrix	CO2	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database
3B5	Settlement	Land Use Change Matrix	CO2	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database
3B6	Other land	Land Use Change Matrix	CO2	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database
3C1	Emissions from biomass burning	Area affected by fire in cropland, forest land and Grass land mass fuel available for burning	CH4, N2O, Nox, CO	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database Annual forest fires report
3D	Harvested Wood product	Data on Harvested wood product	CO2,	Tier 1 /IPCC 2006	D	Updated National Forest assessment report 2010 IPCC emission factor Database Annual data on harvested wood products /export and import data

Table 13 General Methodology Applied for the FOLU

2.4.3 Emission Trends

The AFOLU Category emitted 21,682GgCO2eq for the period 2011 to 2020 (Figure 2.4a below). The emissions ranged from1,957GgCO2eq in 2011 to 2,221GgCO2eq in 2020.

Fig: 24 AFOLU Emissions Trends from 2011 to 2020

The AFOLU category emitted 2,221GgCO2eq in 2020. From Figure 2.4b below, 36% (813GgCO2eq) were CO2, 23% (503.5GgCO2eq) were CH4 and 2% were N2O (40.5GgCO2eq). Of the indirect GHG, carbon monoxide (CO) emissions (89.8GgCO2eq) represented 4%.

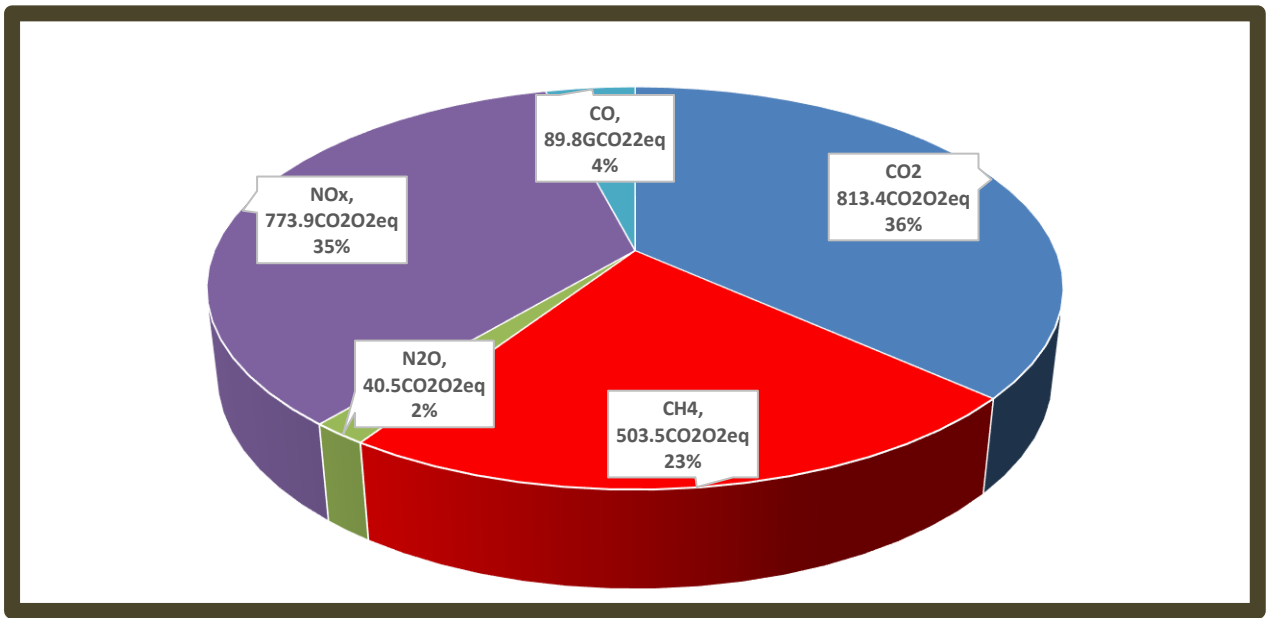


Fig: 25 Total Emissions (GgCO2eq) per Gas from the AFOLU Category in 2020

2.4.4 CO2 Emissions

The AFOLU category produced a net CO2 emission of about 813GgCO2 which is broken into about 834GgCO2 from the Land sub-category, negative 22GgCO2 due to wood

harvesting and 1GgCO2 aggregate emissions by urea applications (see Figure 2.4c below). Livestock management did not emit CO2.

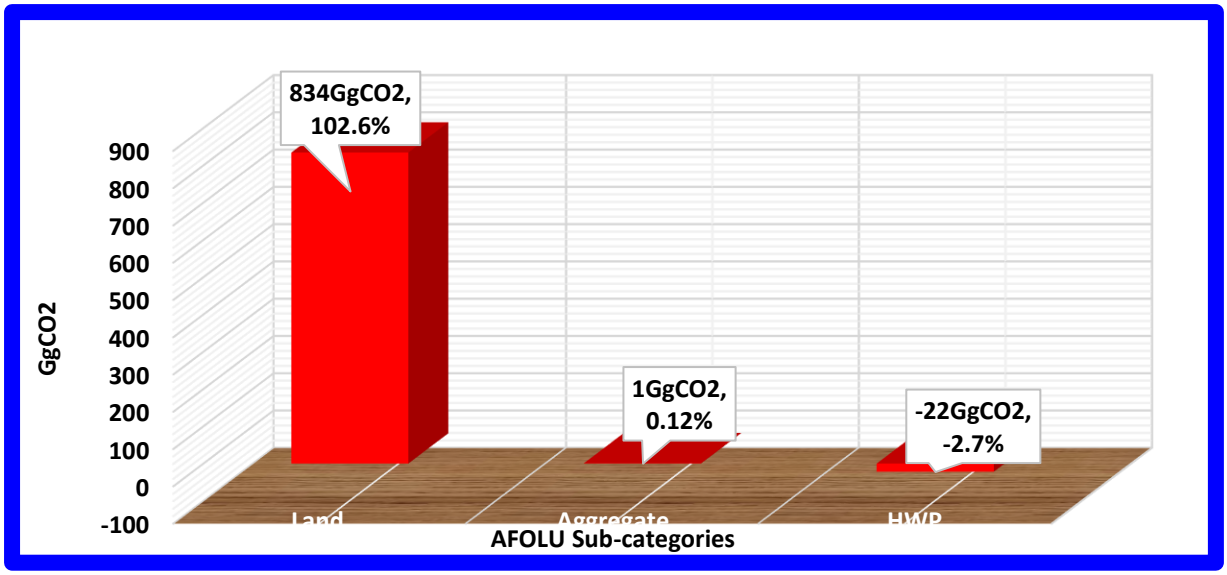


Fig: 26 Carbon Dioxide Emissions (GgCO2eq) from AFOLU Category in 2020

2.4.5 CH4 Emissions

Livestock sub-category is the major emitter of Methane under the AFOLU category (Figure 2.4d below). The sub-category emitted 70% (12.6GgCH4 or 351.6GgCO2eq) of the total AFOLU methane emissions of 18GgCH4 or 503.5GgCO2eq. Livestock emission is further broken down to 337.4GgCO2eq from enteric fermentation and 14.1 GgCO2eq from manure management. Rice cultivation emitted 21% (3.8GgCH4 or 105.1GgCO2eq) and Biomass burning emitted 9% (1.7GgCH4 or 46.8GgCO2eq) of the total methane emissions from AFOLU.

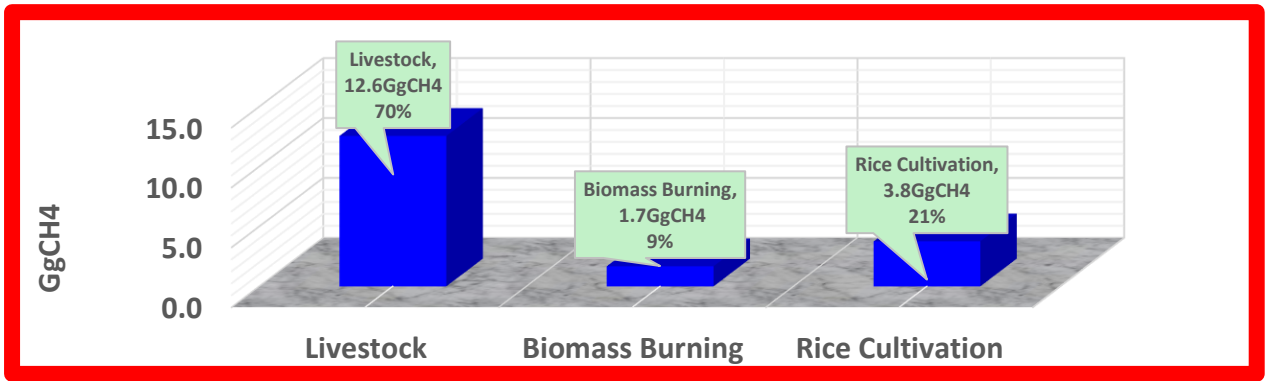


Fig: 27 CH4 Emissions (GgCH4) from the AFOLU Category in 2020

2.4.6 Emissions of N2O, NOx and CO

The Biomass Burning sub-category emitted 0.153GgN2O, 2.835GgNOx and 47.247GgCO. Conversion of these emissions using the GWP of the respective gases, showed a total emission of these gases to be 904.1GgCO2eq. N2O emissions were 40.5GgCO2eq (4%), PFC emissions of 773.9GgCO2eq (86%) and 89.8GgCO2eq (10%). Refer to the estimation of N2O emissions from manure management.

2.4.7 Activity data for Agriculture

Activity data are primarily based on harvested area statistics, which is available from a The Gambia Bureau of Statistics (GBoS) as well as complementary information on cultivation period and agronomic practices. Annual data on area of rice were extracted from the Statistical Abstract of The Gambia (GBoS,2021). Data on irrigated rice was only available for 2020, and the rest of the years were extrapolated. Data on livestock categorisation of animal population as shown in table 3.6 below. Due to the unavailability of detailed data on AFOLU, default emission factors from the revised 2006 IPCC GHG Inventory Guidelines were used.

Year	Other Cattle	Sheep	Goats	Horses	Swine	Chicken
2011	398,472	143,939	302,878	26,902	6,383	870,375
2012	357,369	112,166	312,132	24,504	8,191	637,028
2013	336,054	267,435	310,870	23,515	18,119	616,806
2014	308,287	152,972	270,196	21,593	10,131	806,033
2015	305,217	140,870	267,435	20,566	9,419	516,806
2016	292,837	172,662	328,336	22,070	14,830	937,951
2017	267,724	158,485	319,631	21,051	14,283	917,862
2018	279,536	163,945	348,724	22,023	14,576	964,938
2019	287,077	175,893	365,088	22,996	14,946	970,972
2020	285,182	176,984	378,231	23,313	14,985	982,235

Table 14 Categorization of the Animal Population for 2020 in The Gambia

Year	Liming	Urea application	Swamp Rice Area (ha)	Upland Rice Area (ha)	Irrigated Rice Area (ha)
2011	NA	2,583	15,136	20,138	6,030
2012	NA	3,117	16,752	48,653	4,500
2013	NA	441	17,434	48,946	6,846
2014	NA	3,347	16,204	50,082	6,714
2015	NA	1,265	20,295	47,356	5,890
2016	NA	806	24,346	45,215	5,774
2017	NA	687	15,482	53,418	6,024
2018	NA	8,332	11,528	47,169	6,530
2019	NA	8,660	11,541	48,873	6,694
2020	193	1,084	12,971	48,042	6,762

Table 15 Categorization of data on aggregate sources and N2O emissions from Land in the Gambia

The activity data and emission factors for the Forest and Other Land category include land use change matrix, Annual Wood/ firewood removal data Annual Forest fires and Harvested wood products. Harvested area estimates corresponding to different conditions may be obtained on a countrywide basis through accepted methods of reporting.

Activity Data	Emission factors
Land use change	Default values IPCC Emission Factor Database
Annual Wood/ firewood removal data	Default values IPCC Emission Factor Database
Annual forest fires	Default values IPCC Emission Factor Database
Harvested wood products	

Table 16Activity Data and Emission factor for FOLU

The emission factors used in the inventory were default values from the IPCC emission factor data base throughout the inventory exercise.

2.4.8 Activity data for FOLU

The following tables shows the quantified activity data for FOLU.

Extractions (cm3)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
firewood	48600.9	47476	39760.7	44790.3	64805.4	67840.5	57363	62890.9	48650.3	53222.7
Wood	14300.9	1269.8	11890.8	12536.5	14500.9	12578.8	13300.7	12675.9	12890.6	11696.3
Total(cu.m3)	62901.8	60170.8	51651.5	57326.8	79306.3	80419.3	70663.7	75566.8	61540.9	64919

Table 17 Quantified Activity Data for FOLU

Category of fires (ha)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
forest fires	26900.8	24850.3	36250	29460.7	24890.8	30780.3	37970.6	27658.7	31270.7	28700.6
cropland fires	9036.7	8242.5	11150.6	12300.9	8120.8	12680.5	14290.1	8460.2	12900.9	11960.5
Grassland fires	2780.1	2487	3208.9	4006.7	4045.6	3690.9	4964.7	2580.6	1760.2	3480.9
Total ha	41378.4	35828.3	51080.4	46773.1	37367.1	47822.4	58126	39033.4	46229.6	44631.4

Table 18 Quantified Activity Data for FOLU

Roundwood				Sawn wood			Wood base panels			Charcoal residues		
Year	Production	import	export (cm3)	Production Cm3	import	export	Production	Import Cm3	Export	Production(metric tons)	Import (metric tons)	Export
2011	0	0	0	11,696	0	0	0	155.2	0		114,240	0
2012	0	0	64800	12,891	0	0	0	163	0		117,139	0
2013	0	0	65376	12,676	0	0	0	186	0		119,770	0
2014	0	0	0	13,301	0	0	0	158	0		122,540	0
2015	0	0	65875	12,579	0	0	0	147	0		125,638	0
2016	0	0	66430	14,501	0	0	0	180	0		128,899	0
2017	0	0	0	12,537	0	0	0	156	0		134,508	0
2018	0	0	67708	11,891	0	0	0	194	0		141,928	0
2019	0	0	68465	12,695	0	0	0	166	0		143,290	0

2020	0	0	69650	14,301	0	0	0	154	0		144,717	0
Total	0	0	468,304	129,068	0	0	0	1,659	0		1,292,669	0

Table 19 Quantified Activity Data for FOLU

2.4.9 Uncertainty Assessment in AFOLU

Technically due to the inadequacy in available of data for the compilation of this inventory report, there are uncertainties in the assessment process based on the activity data available for the inventory and the application of expert judgement. The uncertainty in activity data elements as well as default uncertainty associated with the IPCC default emission factors contribute to overall uncertainty in GHG emissions estimates.

2.4.10 Quality Assurance, Quality Control and Verification

As highlighted in the data collection methodology and sources of data, the data obtained are satisfactorily vetted by team of expert from Department of Planning and National Agricultural Research Institute (NARI) both under the Ministry of Agriculture, Livestock and Food Security, as well as Department of Forestry). Alongside that, expert judgment was also used to obtained additional data and information. The quality assurance was conducted by UNFCCC Secretariat, UNEP, and US EPA. In essence the overall report proved to be satisfactory in the context of the team's experience in conducting and executing National Greenhouse Gas inventories in the AFOLU sector.

2.5 EMISSIONS FROM WASTE CATEGORY

2.5.1 Data Sources

Two questionnaires were designed for the purpose of waste data collection: a) Form W1: Waste Generated (Solid and Liquid) and b) Form W2: Solid Waste Disposal Sites (SWDS). The questionnaires were used to collect Solid and Liquid Waste Data from Households, Industries, Institutions, Clinics/Hospitals, Gardens and Waste Dump Sites.

The Sample Data was used with Population Projection Data to arrive at Per-Capita Waste generation rates which were used to estimate annual waste generation. The per capita waste generation is 0.41kg. Hence, the Municipal Solid Waste (MSW) has increased from 0.4 Metric tons (Mt) in 2011 to 0.6 Mt in 2020. The quantity of Solid Waste Dumped at Solid Waste Disposal Sites (SWDS) has increased from 0.3 Mt in 2011 to 0.4Mt in 2020.The Sewerage Data was supplied by NAWEC and this was used with the toilet facility Data of the 2013 Census and the Population of Kanifing Municipal Council(KMC) to estimate liquid waste for the KMC region that uses the four waste water Ponds at Kotu for disposing Sewerage. The four ponds at Kotu operate in series and treatment is by sedimentation. By the time you get to the fourth pond the relatively clear water affluent flows into the stream.

The training of data collectors was not enough and apart from portable weighing scales, other protective and working gears were not available to the data collectors. This can affect the accuracy of waste classification and measurements.

The quality of CH4 emission estimates is directly related to the quality and availability of the waste generation, Composition and management of data used to derive these estimates using standard IPCC protocols. The method used to produce the underlying datasets introduced inherent uncertainties into the inventory. The methodology section above unveils the possibility of committing errors by way of the technique used for estimating the activity data. The 2006 IPCC software was used to compute uncertainty for the waste sector. Uncertainty in total inventory for the year 2020 is 15% and trend uncertainty is 17%. The IPCC Database used to calculate uncertainties associated with the default waste parameters used in estimating GHG emissions from the Waste Sector. The parameters considered include; Methane correction factor (MCF); Degradable organic carbon (DOC); Fraction of Degradable Organic Carbon Factor which decomposes (DOCF); Fraction of CH4 in landfill gas (F); Methane recovery (R); Oxidation Factor (OX); and the half-life.

2.5.2 Key Categories

The municipal solid waste is a key category under the waste sector and was determined using the IPCC software for the analysis (See table 2.1a).

2.5.3 QA/QC Protocol

As highlighted in the data collection methodology and sources of data, the data obtained are satisfactorily vetted by team of expert from stakeholder Institutions (NEA, GBoS, Data Firm) and accepted. Alongside that, expert judgment was also used to obtained additional data and information. The quality assurance was conducted by UNFCCC Secretariat, UNEP, and US EPA. In essence the overall report proved to be satisfactory in the context of the team's experience in conducting and executing National Greenhouse Gas inventories in the waste sector.

2.5.4 Sources and Sinks of GHG Emissions Expressed as CO2eq.

The bulk of the emissions from the Waste Category is Methane (268.5 Gg CO2eq, 98.9%). From Figure 2.5a below, CO2 and N2O emissions constitute about 3.0 Gg CO2eq (1.1%).

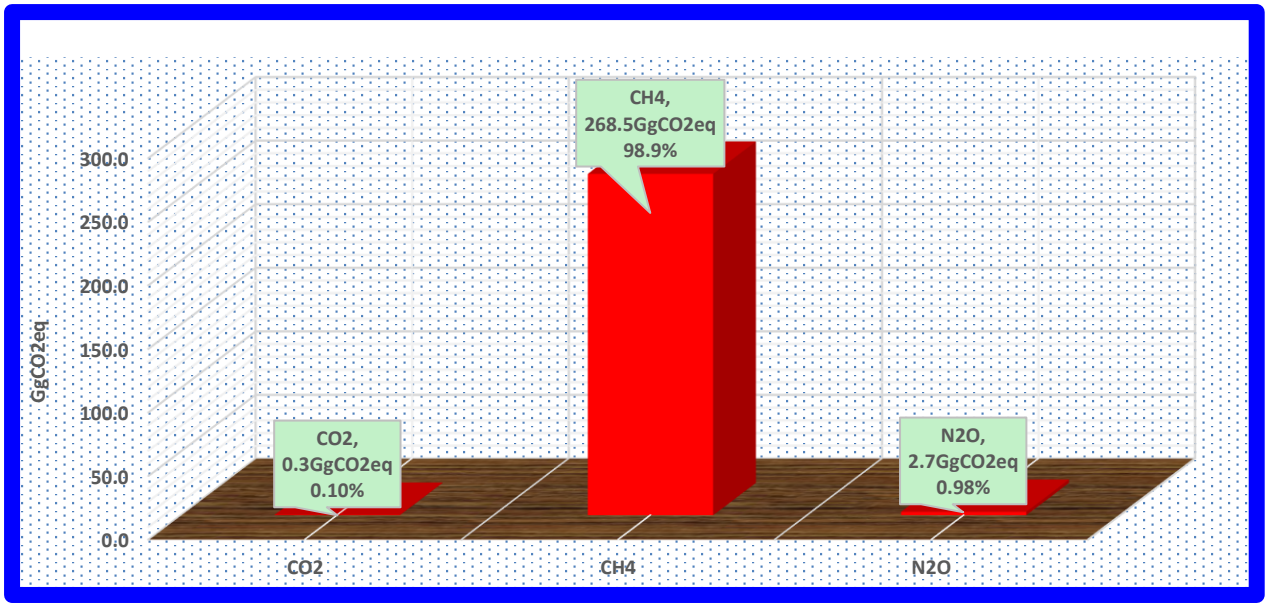


Fig: 28 Total Emissions (GgCO2eq) of HGH per Gas from the Waste Category in 2020

2.5.5 Emission Trends

Generally, the Trend analysis shows that emissions continue to increase from about 15 Gg CO2eq in 2011 to about 271 Gg CO2eq in 2020. Between 2011 and 2014, the reason for the sharp increase was as a result of the mass evacuation/clearing of illegal dumpsites in 2012; and this has increased the volumes of wastes at the designated dumpsites, thereby increasing the emissions of CH_4 gases. Factors that may contribute to this annual increase include increased population growth, increased waste generation and increased quantity of waste that is collected and dumped at dump sites.

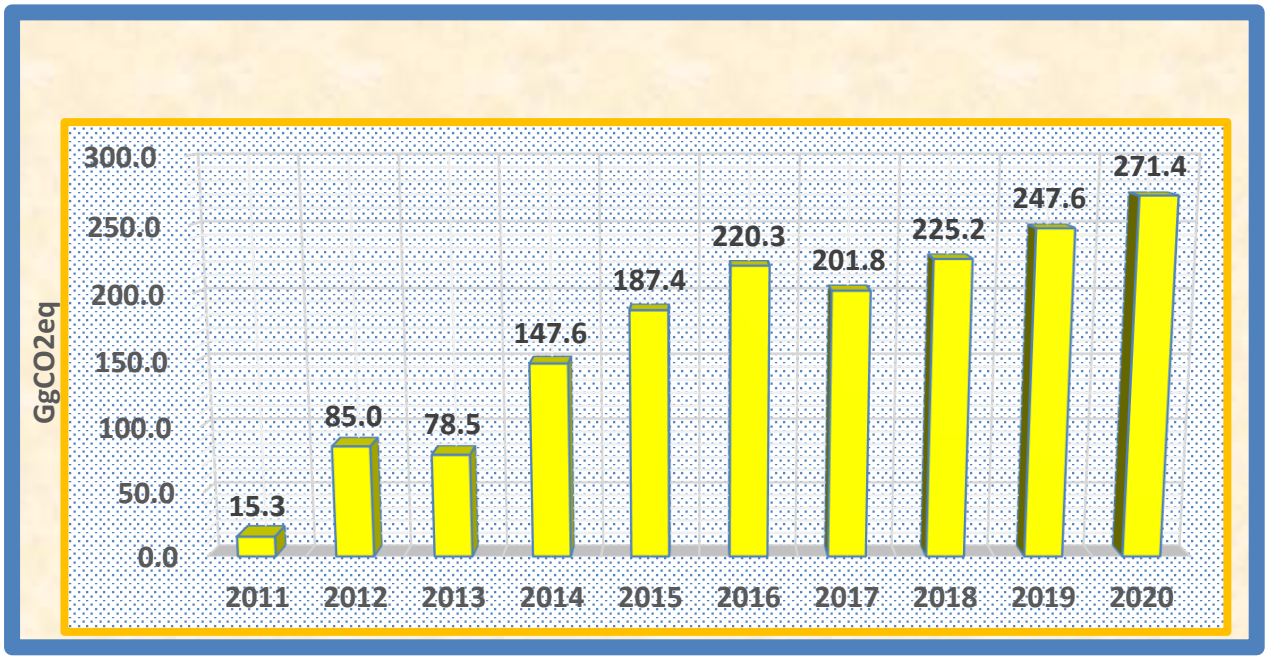


Fig: 29 Trend in Emissions from Waste Category 2011 - 2020

2.5.6 CH4 Emissions

As shown in Figure 2.5c below, about 9.59GgCH_4 or 268.5GgCO2eq were emitted by waste management in 2020, Solid Waste Disposal emitted the most methane (96%). Waste Water Treatment (WWTreat), Composting, and Incineration and Open Burning (IOB) of waste contributed to the remaining 4% of the emissions (11.91GgCO2eq).

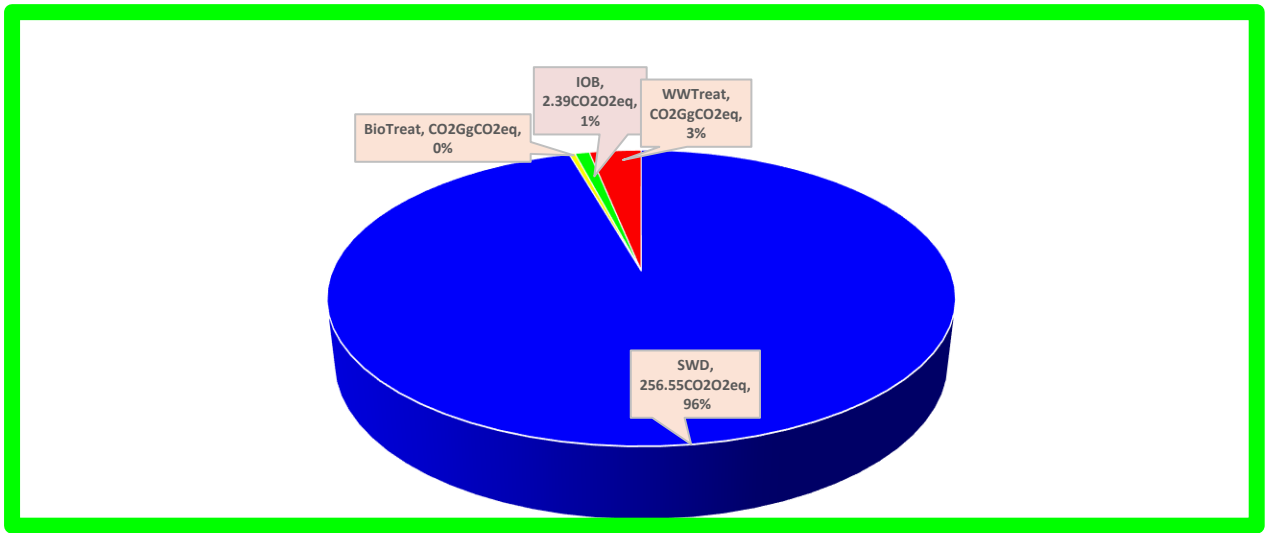


Fig: 30 Methane Emissions (GgCO2eq) from the Waste Sector

2.5.7 N2O Emissions

The Wastewater Treatment (WWTreat) and the Incineration and Open Burning waste management sub-categories contribute to N2O emissions of 0.010 Gg N_2O which is equivalent to 2.662 Gg CO2eq.

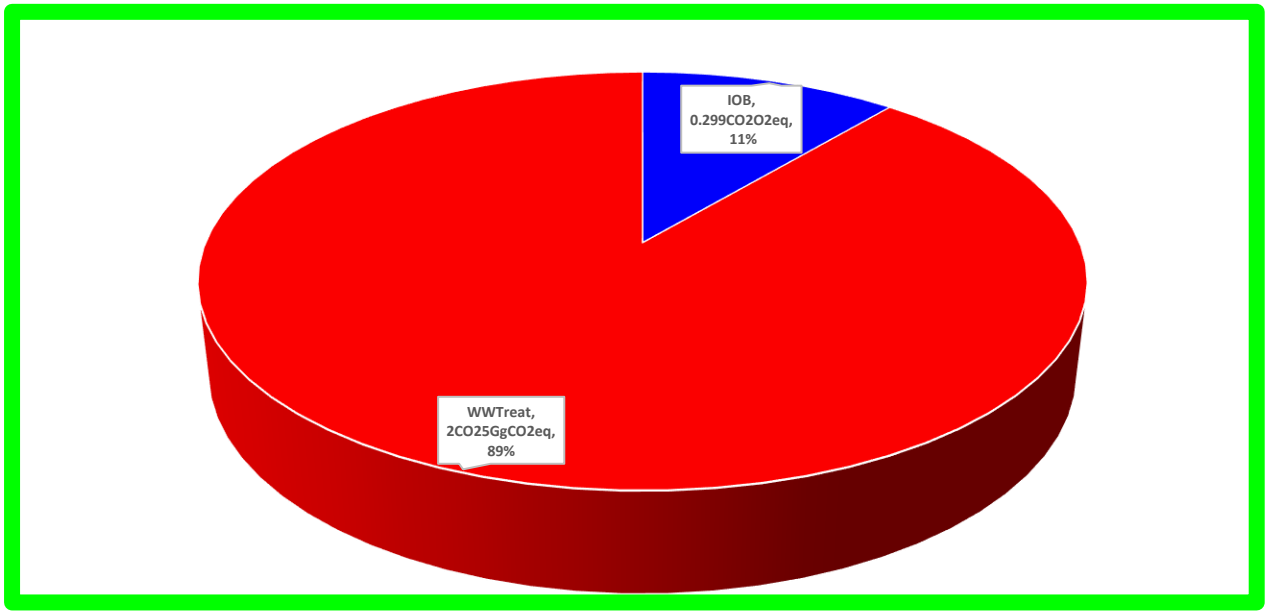


Fig: 31 N2O Emissions (GgCO2eq) from the Waste Sector

2.5.8 Solid Waste Disposal

The management of solid waste in The Gambia is under the purview of the Local Government Area Councils whose technical and financial capacities do not commensurate with the waste generation rate. One of the major challenges of proper management of solid waste is due to inadequate and inefficient waste management facilities. This coupled with the insufficient collection rate, and inappropriate final disposal sites.

The quantity and composition of solid waste generated is influence by lifestyle and, an increase in population growth, and increase in economy activities especially in the urban/growth centres. Depending on the common management practice at the solid waste disposal site, the solid waste emission sources are categorized into managed waste disposal sites; unmanaged waste disposal sites; and the Uncategorized Waste Disposal Sites. However, most of the final disposal sites in The Gambia are generally considered unmanaged as a result of inadequate and inefficient collection and inappropriate final disposal. These factors eventually lead to an increase in the emission trend of the methane and CO2 gases from the sites.

In addition, there are limited segregation at source and the final disposal site especially in Tambana waste disposal site where Dresden Banjul project was executing waste composting for agricultural purpose. Generally, most wastes at source are not segregated. These waste are sometimes scavenged by waste collectors before reaching at the dumping sites. Also, at the dumping site, scavengers are constantly searching for reuse and recyclables for consumption, thus, returning some waste back into the community.

2.5.9 Biological Treatment of Solid Waste

Dresden Banjul, a private waste management institution, was engaged in production or manufacturing of compost manure at Tambana waste dumping site. This institution was a project base, focused on biodegradable wastes from municipal waste generated at market level and household level.

2.5.10 Incineration and Open Burning of Waste

Incineration and open burning of waste are one of the primary sources of greenhouse gas emissions. These gases emitted include CO2, methane (CH4) and nitrous oxide (N2O). in many occasions, emissions of CO2 from incineration are more significant than CH4 and N2O emissions. During incineration process and open burning, carbon in waste of fossil origin (e.g., plastics, certain textiles, rubber, liquid solvents, and waste oil) are considered net emissions.

When waste streams are incinerated or open-burned most of the carbon in the combustion product oxidizes to CO2. If the CO2 emissions are determined on a technology- or plant-specific basis in the country. The general approach to calculate greenhouse gas emissions from incineration and open burning of waste is to obtain the

amount of dry weight of waste incinerated or open-burned (preferably differentiated by waste type) and to investigate the related greenhouse gas emission factors (preferably from country-specific information on the carbon content and the fossil carbon fraction).

Incinerators are available in all the Regional Health Directorates across the country for the treatment and burning of clinical waste from the health care facilities and services. Some major health facilities were provided with an incinerator in facilitation of their clinical waste treatment and management.

2.5.11 Wastewater Treatment and Discharge

The country has two wastewater management facilities, and these are: Kotu Wastewater Stabilization Ponds (KWSP) and Banjul Sewerage Facility (BSF). However, there is no effective wastewater treatment undergoing in any of the facilities in the country. The KWSP has been in existence for many years. This facility has been accommodating most part of GBA's public wastewater, in particular sewage, for effective management, and is now experiencing more challenges due to their limited capacity to treat the wastewater effectively, thus, discharging directly into the water bodies without reaching its Hydraulic Retention Time (HRT). The results of this process is threatening the lives of fauna and flora species, especially the marine species.

In addition, the BSF pumps untreated wastewater directly into the water bodies through the inter-pipe connected from sources. The facility has two stations: the lifting station and the pumping station. The lifting station collects and accommodate wastewater from houses, institutions, and other establishment; and pump it to pumping station from a distance of 850m with the aid of a pumping machine inserted at the bottom of the wastewater tank. The pumping station is responsible for the collection of wastewaters and pumping of wastewater into the water bodies, mostly, the Atlantic Ocean. The data characterizing sewerage composition needed for emission estimations include carbon and, nitrogen contents, and Degradable Organic Carbon (DOC) of the wastewater.

2.5.12 Industrial Waste Water

Industrial wastewater may be treated onsite or released into domestic sewer systems. Here we are referring to the estimation of CH4 emissions from onsite industrial wastewater treatment as emissions from industrial wastewater released into the domestic sewer system. Only industrial wastewater with significant carbon loading that is treated under intended or unintended anaerobic conditions will produce CH4. Organics in industrial wastewater are often expressed in terms of Chemical Oxygen Demand (COD). These include the followings: the fish meals processing plants, food processing industries, soap manufacturing plants, and recycling plants (e.g. plastic).

2.5.13 Uncertainty Assessment in the Waste Sector

The quality of CH_4 emission estimates are directly related to the quality and availability of the waste generation, composition; and management of data used to derive these estimates. The activity data in the waste sector include the Municipal Solid Waste, Industrial Waste, waste composition, and the fraction of solid Waste sent to Solid Waste Disposal Sites (SWDS). The emission inventory figures are ideal estimates using standard

IPCC protocols. The method used to produce the underlying datasets introduced inherent uncertainties into the inventory. Uncertainty in total inventory for the year 2020 is 15%; and trend uncertainty is 17%.

Wastewater management in the country is mostly practice at KWSP and BSF at onsite. KWSP system undergoes partial treatment of wastewater before being discharge into the water body or ecosystem. The facility has four ponds that are use in the management of the wastewater/sewage. The BSF discharge wastewater/sewage directly into the Atlantic Ocean and/or the mangrove land. The only treatment means is the removal of the heavy/big particles through the grit.

Open burning of waste is a common activity/practice at the dumpsites. It is mainly done by scavengers and a disposal team where applicable. The burning of some of the complex waste produces high amount of emission into the atmosphere that have an impact on climatic condition. Open burning is also practiced at both illegal and communal dumping sites within the communities by people as a way of managing their waste.

CHAPTER 3: CLIMATE CHANGE MITIGATION AND ACTION PLAN

3.1 INTRODUCTION

The Republic of The Gambia and many developing countries have realized that a lot of Project Grant Money and Loans are being received to implement climate change and development projects funded by various bilateral and multilateral development partners. The implementation of these projects may last between 3 to 15 years or more. However, about three years after the funding has dried up and implementation has stopped, the project investments cannot be traced. The major reason is that there is no Project Exit and Sustainability Strategy built in the project. Experience in the Implementation of the River Gambia National Park Facility has shown that the design and implementation of a Sustainability Strategy has been successful and has been working since 2005.

The Sustainability Strategy involves partnership between the Community that owns the land, the Public Sector (a government Department providing extension services), a private sector partner who is ready to collaborate with the communities and the Public Sector. The Partnership is defined by a Memorandum of Agreement (MOA/MOU). Hence, the partnership is called the Community-Public-Private Partnership (CPPP).

3.1.1 Institutional Framework for Mitigation

The Mitigation Task Force (MTF) of the National Climate Committee (NCC) is responsible for the Greenhouse Gas Mitigation assessment and the development of mitigation measures. The MTF comprises the following institutions, vis-a-viz:

No	Key Institution	Subsidiary Institutions
1	Ministry of Environment Climate Change and Natural Resources (MECCNAR)	The Climate Change Secretariat (CCS)
		Department of Forestry (DoF)
		National Environment Agency (NEA)
2	Ministry of Petroleum and Energy (MoPE)	Department of Energy (DoE)
		National Water and Electricity Company (NAWEC)
3	Ministry of Agriculture (MoA)	National Agriculture Research Institute (NARI)
		Department of Planning Services Unit (DoPSU)
		Department of Livestock Services (DLS)
4	Ministry of Transport, Works and Infrastructure (MoTWI)	Directorate of Transport (DoT)
		National Roads Authority (NRA)
		Gambia Civil Aviation Authority (GCAA)
		Gambia Ports Authority
5	Ministry of Lands, Local Government and Religious Affairs	Municipalities
		Area Councils

Table 20 Institutional Arrangement for Mitigation

3.1.2 Legal Framework

When information and data relevant to GHG mitigation assessment is not publicly available, legal and/or less formal collaborative arrangements are established with the view to obtaining the needed data and information in a timely manner and in the desired format. In The Gambia, it was noted that there is no law or overall legal framework upon which the institutional framework for the GHG mitigation assessment is based. The country is in the process of developing a climate change regulation/Act to underpin the development and implementation of its mitigation measures. Presently only memorandums of understanding (MoU) are used for the purposes of data collection. Coordination with other institutions is done based on letters and direct contacts with the head of institutions and/or focal points.

3.1.3 Sector-based Approach to Emissions Reduction Actions

Table 3.1, figure 3.1 and the following sub-sections provide sector-based approaches to Emission Reduction measures.

Table 3.1: Mitigation Actions and their Emission Reductions Targets by 2025 and 2030

NDC2 Mitigation Actions	2025 GgCO2eq	2030 GgCO2eq
Harmonized Energy Systems		**97.00**
Wind power	2.64	4.20
Reduced Transmission and Distribution Losses (TDL)	22.00	35.00
Replace All HFO System	6.91	11.00
Solar Home Systems	0.05	0.08
Efficient lighting	0.11	0.18
Solar Water Heating	27.22	43.30
Solar Rooftop Systems	4.11	6.54
Downsizing Transport	80.63	129.00
Reduced HFCs	233.10	804.00
Rice Ecologies	245.70	449.00
Climate Smart Agriculture	112.18	205.00
Food Value Chain	71.90	131.00
Livestock Productivity	403.20	408.00
Restoration of Degraded landscapes	87.95	373.00
Efficient Cookstoves	51.40	218.00
Multi-strata Agroforestry	39.85	169.00
Integrated Fire Management	39.85	169.00
Integrated Waste Management	405.48	497.00
TOTAL	**1795.99**	**3745.10**

Table 3.1: Mitigation Actions and their Emission Reductions Targets by 2025 and 2030		
NDC2 Mitigation Actions	**2025 GgCO2eq**	**2030 GgCO2eq**
AVERAGE	**128.29**	**214.59**

Table 21 Mitigation Actions and their Emission Reductions Target by 2025 and 2030

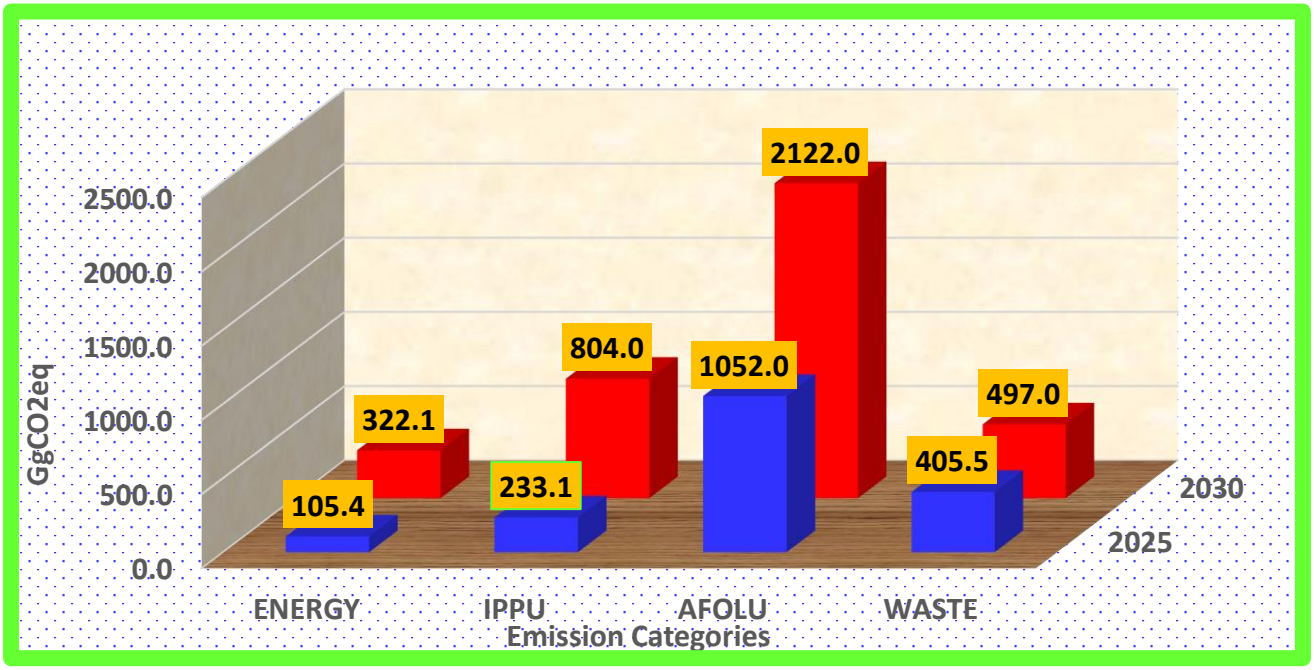


Fig: 32 Projected Emission Reduction Targets (GgCO"eq) for GHG Mitigation Action in the Different Emission Categories for 2025 and 2030

3.1.4 Energy

The Government of The Gambia intends to **harmonize the NAWEC, KarPowerShip and the River Gambia Development Authority (with French acronym OMVG) electricity supply networks** which will be used to connect Gambia with the West African Power Pool (WAPP). This will provide additional operational opportunities and significant benefits, frequency and voltage stability, and greater security of supply for a small electricity. Cost is expected to decrease through several channels, including shared reserves allowing a reduction in national reserve requirements, imports of low-cost hydropower and gas-fired thermal power from neighbouring countries and much efficient IPPs within the ECOWAS Regional Electricity Market.

The further rehabilitation and expansion of the distribution systems should be accomplished with the support of grants, while PPP financing must be directed to generation. The financial viability of the IPP is impeded by the large revenue risks (such as payment arrears, incomplete pass-through of fuel costs in electricity prices.

GHG emissions in the electricity sector under BAU, are expected to increase from 241 GgCO2e in 2020 to 535 GgCO2e in 2030 (122%). Based on the mitigation measures arising

from the harmonization of the three networks listed here, GHG emissions in 2030 will be 360 GgCO2e. This is a 49.4 percent increase compared to the 2020 level and a decrease of 32.7 percent compared to the expected baseline level in 2030.

The Gambia has proposed the development and operationalization of grid-connected wind power as a GHG mitigation measure.

Modern wind turbines extract energy from the ambient wind field and transform the mechanical energy of rotation into electricity. Wind as a renewable energy source and technology is adopted, promoted, and popularized under this project with the ultimate objective of replacing fossil fuel with wind power generation, decreasing the unit cost of energy, and reducing carbon dioxide emissions from power generation industry. From 2010–2019, there have been sustained decreases in the unit costs of wind energy (55%), and large increases in its deployment.

The driving force for using wind and other renewable energy technologies are energy security, economic impacts, and CO2 emission reduction. The emphases for the economic impacts are job creation, industrial innovation, and balance of payment. Renewable energy technologies could enable countries with good wind resources to implement these energy sources to meet their own domestic demand. Life-cycle CO2 emissions for renewable energy technologies are much lower than fossil fuels. From a fuel substitution approach, wind turbines could reduce emissions by 434 to 975 gCO2 per kWh of electricity produced from natural gas and coal-fired turbines respectively (White, 2004). Under this project, a 3.6 MW of utility-scale wind capacity will be installed and operated to produce greenhouse gas emission reduction of about 2.64 GgCO2e by 2025 and 4.2GgCO2e by 2030 (GoTG/NDC, 2021).

Transmission and Distribution Losses of Electricity and Water Systems as a mitigation measure are expected to reduce the losses to 15% by 2030. The current transmission and distribution network is characterized by aging lines and transformers resulting to a high level of losses. The electricity supply infrastructure faces decreased thermal efficiency of power lines, and possibly damage to infrastructure. Higher temperatures degrade heat exchange efficiency of engines and encourage use of air-conditioning, resulting in higher fuel consumption and increased GHG emissions.

Improving and expanding the network to enable production to be offloaded to reach consumers would reduce losses and the need for additional generation. The transmission network is at the 33Kv level that requires upgrading to 132Kv to ensure stability to minimize losses due to outage and ensure increase system reliability and ensure network stability (GOTG/NAMA, 2016). The improvement of the transmission system is expected to generate electricity savings of 85 GWh by 2025 and 125 GWh by 2030. For 2025 this represents between 12% (high demand scenario) and 16% (low demand scenario) of total electricity production. For 2030 this represents between 13% (high demand scenario) and

19% (low demand scenario) of total electricity production. (GoTG/INDC, 2015). Under this NDC activity, the reduction of transmission and distribution losses to 17% produces greenhouse gas emission reduction of 22GgCO2e by 2025 and 35GgCO2e by 2030 (GoTG/NDC, 2021). Besides emission reductions through cuts in the energy consumption of generating plants, this option can increase access as more electricity would be made available as well as increased system reliability and ensure network stability.

The mitigation measure that switches All HFO-powered Heating and Lighting Systems by Solar PV and Battery-based power mini-grids between 2000 to 2030, will involve the installation of 75 MW of renewable sources in the Greater Banjul Area (GBA) and 10MW will be installed in the provinces. Baseline Scenarios indicate there are large emissions per unit of electricity produced. In 2020, electricity production emitted 239.51GgCO2e.[8] Projected GHG emission from the Energy Sector to 2030 is 0.711MtCO2eq. It is projected to increase by 20% the share of renewable sources in the electricity mix (20%*525MW); 30MW Wind & 75MW solar[9].
GHG emissions in the electricity sector are expected to increase from 241 GgCO2e in 2020 to 535 GgCO2e in 2030 (122.0percent). The contribution of the replacement of HFO mini-grids with solar PV and battery-powered and storage systems mitigation measure would be 6.91GgCO2e by 2025 and 11GgCO2e by 2030.

Establishment and operationalization of Solar home systems, as a GHG mitigation measure, will contribute to The Gambia meeting her plans to reduce its GHG emissions by 197GgCO2e through investment in renewable energy capacity, reducing power transmission losses, and adopting the use of Solar Home Systems (SHSs) for lighting and heating. The Strategy and Action Plan developed for the implementation of this mitigation measure (establishment and operationalization of Solar Home Systems) aims to extend the life of this equipment to the extent possible, through a Sustainable Exit Strategy and Plan for optimizing its end-of-life value by designing it to allow for disassembly and the reuse of most of the materials and components. The sustainability strategy will also facilitate the development of a national recycling capacity including the logistics infrastructure.

Employment of renewable energy and promotion of energy efficiency, including Solar Home Systems, is expected to produce emission reductions of 56.4GgCO2e in 2020, 121.7GgCO2e in 2025 and 174.4GgCO2e in 2030 (Gambia NAMA, 2015). The **NAMA**

[8] 2020 National Inventory Report of The Gambia
[9] Solar PV projects in the base case of the least cost generation plan are Basse NAMA 6.5 MW by 2022; Bansang 2 MW in 2022 rising to 5 MW by 2026 (this could be targeted earlier if the Eastern Backbone is delayed); N'Joben 5 MW from 2022 and the IDB projects, 3 MW at Njaw and 2 MW at Nyanga Batang, both due in 2025. About 10 MW in total would be needed in Bansang and Basse by 2025 and 10-11 MW in Bansang and 15 MW in Basse by 2030.

Support Project (NSP) will allow The Gambia to add up to 10MW of solar PV to its energy mix in all regional grids. The NSP intends to generate annual emission reductions of at least 7.2GgCO2. Over 5 years, emission reductions are expected to add up to 57.6GgCO2. Over the next 10 years, emission reductions are estimated to be around 129.6GgCO2. The Gambia intends to use Solar Home Systems to supply off-grid consumption, and this mitigation measure will contribute to emissions reductions of 0.05GgCO2e by 2025 and 0.08GgCO2e by 2030 (GoTG/NDC, 2021)[10].

Direct fuel use in the residential and services sectors is a source of 15GgCO2e. Almost all residential buildings in The Gambia require large amounts of energy to improve the indoor environment. These issues can largely be solved by adopting appropriate design, reducing electricity consumption, and avoiding the associated GHG emissions. **Substitution of incandescent light bulbs with efficient lighting systems** is a mitigation measure to reduce emission from indoor lighting systems. The sectoral categories include efficient lighting, high performance distribution of electricity and energy efficiency standards. The effective implementation of the energy efficiency targets and trajectories will depend on the appropriateness of the measures and activities it adopts to create an enabling environment for actors. The measures and activities proposed include efficient lighting through substitution of incandescent light bulbs with energy efficient bulbs. The installation and operationalization of Efficient Lighting Systems will produce emission reductions of 0.11GgCO2e by 2025 and 0.18 GgCO2e by 2030.

The mitigation measure to establish and operationalize Solar water heating systems is one of the most effective plants for general and easy use of solar energy to supply hot water in domestic and industrial sectors. Jahangiri et al. (2021)[11] show the high potential of GHG emission reductions due to reduction or non-consumption of fossil fuels owing to the deployment of SWHs. Solar energy is a promising source for water heating in the household sector in The Gambia, especially during the short cold season (December to March). SWH systems are economically feasible but family size, equipment installation costs and energy costs play major roles in the economic feasibility of SWH systems deployment.

The Strategy and Action Plan developed to implement SWH systems as mitigation measures will install solar water heating facilities on public, commercial and residential buildings. The objectives of the design and implementation of the SWH mitigation measure were to determine the amount of energy saved and GHG emission reduction through the installation of SWHs; to determine the efficiency and sufficiency of SWHs for the average family; and to determine the contribution of SWHs towards reduction of GHG

[10] Second Nationally Determined Contribution of The Gambia to the UFCCC.

[11] Mehdi Jahangiri, Esther T. Akinlabi, and Sam M. Sichilalu (2021): Assessment and Modeling of Household-Scale Solar Water Heater Application in Zambia: Technical, Environmental, and Energy Analysis(https://doi.org/10.1155/2021/6630338)

emissions. The SWH mitigation measure and facilities are designed to supply 10% of demand by 2030 and reductions in emissions are projected to be 27.22GgCO2e by 2025 and 43.3GgCO2e by 2030.

Establishment of Solar rooftop PV Systems for institutions is reported **as a viable mitigation measure.** Solar Roof Top PV Systems are becoming a common sight in The Gambia, but it is difficult to get reliable data on the quantity of systems installed so far. A typical 2019 Partnership project of the Medical Research Council (MRC) – Gambia installed more than 1,600 solar panels with a total capacity of over 500 kilowatts at peak power. Through a well thought and appropriately designed Strategy and Action Plan, this project will install and operationalize a 6 MW of solar PV rooftop systems that will contribute to reduction of greenhouse gas emissions by 4.11GgCO2e by 2025 and 6.54 GgCO2e by 2030.

Decarbonization of Transport Sector is proposed through downsizing the carbon footprint of Gambia's transport sector. The climate change integrated Transport Policy of the Ministry of Transport, Works, and Infrastructure (MoTWI) include the objectives that address the reduction of GHG emission with (a) enforcement of periodic vehicle inspection for emissions and roadworthiness, (b) vehicle Fuel Efficiency, and (c) improvement of the efficiency of public transport system for Greater Banjul Area (GBA). This proposed GHG mitigation project to downsize Gambia's transport sector carbon footprint can be achieved through the implementation of vehicle fuel efficiency standards; strengthening public transport systems; and increasing use of blended fuel in road transport. According to the GoTG/NDC 2021 report, projected emissions reduction targets are 80.63GgCO2e by 2025 and 129 GgCO2e by 2030.

3.1.5 Industrial Processes and Product Use

Using Fuel Substitution as a mitigation measure can reduce consumption of HFCs and resulting GHG emissions in the IPPU category. The implementation activities of this measure, aim at recovering HFCs and substituting them with hydrocarbons through (a) redesigning products to phase out both ozone-depleting substances and GHGs; (b) extending the lifespan of existing appliances and training technicians to handle these substances and repair products that use them; (c) supporting companies to convert to service-oriented business models, where value is retained, products and resources are reused, and supplies are circular; and (d) supporting governments to monitor the import and consumption of ozone-depleting substances and GHGs and provide policy advice.

The implementation of this measure includes the development of a Strategy and Action Plan containing mitigation options for potential reduction in HFC consumption and resultant greenhouse gas emissions. Implementation will (a) invest in a programme to improve cold storage capacity and accelerate the phase-out of HFC use in The Gambia; (b) phase out the use of HFCs as aerosols and allow only alternatives with a low Global

Warming Potential, such as hydrocarbons and oxygenated organic compounds, to be imported; (c) target capacity building through trainings at both service technicians and end users, while also improving overall awareness of the adverse impacts of HFC use; and (d) promote HFC recovery, recycling and reclamation. Projected reduction in emissions of greenhouse gases is 233.03GgCO2e by 2025 and 804 GgCO2e by 2030 (GoTG/NDC, 2021)

3.1.6 Agriculture, Forestry and Land Use

The Gambia possesses a good range of suitable ecologies for rice production. Rice is the staple food of the country with a per caput consumption of 117kg per annum of which only 17% is produced locally.[12] GHG reduction through the **determination and implementation of GHG reduction measures from different rice ecologies in the Gambia** cand be achieved through (a) Upland Rice system of NERICA cultivation; (b) Lowland System of Rice Intensification (SRI); and (c) Lowland system of Tidal irrigation. NERICA Rice production will consist of promoting and facilitating the expansion of the cultivation of NERICA in upland rice fields which will reduce GHG emissions from agriculture by reducing the need to expand irrigated rice cultivation. Rice efficiency seeks to increase production and productivity in a given area.

Climate Smart Agriculture [CSA] is adopted and implemented as a mitigation measure for GHG emission reduction. Improving agricultural resilience by implementing climate-smart agriculture as a greenhouse gas mitigation option proposes a combination of measures that reduce GHG emissions, while also improving the resilience of agricultural production to climate change impact. It does so typically through a combination of measures involving soil and nutrient management, water harvest and use, biodiversity management, pest and disease control, and the use of quality seeds and planting materials of well-adapted crops and varieties.

The Comprehensive and Gendered Strategy and Action Plan to implement CSA contains measures that include (a) practicing conservation agriculture with adequate crop rotation, minimum tillage and the use of cover crops; (b) implementation of integrated pest management; (c) intercropping with nitrogen fixing legumes to improve nutrient management; (d) improving irrigation infrastructure, relying on both tidal irrigation in rivers and groundwater wells; and (e) reducing the need for synthetic fertilizer inputs and improving soil organic carbon. Projected reduction in greenhouse gas emissions from CSA mitigation measure are 112.18GgCO2e by 2025 and 205GgCO2e by 2030 (GoTG/NDC, 2021)

[12] D B Jallow & M Manga (2016): Rice Situation in The Gambia; Promotion of African Rice Development for Sub-Saharan African Countries. https://riceforafrica.net/joomla/images/tsukuba2016/pre_gambia.pdf.

GHG emissions reduction measures are adopted and applied in Full Food Value Chain of The Gambia. The Special Report on Climate Change and Land (SRCCL Mbow et al. 2019) found that the technical mitigation potential by 2050 of demand-side responses at 0.7–8.0 GtCO2-eq yr^{-1} is comparable to supply-side options at 2.3–9.6 GtCO2-eq yr^{-1}. This shows that mitigation actions need to go beyond food producers and suppliers to incorporate dietary changes and consumers' behavioural patterns and reveals that producers and consumers need to work together to reduce GHG emissions.

Reduction of food losses as a greenhouse gas mitigation measure involves (a) improving harvesting techniques; (b) provision of adequate storage to limit exposure to moisture, heat and pest infestation using hermetic bags or metal silos; (c) applying mobile processing units, solar dryers, graters and pressers, where applicable; (d) contractual and aggregation points that help bring the product to market and warehouse receipt systems to reduce losses during storage; and, (e) improving transport conditions and cold storage capacity. Implementation of Food Loss and Waste Reduction Strategy and Action Plan as GHG mitigation in the Food Value Chain will reduce greenhouse gas emissions by 71.69GgCO2e in 2025 and 131GgCO2e in 2030.

Livestock Productivity is improved through effective GHG Mitigation measures. Methane emissions from enteric fermentation make up around 96% and manure management make up around 4% of the emissions from the Livestock sub-category. According to the activity, some of the mitigation options are already practiced in The Gambia, including free roam grazing and combined forestry with cattle grazing. Still, livestock make up 10% of the national GHG emissions. Additional productivity improvements offer mitigation potential. The World Bank and FAO have identified measures that may still be relevant to the Gambian context, ranging from improved forage quality to grazing management and improved animal health. Reduction in greenhouse gas emissions (N_2O and CH_4) are projected at 223.26GgCO2e by 2025 and 408GgCO2e by 2030 (*ref:* GoTG/NDC, 2021)

The mitigation measure on the restoration of degraded landscapes (including protected forests) are restored promotes improved management of degraded agricultural lands and natural ecosystems, will reduce net GHG emissions by (a) increasing the sequestration of soil carbon through enhancement of vegetation cover in degraded areas and through reducing the rate of clearance of natural vegetation for conversion to agriculture; (b) increasing the sequestration of GHGs by increasing the total woody biomass in natural ecosystems such as forests and woodlands; and (c) reducing the loss of topsoil as a result of erosion in degraded areas. Therefore, the measure will contribute towards the national mitigation priorities established in Gambia's 2nd NDC submitted in 2021. Reduction in greenhouse gas emissions is projected at 87.95GgCO2e by 2025 and 373GgCO2e by 2030 (GoTG/NDC, 2021)

Promotion and upscaling Fuel-efficient and cleaner cookstoves are a mitigation measure. Under this GHG mitigation intervention, community cookstoves will replace more traditional three-stone stoves of open fires with efficiently designed alternative fuel stoves that will reduce the time in collecting fuel wood, create supplementary livelihoods, empower women through incorporation of women's cooperatives in project activities, produce significant cost savings through the use of alternative fuels such as rice husk and peanut shells which are much cleaner and less bulky than wood and charcoal, reduce particulate matter by 67% compared with traditional stoves and thus bring a number of respiratory and bronchial health benefits and reduces indoor pollution. Upscaling deployment of fuel-efficient and improved biomass combustion cookstoves involves residential, commercial, and industrial applications and will produce greenhouse gas reductions of 51.40GgCO2e by 2025 and 218GgCO2e by 2030 (GoTG/NDC, 2021).

Multi-strata agroforestry as a GHG mitigation measure is adopted, promoted, and implemented. Community-based forestry activities in The Gambia have helped to expand forest area and increase crop production. Combining useful trees with crops helps protect soil nutrients and soil moisture and avoid erosion, while storing more carbon than in a monoculture cropping system. Under this unconditional NDC mitigation project, efforts will be made towards supporting the consolidation and sustainability of the investments already initiated in previous and existing projects, particularly, the evident gender disparities in land ownership as women do not own land for farming and business investments. It will also address policy challenges especially land tenure and land ownership. This mitigation strategy aims to strengthen these initiatives to increase tree cover in The Gambia, both in urban and rural areas. Trees help retain water and improve drought resilience, provide food to the rural population in case of shortages, and provide shade in cities. This activity is projected to produce greenhouse gas reductions of 39.85GgCO2e by 2025 and 169 GgCO2e by 2030 (GoTG/NDC, 2021).

Sustainable Fire Management is applied as a GHG mitigation measure. The Policy target is to have 33,342.93 hectares of forests placed under community control representing 16.67% (percent) of the Policy target of sustainably managing 200,000 ha. Land-use changes also result in GHG emissions through the burning of forest cover. According to the 2020 National Inventory of GHG Emissions of the Gambia, total net emission from burning in the forestland, cropland, grasslands, and other lands was 30.42GgCO2e. Implementation of this NDC mitigation measure will contribute to a reduction of 39.85GgCO2e by 2025 and 169 GgCO2e by 2030 (GoTG/NDC, 2021).

3.1.7 Waste

Integrated Waste Management is designed, established, and promoted as a mitigation measure. There is an increase in waste generation because of increased urbanization, affluence, and rapid population growth. Proliferation of illegal dumpsites is a common sight/feature in the Greater Banjul Area (GBA). Littering is widespread and

very difficult to control despite the introduction of the Anti-littering Regulations. The Waste Category has been identified as a major emitter of greenhouse gases in The Gambia. There are landfills officially designated but their management is inadequate.

An estimated 53% of municipal solid waste in The Gambia is organic waste. Most solid waste is dumped in informal dumpsites or burned. Only an estimated 3% is composted. Implementation of the Comprehensive Waste Management Strategy and Action Plan aims to reduce the volume of organic waste that is dumped or burned, while producing a soil enhancer. Agricultural soils in The Gambia have relatively low fertility. In addition, new processing capacities, like fishmeal factories, increase the industrial organic waste flow. However, before seeking to optimize the use of compost, food loss in the food value chains should be minimized. Implementation of this NDC waste management mitigation measure will contribute to greenhouse gas emission reductions of 405.5 GgCO2e by 2025 and 497GgCO2e by 2030.

CHAPTER 4: CONSTRAINTS AND GAPS: TECHNOLOGY, FINANCIAL AND CAPACITY-BUILDING NEEDS AND SUPPORT RECEIVED

4.1 INTRODUCTION

A diagnostic analysis of process management within the TNC context has uncovered several systemic and circumstantial problems impeding timely publication of a comprehensive report. Specifically, the compounding effects of poor institutional memory, weak organisational frameworks and task-related capacity gaps, show up in the content as missing information on the actual status of sector-wide implementation of the UNFCCC. Climate related constraints to implementing national development priorities can be construed as risk aversion towards agricultural expansion, vulnerable infrastructure, and private sector engagement and leadership.

Gambian landscapes, economy and its people are exposed to changes moderately to highly sensitive to climate variability and manifestations of future climate change. Therefore, the lead ministry, Ministry of Environment, Climate Change and Natural Resources (MECCNAR), has a big role to play inter alia in service provision, problem solving, information diffusion, capacity building, and building strategic partnerships, with respect to climate risk management and implementation of the UN Framework Convention on Climate Change (UNFCCC). To this effect, MECCNAR and other relevant government agencies need to establish stronger cooperative framework. To complement, self-improvement efforts, international partners are called upon to provide targeted capacity building support and technology transfer through relevant convention bodies/mechanisms, or bilateral arrangements.

4.1.1 Constraints and Gaps

Due to its unique geography, the country's landscapes and ecosystems are exposed to projected climate change from multiple perspectives, notably economic growth, household livelihood strategies and social progress.

Using administrative and scientific information from trusted sources, assessments presented in the Third national Communication (TNC) indicate moderate to high levels of sensitivity of the environment, public health, and selected economic sectors, and quality of life of population groups engaged in the real economy, to adverse impacts of projected climate change. Greenhouse gas (GHG) emissions have grown by 70% since 1993, with methane (CH4) contributing 47% of emissions recorded in 2010. Notwithstanding, several weaknesses including secondary data collection, data aggregation, quality control and analysis, attributable to the absence of a formalised Greenhouse Gas Inventory (GHGI) system embedded in administrative law, have come into evidence during the preparation of the TNC.

There is sufficient reason to believe that improvements are needed with regards to the Ministry of Environment, Climate Change and NAtural Resources' (MECCNAR's) leadership, service provision, problem solving, and information dissemination roles in matters related to climate risk management and implementation of the UN Framework Convention on Climate Change (UNFCCC). Doubtless, the allocation of resources commensurate with expected outputs would eliminate some major shortcomings in the dissemination of diverse genres of information generated within the climate change stakeholder community.

Capacity building outcomes (with support from development partners) continues to lag behind actual needs. Indeed, leadership training of public sector employees and competency gaps in the fields of project management; environmental, ecological and economic modelling; engineering; and data science, remains a top priority at sectoral and at different administrative levels. In this regard, greater effort should be expended in developing the country's South-South cooperation in the field of climate risk management.

Public awareness, supported by multiple agencies/interventions, is increasing but inadequate due to the absence of communication guidelines and weak coordination of public awareness building efforts. However, a sustained drive to train media professionals, extension workers, and community groups, and the recent publication of a glossary of key terms and concepts into major local languages could be seen as a significant step towards greater public enlightenment and engagement on climate change issues.

An objective introspective analysis of the National Communication (NC) preparation process has revealed several systemic and circumstantial problems that remained largely unsolved. Crucially, activities involving pooling, analysis and packaging of relevant information were continually challenged by poor institutional memory, task-related capacity gaps, and weak perception of country-ownership, reflected in delivery schedules, and quality of intermediate outputs. In effect, failure to provide specific details along with inventory information, or a full re-analysis of 1990 and 2000 inventory data, failure to provide an overview of institutional arrangements for GHG inventories, and absence of reporting on Quality Assessment/Quality Control (QA/QC) and uncertainty analyses, are considered as important gaps.

Other gaps relevant to comprehensiveness of documents are briefly listed as follows:

- Harmonised socioeconomic scenarios to be used in sectoral assessments and mitigation analysis.

- Information on the institutional framework for implementation of the Convention, legal frameworks for stakeholder participation and public access to information, stakeholder engagement processes, level of involvement, and outcomes.
- Information on scope and areas of The Gambia's participation in the global research and observation systems and information networks.
- Information on the status of activities and level of participation in South-South cooperation, including capacity building activities for building resilience.
- Information on the status of activities related to coordination and sustainability of capacity-building activities, and level of public awareness and understanding of climate change issues.
- Specific (sectoral) mitigation and adaptation policies and measures and where relevant, linkages to the country's Nationally Appropriate Mitigation Actions (NAMA), Nationally Determined Contributions (NDC), National Adaptation Programme of Action (NAPA), NAP, and Sustainable development Goals (SDGs).
- Measures relating to enhancing the enabling environment for the development and transfer of technologies.

Climate related constraints to implementing development priorities relate to (1) increased population, generally and over concentration of population in the urban and peri-urban areas; (2) agricultural expansion; (3) building critical infrastructure; and (4) turning the private sector into the engine of growth (of the economy). Unfavourable weather and seasonal rainfall patterns have had and still continue to exercise a strong influence on the production of rain-fed agricultural production systems. Specifically, a shorter rainy season continues to exert a strong negative influence on groundnut, maize, and rice production. To a large extent, revitalisation of the National Agricultural Statistics Survey (NASS) would be crucial to a holistic assessment of progress, evidence-based planning and decision-making in the ANR sectors.

4.1.2 Progress Towards Reducing Constraints

MECCNAR and relevant government agencies need to urgently address some of the problems identified in this report, through:

- Initial framing of issues and expectations relating to the establishment of formalised GHGI system (under the NSS coordinated by the Gambia Bureau of Statistics), climate risk management coordination mechanism (including role definition and MOUs if required) and system audit to assess deficiencies, should follow the publication of this report. UTG should lead discussions around the establishment of an NCCRC, criteria for affiliation and modalities for deciding upon research priorities.
- Joint development of key messages for various audiences to ensure coherence between GOTG Education & Awareness Programme, and its Research Programme.

- Take advantage of UNFCCC Biennial Update Reviews (BURs) to implement imperative structural and management reforms.
- Measurement and reduction of their GHG footprint (additional to the INDC), as a sign of leadership by example.

4.1.3 Support Needed in MRV Of GHG Trends and Mitigation Action.

Proposed interventions contained in the Gambia's Special Programme for building Climate Resilience (SPCR) in the form policy integration, strategic assessments and audits, underpinned by requisite investments in scientific assets and human resources, designed to overcome obstacles to an evidence-based (Component 3), long-term and sector-wide approach to policymaking (Components 1, 4 and 5) and development practice (Components 2 and 5), geared towards climate resilient development in The Gambia, are estimated at USD28.5 million.

1. Three key recommendations as follows, are formulated for the attention of international partners:
   - Provide training support to Gambian sectoral experts (including social scientists) on various thematic areas and integrated assessments, through the relevant convention bodies/mechanisms, or bilateral arrangements, and monitor impacts and outcomes through participatory programmes.
   - Provide technical assistance in the person(s) of a GHG inventory expert(s) to establish and operationalise a formalised GHGI system, building on potential synergies with the National Statistics System (NSS) reporting biennially on core environmental statistics including GHG emissions.
   - Provide technical assistance and programming support towards the establishment of a productive National Climate Change Centre (NCCRC), built around research clusters working on key Convention and national development issues (including transition to a low emissions economy).

4.1.4 Gender Consideration in Climate Change Mitigation

The following projects and programmes have been executed by the Ministry of Petroleum and Energy (MOPE) and other government institutions to mainstream gender issues in the energy and the environment sectors. These includes: the distribution and popularization of improved cookstoves and LPG as replacing fuelwood for domestic purposes. These measures reduced women exposure to indoor air pollution thus improving their health conditions.

Increase renewable energy access to rural off-grid areas in the country by the provision of solar home systems and green mini grids which improve safety, lifestyle as well as education of communities especially women and girls; the provision of clean drinking water and gardening for the women folks in rural communities in The Gambia has been facilitated by the provision of solar water pumping system. The MOPE as part of its efforts

to mainstream gender in energy access has developed and validated national action plan (NAP). There are numerous projects and programmes that have taken into consideration gender issues in clean energy access.

The Large-scale Ecosystem based adaptation (EbA) project has empowered women to take part in developing enterprise on forest base resources, agroforestry, Assisted Natural Regeneration, mangrove planting and restoration.

4.1.5 Support Needed for the Implementation of Mitigation Actions.

The Gambia's plans and commitments to reduce GHG emissions are clearly indicated in the Second Nationally Determined Contribution (NDC), which estimates that the required support of approximately USD 324.10 million for five (5) years is required to cover the necessary activities for climate change. Climate change adaptation constitute USD 55.9 million which translates to 17% of the required support while the mitigation activities constituting USD268.2 million translates to 83%. The total estimated cost is expected to address climate change issues and build the capacities of officials as well as provide technologies to support the mitigation and adaptation interventions.

4.1.6 Support Received.

The Government of The Gambia received funding from GEF to prepare and submit its first BUR to the UNFCCC. The funds for the BUR have enabled the development of the national GHG inventory and the mitigation analysis for this report. Moreover, under this project, national experts were trained on the 2006 IPCC Software and Guidelines for GHG Inventory. In addition, the national experts from line ministries and agencies received training on baseline and mitigation scenarios as well as the domestic MRV System.

However, there are several other development partners through providing climate finance to address adaptation or mitigation efforts as well as technical assistance which are geared towards the implementation of climate policies and strategies such as the NDCs. The table below shows the resources earmarked for on-going or committed climate finance projects in The Gambia.

Funding Source	Project Name	Project Objective	Amount	Project Status
GEF	Sustainable Dry land Forest Management Project	Reforestation, Institutional strengthening, MA&D	15,784,447.00	2016-2021
GEF	Landscape Planning and Restoration to Improve Ecosystem Services, and Livelihoods, Expand and Effectively Manage Protected Areas	To create an enabling environment for The Gambia in building national capacity to lead the reform of land use and marine spatial planning policies and to implement land/seascape level management that conserves ecosystem services in productive and protected land/seascapes	5,644,685.00	2020-2025
GEF	Unintentional Persistent Organic Pollutants (UPoPs) Project	Capacity building and institutional support for the management of UPoPs	1,998,000.00	2019-2023
KFW, World Bank, KF	The Gambia River Basin Development Organization Energy Project OMVG	Energy Access RE	77,085,810.00	2018-2022
GCF	Large Scale Ecosystem Based Adaptation (EBA)Project	Reforestation, MA&D, Institutional support	21,500,000.00	2017-2022
AfDB	Climate Smart Rural Wash Development Project	Water 7 Sanitation. Delivery of better waste management services to improve environmental conditions and better protect national water resources in changing climatic conditions, particularly in riverine and coastal communities	7,119,747.00	2019 - 2026
Adaptation Fund	Rural Integrated Climate Adaptation and	Resilience building and adaptation activities, and	10,000,000.00	2020 - 2027
WB	West Africa Coastal Areas (WACA) Resilience	Coastal adaptation and resilience building	45,000,000.00	2022 -2028
UNCDF	UNCDF LoCAL Adaptation Mechanism	Community based adaptation using jobs, skills and	4,299,947.00	
AfDB	The Gambia Agriculture and Food Security Project	To increase food and nutrition security, and household incomes, particularly for vulnerable households in the project area.	9,947,950.00	2021 -2028
GCF	Climate Resilient Fishery Initiative for Livelihood Improvement in the Gambia (PROREFISH Gambia)	To assist Gambian fisherfolk to build their resilience against climate change and improve their livelihoods.	17,200,000.00	2022 - 2028
WB	The Gambia Inclusive and Resilient Agricultural Value Chain Development Project (GIRAV)	Promote the development of key priority agricultural value chains with strong growth potential in the country through a combination of soft and hard investments aimed at strengthening production capacity, creating opportunities for complementary private sector-led investments in agribusiness, and development of agricultural small and medium enterprises (SMEs).	10,453,600.00	2022 - 2026
AfDB	Programme to Build Resilience to Food and Nutrition Insecurity in the Sahel (P2 P2RS)	Contribute to reducing poverty and improving food and nutrition security in The Gambia by increasing, on a sustainable basis, agro-sylvo-pastoral and fishery productivity and production.	16,500,000.00	2023 - 2027
WB	Gambia Electricity Restoration and Modernization Project	To improve power supply while increasing Gambia's grid capacity, with the nation currently relying on limited installed power generation.	131,400,000.00	2020 - 2030
GCF	National Framework to Leapfrogging to Energy Efficient and Climate Friendly Refrigerating appliances and Room Air-conditioners in The Gambia	To provide the frameworks for the transition to more energy efficient and climate friendly refrigerating appliances and room air conditioners in The Gambia.	400,000.00	2022-2025
GCF	National Adaptation Plan Formulation (NAP)	To provide adaptation priorities and strategies that would guide resilience building efforts in The Gambia	3,000,000.00	2024-2026
WB	Tourism Diversification and Resilience in the Gambia Project	To support the diversification and climate resilience of the tourism sector at selected destinations	45,000,000.00	2022-2027
UNDP	climate promise project	To promote access to clean and sustainable energy through women-led Microenterprises to boost The Gambia's Off-Grid Renewable Energy market	540,000.00	2024-2025

Table 22 Support Received or Committed Under Climate Finance

4.1.7 Support Analysis

Based on the chart above, The world Bank is the biggest single financier of climate change adaptation and/ or mitigation in the Gambia. The Gambia also receives about 20% of climate finance from GCF, which is one of the dedicated financial mechanism of the UNFCCC, placing the Fund second highest in ranking of climate finance provider in the country.

CHAPTER 5: MONITORING, REPORTING AND VERIFICATION (MRV) SYSTEM IN THE GAMBIA

5.1 Domestic Measurement Reporting and Verification (MRV) System

5.1.1 Status of Domestic MRV System

As a party to the Paris Agreement (PA), The Gambia is committed to the implementation of Article 13 Para (7a and 7 b) of the PA. This commitment is consistent with decision 1/CP.16, which was adopted in Cancun in December 2010, referring to the development of local Measurement, Reporting, and Verification (MRV) to track climate actions.

In response to the call by decision 1/CP.16 to establish and operate a domestic MRV system for climate action and support under the existing international MRV and beyond (response to Decision 18/CMA.1 (MPG for Article 13), The Gambia domestic MRV was coordinated by MECCNAR, which is a mandated institution to regularly track progress in mitigation and adaptation interventions through participatory monitoring and evaluation as per the NCCP. The UNFCCC focal point which was previously hosted by DWR, has now transitioned to MECCNAR.

While the policy provided general directives for monitoring mitigation and adaption initiatives in the Gambia, it fell short of establishing a clear institutional arrangement or providing guidance on roles and responsibilities specific to transparency under the PA. Following the transfer of the Department of Water Resources from MECCNAR to the Ministry of Fisheries, Water Resources, and National Assembly Matters, it was determined that all activities concerning the ETF under the PA would be managed by the NCCS under MECCNAR from September 2024 onwards.

5.1.2 Measuring GHGs

In the absence of legal instruments or policy guidance on institutional arrangements in the past for the MRV of GHGs emissions by sources and removal by sinks, the institutional arrangement regarding MRV was largely at the discretion of the BUR/NC coordinator(s), or by extension, the Project Management Unit responsible for the same.

For the most part, institutions whose mandates were relevant to the four key IPCC sectors of GHG inventory were invited to provide data, participate and/or contribute towards the development of the update reports and national communications. Institutions relevant to the IPCC emission categories are usually engaged through an MoU signed between DWR or its line Ministry and the Implementing Partners (IPs) at any given time. The Gambia did not establish an information management system as well as a database to regularly obtain GHG inventory data from sector institutions in the previous reporting processes. The Gambia, under the NCCS, is working towards establishing Climate Ambitious reporting MRV system.

5.1.3 Progress /Intended Improvements in The Gambia's MRV

Since the transfer of the MRV mandate to the NCCS, efforts have been made to overhaul the MRV process and procedure in the Gambia. One of the first steps in the direction of

fine-tuning the MRV system in the Gambia is the on-going efforts to incorporate clear institutional arrangements with specific roles and responsibilities assigned to respective institutions in the revised NCCP. Furthermore, every effort will be made to ensure that MRV is adequately addressed in the Climate Change bill that is under development, the prospecting article 6 framework, and the carbon market bill. It is, therefore, expected that by the end of 2025, the Gambia will have laws and policy regulations concerning transparency under the PA.

In addition to the development of legal instruments and policy frameworks, The Government of the Gambia through North-South Cooperation, is being supported by Environment and Climate Change Canada to build a reliable MRV system in the Gambia through five pilot projects, namely:

1. MRV on mitigation action on monitoring emission reduction outcomes from solar PV systems.
2. MRV on mitigation action on forest change and degradation;
3. Tracking climate change expenditure through budget coding;
4. Community of Practice;
5. Climate change multilevel governance and;
6. Establishment of climate action research Centre.

The Gambia has initiated yet another partnership through North-South Cooperation with The United States of America Environment Protection Agency (USA EPA) to support The Gambia with the development of BTR/NC4, including improving national MRV.

5.1.4 Proposed Institutional Arrangement

The current project management unit has done an extensive review of previous institutional arrangements, and the lessons learned in the gap analysis were factored into the proposed institutional arrangement for the MRV system in the Gambia, as depicted in the table and the organogram below.

No	Institution	Brief Description of Role and Responsibilities
	Ministry of Petroleum and Energy (MoPE)	Coordinate the energy related data collection for the GHGI of the energy sector. The Ministry will house the Energy Sector Lead Coordinator who will second as the coordinator of the Energy Sector Technical Working Group (ES-TGW).
	Ministry of Transport, Works and Infrastructure	This Ministry will back stock the MoPE in the ES-TWG. The Ministry will be responsible for, among other things, the provision of data relevant to emissions in the transport sector.
1	Ministry of Fisheries, Water Resources and National Assembly Matters	The Ministry host the Department of Water Resources (DWR) which has been responsible for all National Communications and Biennial Update reports of the Gambia. The Ministry through the DWR will be responsible for provision of both historical data on previous national and biennial update reports and,

No	Institution	Brief Description of Role and Responsibilities
		share meteorological data for future reports on transparency under the PA.
2	Ministry of Finance and Economic Affairs (MoFEA)	The Ministry of finance oversee the Central Bank of the Gambia and Accountant General's Department and by the same virtue, oversee and manage all financial resources receive or transacted in The Gambia including, but not limited to Climate Finance. The key directorates under the Ministry relevant to the implementation of article 13 of the PA are: A) Directorate of Aid Coordination B) Directorate of Climate Finance C) Directorate of Budget These departments will be engaged through MoFEA for issues on transparency reporting.
3	Ministry of Agriculture:	This Ministry will host the sector Lead Coordinator for the Agriculture Sector who will also second as the coordinator for the Agriculture Sector Technical Working Group (AS-TWG). The AS-TWG will comprise the Department of Livestock, National Agricultural Research Institution (NARI) and Department of Planning Service Unit (DoP) under the same Ministry.
4	Ministry of Land, Regional Governance and Religious Affairs	This Ministry will serve under Forestry and Other Land Use Change TWG - (FOLU-TWG) to provide information on land use change of the Gambia as it relates to GHG emission by sources and removal by sinks in the Gambia. Additionally, the councils under the Ministry will be providing information to WS-TWG.
5	Ministry of Gender, Children and Social Welfare	This Ministry will be a member of all TWG working groups to ensure the mainstreaming of fair representation of gender in all relevant sections of the BTR/NC4 communications
6	Gambia Revenue Authority (GRA)	GRA will be part of Energy TWG to provide information on the volume of energy related products that gain entry through the different ports of the country as per the custom registry. This will provide opportunity to cross check information that will be provided by MoPE and transport sector.
7	National Environment, Agency	The agency will be responsible for the compilation of data on waste sector and will host the sector lead coordinator for waste. The sector lead coordinator for waste will also second as the coordinator of the waste sector technical working group (WS-TWG).

No	Institution	Brief Description of Role and Responsibilities
8	The University of The Gambia	The university will lead research efforts in adaptation stock take of the Gambia in collaboration with all relevant national stakeholders. UTG will form a technical working that will include institutions from relevant government and non-government sectors necessary to carry out research, systemic observation and cross-cutting issues including public relation matters. The Research technical working group (R-TWG) shall include the on-going Technical Assistance on MRV pilot projects under UTG.
9	The Gambia Police Force	The registration unit of the police force will serve as a member of the ES-TWG to provide quantitative data on vehicles that are registered and active in the Gambia. This is key in assessing data relevant to emission in the transport sector.
10	Department of Forestry (DoF)	DoF will be responsible for data collection an GHGI for the Forestry and Other Land Use (FOLU) in the Gambia. The Lead Coordinator will be recruited from DoF and will serve as the coordinator for FOLU-TWG.
11	Department of Parks and Wildlife Management	This department will serve as a member of the FOLU-TWG considering the institution's mandate in managing mangroves which are potent carbon sink.
12	Department of Livestock Services	This department will serve as a member of the AS-TWG and shall provide emission data on enteric fermentation of livestock animals among others.
13	Gambia Bureau of Statistics (GBoS)	GBoS will be responsible for data collection and GHGI associated with the Industrial Processes and Product Use (IPPU) sector. The Bureau will host IPPU sector Lead Coordinator who shall serve as the coordinator of the (IPPU-TWG). The Bureau shall also support the entire data collection and analysis of the different sectors/ TWGs as required, leveraging its expertise in survey and statistical data analysis.
14	National Water and Electricity Company (NAWEC)	NAWEC is the public electricity utility responsible for the generation and sales of electricity in the Gambia. The utility will serve as a member of the ES-TWG to provide emission data on energy generation operations.
15	Petroleum Commission	The Petroleum Commission will serve as a member of the ES-TWG group and will provide information on volume of petroleum products that are imported in the

No	Institution	Brief Description of Role and Responsibilities
		country and any other required information associated with its mandate.
16	National Agricultural Research Institute (NARI)	NARI will be part of the AS-TWG, to provide information on emissions associated with paddy field and other relevant emissions.
17	Department Of Planning Service Unit (DoP)	The DoP under agriculture will serve as the integral member of the AS-TWG given its centrality in the management of synthesized agricultural data. The Department will work in close collaboration with the DLS and NARI to provide information on emission in the agriculture sector.
18	Ministry of Trade, Industry, Regional Integration and Employment (MoTIE)	MoTIE is mandated to oversee at the policy level, all issues regarding trade and industries in the Gambia, hence, its importance in data acquisition on IPPU. MoTIE will therefore serve as a member of the IPPU-TWG.

Table 23 Name and Roles of Institutions in the Proposed Institutional Arrangment for BTR

5.1.5 Organogram for MRV System in the Gambia:

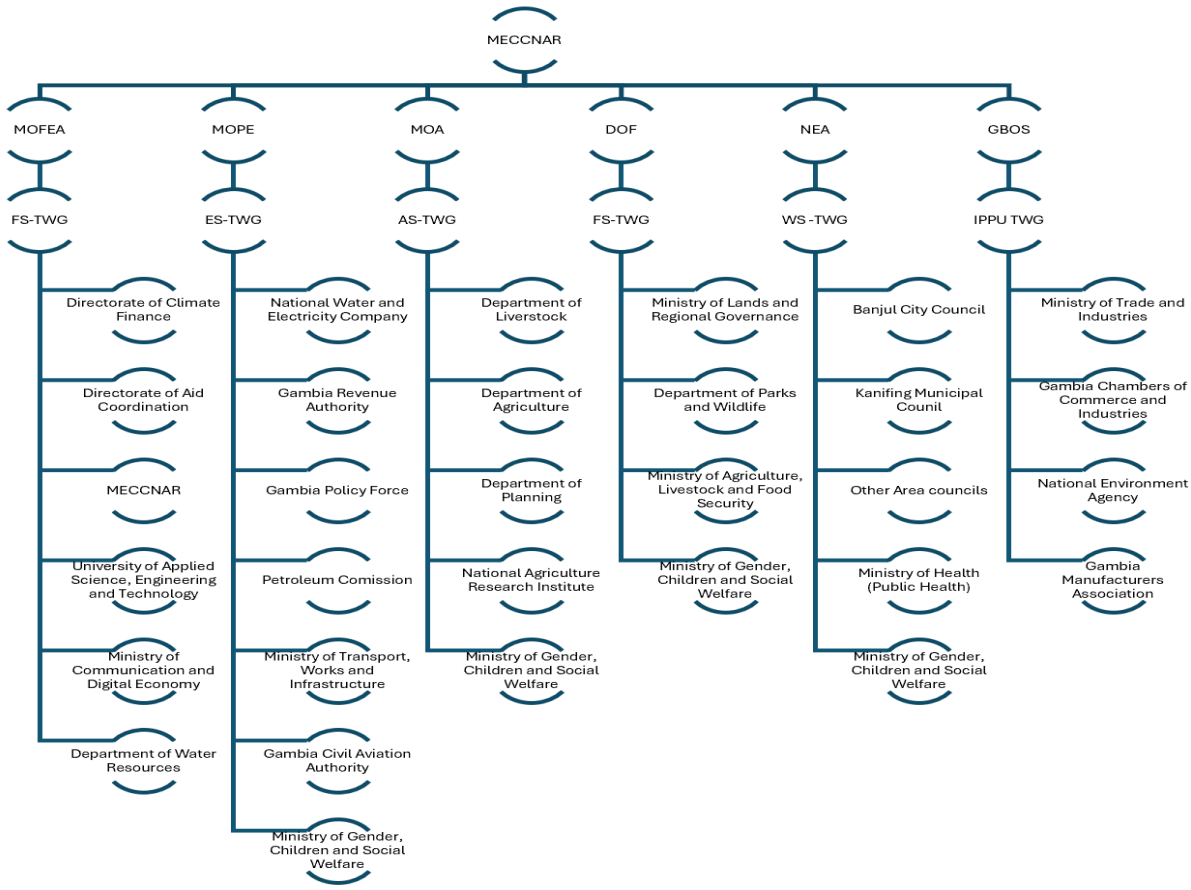


Fig: 33 Current MRV System in The Gambia

5.1.6 Tracking NDC Progress

As part of efforts to implement the Gambia's NDC2 , MECCNAR requested technical assistance (TA) from the NDC Partnership, not only to cost the Country's NDC implementation plan, but also in building national capacities to mobilise resources to meet its commitments as contained in the NDC. MECCNAR and MoFEA are coordinating with the partnership in this exercise

Specifically, the partnership hired a Climate Finance Adviser and NDC in-country Facilitator (Partnership Specialist) to support the newly established Climate Finance Directorate under MOFEA and MECCNAR in their strive to deliver on the NDC implementation plan. Additionally, The Gambia benefited from a regional capacity building in Kigali, Rwanda on the new NDC tracking tool developed by the NDC Partnership. However, there is need for more capacity building on the tracking tool. The Gambia will rely on the tool in tracking its NDC implementation progress, until tailored made local tracking tools are developed, if the need ever arises.

5.1.7 Adaptation Reporting

The Gambia has received funding from GEF through United Nations Environment Programme (UNEP) to develop its first National Adaptation Plan (NAP). The NAP is expected to support the country's transition from project-based adaptation planning to an integrated programme-based approach. The Gambia has already signed a Project Cooperation Agreement (PCA) with UNEP for the immediate development of The Gambia's NAP, where issues concerning adaptation will be accounted for. This will complement information that were or will be communicated in the NCs and Biennial Reports to the UNFCCC transparency division. However, more support on capacity-building and infrastructure is required to enhance the adaptation reporting processes.

5.1.8 Adaptation Communications

At the time of this submission, the Gambia did not submit its Adaptation Communication (AdCOM) as per Decision 9/ CMA.1, which provides guidance for submission of AdCOM. Considering reporting on Adaption has been mainstream in the MPGs for update reports and NCs under article 13 of the Paris agreement, the Gambia will continue to communicate it adaption requirements and efforts in the BTRs and NCs.

5.1.9 Tracking of Climate Finance

As per its mandate, MoFEA has recently established a Climate Finance Directorate to facilitate mobilisation, monitoring and tracking of climate finance resources. In addition, the NCCP further recommends the development of climate change budget coding system that will be harmonised with the existing Integrated Financial Management Information System (IFMIS). The development of such a system would facilitate the tracking and tagging of climate change adaptation, resilience and mitigation resource allocations and expenditures based on climate induced priorities, functions, and thematic areas.

The Ministry of Environment and Climate Change Canada through it's collaboration with MECCNAR, is supporting MoFEA on tracking climate change expenditure through budget coding to ensure accountability of climate finance flow in the country.

ANNEXES

Mitigation measures from the various sector										
Name of Activity	**Description**	**Objectives**	**Types of Instrument**	**Status**	**Sectors affected**	**Gases affected**	**Start year of implementation**	**Implementing entity or entities**	**Estimate of GHG emission reduction(GgCO2eq)**	
									Achieve	**Expected**
Agriculture Sector Mitigation Actions										
GHG reduction from different rice ecologies in the Gambia	Component 1: Upland system Nerica upland rice Component 2: Lowland system - System of rice intensification (SRI) Component 3: Lowland system - Tidal irrigation	To promote the cultivation of upland rice varieties by using efficient water and fertilizer management systems	Second Nationally Determine Contribution(2nd NDC	Implementing	Agriculture	CH_4 N_2O	2020	Agriculture		449 Gg CO2e
Improving agricultural resilience by implementing climate-smart agriculture	CSA proposes a combination of measures that reduce GHG emissions, while also improving the resilience of agricultural production to climate change	To sustainably increase agricultural productivity and the incomes of agricultural producers.	Second Nationally Determine Contribution(2nd NDC	Implementing	Agriculture	CH_4 N_2O	2020	Agriculture		205 Gg CO2e

	impact. It does so typically through a combination of measures involving soil and nutrient management, water harvest and use, biodiversity management, pest and disease control, and the use of quality seeds and planting materials of well-adapted crops and varieties.									
Improving livestock productivity	Some of the mitigation options are already practiced in The Gambia, including free roam grazing and combined forestry with cattle grazing. Still,	To improve animal productivity and reduce emission of selected greenhouse gases, (methane and carbon dioxide)	second Nationally Determine Contribution(2nd NDC	Implementing	Agriculture	CH_4 N_2O	2020	Agriculture		408 Gg CO2e

	livestock make up 11% of national GHG emissions. Additional productivity improvements offer mitigation potential. The World Bank and FAO have identified measures that may still be relevant to the Gambian context, ranging from improved forage quality to grazing management and improved animal health									
Reducing food losses	Reduction of food losses involves activities including: 1. Improved harvesting	To prevent where possible food loss, waste and increase the recycling of all organic waste	Second Nationally Determine Contribution(2nd NDC	Implementing	Agriculture	CH_4 N_2O	2020	Agriculture		131 Gg CO2e

	techniques; 2. Adequate storage to limit exposure to moisture, heat and pest infestation using hermetic bags or metal silos; 3. Applying mobile processing units, solar dryers, graters and pressers, where applicable; 4. Contractual and aggregation points that help bring the product to market and warehouse receipt systems to reduce losses during storage; and, 5. Improved transport conditions									

	and cold storage capacity.									
Forestry Sector Mitigation Actions										
Re-greening degraded landscapes (including protected forests	Enrichment planting on degraded land, Reforestation in schools, road sites, community forest areas. Private forest areas activities and afforestation activities	restore degraded landscape	second Nationally Determine Contribution(2nd NDC	Implementing	Forestry	CO_2	2020	Ministry of Environment, Climate Change and Natural resources(MECCNAR). Climate Change Secretariat. Department of Forestry		373 Gg CO2e
Up scaling deployment of fuel-efficient biomass combustion stoves	supply of fuel efficient biomass combustion stove to households	reduce quantity of fuel wood used by household for their energy needs	second Nationally Determine Contribution(2nd NDC)	Implementing	Forestry	CH_4	2020	Ministry of Environment, Climate Change and Natural resources(MECCNAR). Climate Change Secretariat. Department of forestry		218 Gg CO2e
Multi strata agroforestry	encourage farmers to plant more trees mix with cultivable frops on the same piece of land	enhance/ maximize income for farmers and enhances soil fertility improvement	second Nationally Determine Contribution(2nd NDC)	Implementing	Forestry / Agriculture	CO_2 eq	2020	Ministry of Environment, Climate Change and Natural resources(MECCNAR). Climate Change Secretariat. Department of forestry		169 Gg Co2e
Firewood from	Usage of fuel wood generated	Reduce dependency of household on the	second Nationally Determine	Implementing	Forestry /	CO_2	2020	Ministry of Environment, Climate Change		169 Gg Co2e

agroforestry	from agroforestry sites. Reduce high dependency on the forest cover for firewood consumption	forest cover for firewood consumption	Contribution(2nd NDC		Agriculture			and Natural resources(MECCNAR). Climate Change Secretariat. Department of forestry		
integrated bush fire management	Development of forest fire management strategies and plan	Reduce incidence of forest fires	The Gambia NDC implementation	Implementing	Forestry	CH4	2019			169 GgCO2e
Energy Sector Mitigation Actions										
Promotion of Renewable Energy	In a bid to increase the share of renewable energy in the national electricity mix, thus helping to reduce the country's dependance on imported fossil fuel, the GoTG has put in place the policies, regulations, strategies, and action plans that help in the	-To promote utilisation of renewable energy technologies; -To regulate renewable energy sub-sector as well as encourage local manufacturing; -To provide guidance in the renewable energy sub-sector; Objective for strategies and action plan	Creating the enabling frameworks for the deployment of renewable energy.	Significant awareness of RE has been created, resulting in increased deployment of various renewable energy technologies in the country.	Energy	CO2, CH4, N2O	2005 to Date (On-going)	Ministry of Petroleum and Energy, Public Utilities Regulatory Authority, Renewable Energy Association of The Gambia		Increase the adoption of more sustainable and climate friendly energy technologies

	promotion of renewable energy in the country.									
Development of Utility scale Solar PV plant	In line with The Gambia electricity strategic Roadmap, The GoTG is developing and implementing 3 utility scale solar PV projects namely: 23MWp Solar PV Plant at Jambur; 10.5MW NAMA Solar PV Project in Farefenni and Basse; and 150MWp Regional Solar PV Park in Soma.	1) Increase renewable energy-based electricity generation capacity 2) Reduce fossil fuels imports 3) Reduce Greenhouse gas emissions	Increasing the share of Renewable Energy in the electricity mix	-23MWp Jambur Solar PV Project: Implementation Phase (on-going) -10.5MWp NAMA Solar PV Project: Preparatory Phase (on-going) -150MWp Regional Solar PV Park: Preparatory Phase (on-going)	Energy	CO2, CH4, N2O	-23MWp Jambur Solar PV Project: 2019 – 2024 -10.5MWp NAMA Solar PV Project: 2021 – 2023 -150MWp Regional Solar PV Park: 2022 – 2023	-Ministry of Petroleum and Energy, -National Water and Electricity Company Ltd. (NAWEC), -Ministry of Environment, Climate Change and Natural Resources, -Ministry of Land and Regional Administration		GHG impacts: 20.185Gg CO_2e/year Non-GHG impacts: -Increase the RE share in the national energy mix to 40% by 2030 Create job opportunities for the 100 youths
Development of Utility scale Wind Energy Plant	In a bid to harness wind energy potential along the Coastline to help	1) Increase renewable energy-based electricity generation capacity 2) Reduce fossil fuels imports	Increase the uptake of renewable energy in the electricity generation mix	The project was in operation for one year. However, the Plant ceased to operations	Energy	CO2, CH4, N2O	2010 to date (on-going)	-Ministry of Petroleum and Energy, -National Water and Electricity Company Ltd. (NAWEC), -		GHG Impacts: 8.073Gg CO2e/year Non GHG impacts: -Increase the RE

	diversify the national electricity generation mix, thereby reducing the dependance on fossil fuel based electricity generation, the first PPA for a Utility scale Wind Energy Farm (0.9MW) was signed end of 2012.	3) Reduce Greenhouse gas emissions		following an executive directive. Currently, efforts are on the way to bring the plant back to operation with the option to expand the capacity.				National Environment Agency, - Ministry of Land and Regional Administration		share in the national energy mix to 40% by 2030 Create job opportunities for 100 youths
Deployment of Green Mini-grids	As part of effort to achieve universal electricity access by 2025, the GoTG is cognisant that not all communities can be covered through grid extension. In this regard, the GoTG advocates for the deployment of off-grid solutions	1) Increase access to electricity for off-grid communities 2) Stimulate productive uses of energy and enhance security 3) Reduce the dependence on small gensets and hence contribute to reduction of Greenhouse gas emissions	Increase access to renewable electricity in off-grid communities.	This is a national programme that seeks to promote the deployment of GMG in The Gambia. Currently, 120kW Solar PV GMG has been installed and operational in the community of Nyamanari, URR. Works are also on-going to design and install other	Energy	CO2, CH4, N2O	2022 – To Date (On-going)	Ministry of Petroleum and Energy, Unique Energy, National Environment Agency, Renewable Energy Companies, Local Government Authorities		GHG Impacts: 0.132Gg CO2e/year Non GHG Impacts: - 35,500 households are expected to be served by GMGs corresponding to 1.2 MW of total installed capacity for the 10 GMG studied sites. Creation of Job opportunities for the communities where they will be installed

	such as Green Minigrids to serve as interm electrificatio n options for accelerated universal electricity access.			GMGs in the community of Sare Demba Toro, URR and the Island communities of Jinack (Kajata and Niji), NBR.						
Installation of Solar Home Systems (SHSs)	In order to achieve universal electricity access by 2025, The GoTG is deploying all options for the national electrificatio n program, including solar home systems to provide electricity access to small and remote off-grid rural communitie s in The Gambia.	1) Increase access to electricity for off-grid communities 2) Enhance security and learning at night 3) Reduce the dependence on small gensets and hence contribute to reduction of Greenhouse gas emissions	Provide electricity access to off-grid communities using decentralised Solar PV systems	Since 2017, several remote, off-grid rural communities have been provided with Solar Home Systems. These include: -15 SHSs provided to the community of Ballangar Chamen, in CRR-North -63 SHSs provided to the community of Buduk, in CRR - North	Energy	CO2, CH4, N2O	2017 to Date (On-going)	Ministry of Petroleum and Energy, Renewable Energy Companies, Local Government Authorities		GHG Impacts: 1.287Gg CO2e/year Non GHG Impacts: - Currently, 78 households are already served by SHSs corresponding to 11.7 kW of total installed capacity for the communities of Buduk and Ballangar Chamen. Improved electricity services within the communities where they will be installed
Schools and Health Facilities Solarisation	As part of efforts to electrify all schools and health	(a) To provide reliable electricity supply to selected schools and health facilities;	Provision of Solar PV systems to power several	SESCO as the SPV is moblising for the implementati	Energy	CO2, CH4, N2O	2023 – 2024	Sustainable Energy Services Company (SESCO), MOFEA, MOPE, MOBSE, MOH		GHG Impacts: 1.54Gg CO2e/year

	facilities in the country, the government of The Gambia through the EU delegation intends to solarise 1000 schools and 100 health facilities across the country. A special purpose vehicle, SESCO is established to coordinate and manage the project.	(b) To enhance IT education in schools; (c) To improve health service delivery; (d) To reduce GHG emissions	schools and health facilities	on of the project						Non-GHG Impacts: - Improved health and education services through access to electricity services.
E Energy Mitigation Actions										
Promotion of Energy Efficiency	Aware of the importance of energy efficiency (EE) as a pillar to facilitate universal electricity access, fight against energy poverty, and enhance	-To promote energy efficiency across all sectors such as residentials, commercial/industries, public sectors -To regulate energy efficiency sub-sector; -To provide guidance and incentives for the energy efficiency sub-sector	Creating the enabling frameworks for the promotion of energy efficiency.	Several policies, strategies and measures have been developed to promote energy efficiency and conservation.	Energy	CO2, CH4, N2O	2005 to Date (On-going)	Ministry of Petroleum and Energy, Public Utilities Regulatory Authority, Alliance for Sustainable Cooking Energy of The Gambia (ASCEG), The Gambia Standards Bureau (TGSB)		Increased the adoption of more sustainable and climate friendly energy efficient technologies

	economic and social benefits, the Ministry of Petroleum and Energy (MoPE) with support from partners is commited to put in place the right policies, regulations, strategies, and action plans that helps the intensificati on of energy efficiency projects and programs in the country.									
Energy Efficiency in Public Buildings	With support from the World Bank, the GoTG is conducting energy audits for minimum of 20 public buildings in the country. Following the audits, the GoTG	-To reduce energy consumption of public buildings; -To increase electricity access to others not connected to the electrical grid; -To avoid / delay the construction of new fossil fuel based powerplants	Reduction of the energy consumption of public buildings	Minimum of 20 public buildings are currently being audited and once the audit is completed, a ToR will be developed for retrofitting of the audited public buildings.	Energy	CO2, CH4, N2O	2022 – To Date (on-going)	Ministry of Petroleum and Energy, National Water and Electricity Company Ltd.		GHG Impacts: 12.2462Gg CO2e/m2/year / building and 61.2Gg CO2e/m2/building by 2030 for the audited public buildings

	through the Gambia Electricity Restoration and Modernisation Project (GERMP) will support the retrofitting of the audited public buildings.									
Replacement of inefficient energy appliances in institutions	Under the UNIDO/GEF 6 project, a number of public and private institutions benefitted from the replacement of inefficient appliances (such as light bulbs and ACs) with efficient ones.	-To reduce energy consumption of public buildings; -To increase electricity access to others not connected to the electrical grid; -To avoid / delay the construction of new fossil fuel based powerplants	Reduction of energy consumption for public and private institutions	At least one telecom company benefitted by replacing the inefficient lighting and Acs within it's facilities and transceivers tower sites. Also some public buildings also benefitted with the replacement of their inefficient light bulbs with efficient ones	Energy	CO2, CH4, N2O	Completed (2019 - 2023)	Ministry of Petroleum and Energy, UNIDO-PIU		GHG Impacts: For the entire project life span about 750 000 GgCO2e is expected to be saved (both direct and indirect emissions) Non-GHG Impacts: - About 40% of various energy appliances (Bulbs, and ACs) have been replaced in both public and private institutions Replacement of 305,000 inefficient light bulbs with LEDs

Rehabilitation and expansion of T&D network	Due to the huge increase in electricity demand coupled with the aging T&D infrastructure, there is need to improve and expand the T&D network accross the country. Therefore, with support of partners, the GoTG developed 3 projects namely: The GERMP, ECOREAP, & GEAP to upgrade the T&D infrastructure, and also extend the distribution backbone throughout the country. These projects will construct a new dispatch	(a) To absorb all the existing generation capacity (b) To prepare for future capacity expansion including the OMVG and other pipeline projects; (c) To help reduce T&D losses and power cuts; (d) To extend the distribution networks throughout the country; and (e) To enable future grid extension.	Upgrading and expansion of the T&D infrastructure to reduce technical losses	The upgrading and expansion of the T&D infrastructure include 3 projects which are under implementation and expected to be completed by 2024.	Energy	CO2, CH4, N2O	2018 – 2024	Ministry of Petroleum and Energy, National Water and Electricity Company Ltd.		GHG Impacts: For the entire project life span of 40 years about 24.25 GgCO2e is expected to be saved. Non-GHG Impacts: - Universal access to grid connected electricity to all by 2025

	center, which will increase the ability for the GBA network to absorb intermittent energy from solar and imports from the OMVG interconnector.									
Distribution of improved cookstoves	Due to high rate of deforestation, leading to scarcity of biomass cooking energy and the resultant high domestic cooking energy prices, the Ministry launched a nationwide campaign to distribute annually the following: 1. Improved cookstoves 2. Alternative cooking fuel (briquettes)	The overall objectives of this program are to (i) create awareness among end-users on the importance and benefits of using efficient and clean cooking devices and (ii) distribute efficient and clean cooking devices and fuels in The Gambia.	Mitigate the dependance on forest resources for cooking and heating	The first Nationwide Improved cookstoves distribution campaign was held in 2019 in collaboration with UNIDO. The 2nd campaign was held in North Bank Region in 2022. Distributions of ICS by Private Sector Organisations such as DELAGUA, C-QUEST etc. Currently planning the	Energy	CO2, CH4, N2O	2019 – To Date (On-going)	Ministry of Petroleum and Energy, Ministry of Environment, Climate Change and Natural Resources, Department of Forestry, Department of Community Development, LGAs		GHG Impacts: About 500 GgCO2e/year and 2500 GgCO2e by 2030 Non-GHG Impacts: Access to clean cooking provided to morethan 150,000 urban, peri-urban and rural households accross the country

				3rd campaign in another Region.						
Popularisation of the use of LPG	Given the heavy reliance on fuelwood for cooking, resulting in deforestation and climate change, the GoTG has been making serious efforts to provide sustainable cooking solutions, including LPG. Since 2008, an LPG storage facility has been established to facilitate bulk importation and marketing of LPG in the country.	1) Reduce the dependance on forest resoures for cooking 2) Increase access to clean cooking energy 3) Reduce the Greenhouse gas emission 4) Reduce in-door air pollution, thereby improving health status of women and children	Provide access to clean cooking energy for the population	Increased use of LPG for cooking and Industrial applications	Energy	CO2, CH4, N2O	2008 to Date (On-going)	Ministry of Petroleum and Energy, Oil Marketing Companies, Gam-Petroleum, Public Utilities Regulatory Authority		Increase the supply/stock of LPG in the country at affordable prices, thereby reducing the dependance on forest resources for cooking. Job creation for many Gambians will be a non-GHG impact.
Fuel Switching from Heavy Fuel Oil (HFO) to	As most of the existing electricity power plants are	1) Transition to cleaner fuels for electricity generation	Improve electricity generation efficiency	Preparation and finalisation of tender documents	Energy	CO2, CH4, N2O	2025 - 2026	Ministry of Petroleum and Energy, IPP, NAWEC		GHG Impacts: 1.62 GgCO2e/year

Natural Gas power plants	old, inefficient and bearly operational, thus justifying the need to replace them with new conventiona l power plants with higher efficiency and possibility for operating them using dual fuels such as Natural Gas and Heavy Fuel Oil (HFO).	2) Reduce the dependence on HFO 3) Reduce the Greenhouse gas emissions Increase electricity generation efficiency leading to lower tariff		for the 30MWp Dual Fuel Power Plant						
Transport Sub Sector Mitigation Actions										
Promotion of Fuel Efficient Vehicles	Imported used vehicles, of perceived low standards and quality, are common in The Gambia and their importation has increased over the	-To limit the age of second-hand vehicles imported into the country to 10 years, but for light commercial vehicles is 5 years -To Improve vehicle fuel efficiency, address climate change, improve urban air quality and thereby increase fuel cost	- Limit the age of the vehicles imported into the country - A study was conducted to have a baseline vehicle inventory of imported vehicles and new registration trend as well	The Road Safety Action plan has been validated to enhance the importation of safer and fuel-efficient vehicles to reduce GHG emission in the country. Awaiting	Energy	CO2, CH4 and N2O	To be completed by 2030	MoTWI, MoFEA, TGSB, NEA and GRA		Increase the adoption of more sustainable and climate friendly vehicles

	years. Unlike many other countries, higher taxes are imposed on imported new vehicles than used ones, which contributes to the large share of old vehicles in the country's vehicle fleet, thus contributing to high GHG emissions. The promotion and utilization of more fuel efficient vehicles coupled with cleaner fuels and other relevant regulatory standards will immensely contribute to achieve climate	savings for consumers.	as establish the average fuel economy with corresponding CO2 emissions of The Gambia for policy recommendations to promote import of cleaner and more fuel efficient vehicles.	implementation.						

	change mitigation targets. In order to cap CO2 emissions from vehicles at lower level even if the kilometers driven double by 2050, there is a need to improve vehicle fuel efficiency and formulate emission standards.									
Strengthening public transport systems	Given the rising number of vehicle fleet in the country, it is paramount to have an efficient and reliable public transport system that will pave the way to de-congesting our roads and thereby reducing GHG	-Provide affordable and convenient bus services in place of private cars, will help reduce GHG emissions and thereby mitigating the effects of climate change. -Enhancing the river transport system, will help to de-congest the roads and thereby reducing emissions from vehicles.	Expanding and Improving the public transport systems	New public transport buses have been procured and handed over to the GTSC.	Energy	CO2, CH4 and N2O	2023 – 2030	MOTWI, NRA, GTSC		Increase the adoption of more sustainable and climate friendly vehicles

	emissions. It will also promote mass rapid transportation.									
Waste Sector Mitigation Actions										
Integrated waste management	In a bid to reducing waste and mitigating the negative impact on the environment, three components are relevant for consideration: Component 1: Solid waste management Component 2: Wastewater management Component 3: Small-scale, decentralized waste treatment. All these are necessary to making sure that the waste	-To promote the establishment of land fills -To raise awareness on waste management regulations -To advise councils to adopt proper waste management strategies -To guide the general public on how waste is properly managed	Second Nationally Determine Contribution (2nd NDC)	Ongoing	NEA, MoH, Councils	CH_4 CO_2, N_2O	1997	NEA, Councils, MoH, MECCNAR	Integrated waste management	In a bid to reducing waste and mitigating the negative impact on the environment, three components are relevant for consideration: Component 1: Solid waste management Component 2: Wastewater management Component 3: Small-scale, decentralized waste treatment. All these are necessary to making sure that the waste generated are properly managed at national administrative levels

	generated are properly managed at national administrative levels									
Organic waste recovery	An estimated 53% of municipal solid waste in The Gambia is organic waste. Most solid waste is dumped in informal dumpsites or burned. Only an estimated 3% is composted. Agricultural soils in The Gambia have relatively low fertility. In addition, new processing capacity, like fishmeal factories, increases the industrial organic waste flow.	-to reduce the volume of organic waste that is dumped or burned, while producing a mechanism for soil fertility improvement	Second Nationally Determine Contribution (2nd NDC)	Ongoing	NEA, Councils, NGOs	CH_4 CO_2, N_2O	1997	NEA, Councils, NGOs, CBOs		0 $GgCO_2eq$

Biogas from waste management and landfills	The sewage system is to be improved and equipped with wastewater treatment facilities that capture and use the biogas. Existing landfills are covered and the landfill gas methane is also captured. These activities also aim to avoid pollution of ground and surface waters and contribute to meeting the objectives of existing rural water supply and sanitation initiatives in The Gambia. If the sludge from the wastewater	- To maximize renewable energy-based - Reduce waste stream - Reduce Greenhouse gas emissions	Second Nationally Determine Contribution (2nd NDC	Not yet	NEA, Councils	CH4 CO2, N2O	-	NEA, Councils, NGOs		0 $GgCO_2eq$

	facility is clean, it can be used as an organic fertilizer, thereby replacing the use of synthetic fertilizers.									