THE REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

UGANDA'S SECOND BIENNIAL UPDATE REPORT TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

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August 2025

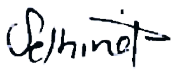
Foreword

On behalf of the Republic of Uganda, I am pleased and honoured to submit Uganda's Second Biennial Update Report (SBUR) to the United Nations Framework Convention on Climate Change (UNFCCC) in fulfilment of its reporting obligation under decision 2/CP/17 paragraph 41(f). This report is Uganda's final Biennial Update Report (BUR) to the UNFCCC as the country will be transitioning to Biennial Transparency Report (BTR) regime under the Paris Agreement as per the decision 18/CMA adopted at COP24 in Katowice. This report also builds upon our first Biennial Update Report (FBUR) submitted in 2019 and the previous National Communications submitted in 2002, 2014 and 2022.

In this report, Uganda has documented the latest information on its national-level efforts on climate actions and its contributions to sustainable development with updated information on the National Greenhouse Gas (GHG) inventory, mitigation actions and their effects, including the associated domestic Monitoring, Reporting and Verification (MRV), and needs and support received, and institutional arrangements. The SBUR publishes key findings covering data for the period 1995-2019.

The information presented in this report is instrumental in shaping government policies and setting priorities for climate action. It will play a vital role in accelerating Uganda's progress toward achieving both its short-term goals under the Nationally Determined Contributions (NDCs) and its long-term vision as outlined in the Long-Term Low Emissions Development Strategy (LTS). This report marks a significant milestone in Uganda's ongoing journey toward a climate-resilient, low-carbon, and sustainable future.

I would like to extend my sincere appreciation to the dedicated professionals from various Government Ministries, Departments, And Agencies, as well as civil society organizations and the private sector, whose invaluable contributions made this report possible. Under the guidance and leadership of the Ministry of Water and Environment, Climate Change Department, their collaborative and participatory efforts were central to the successful preparation of this important document.



Aisha Sekindi (Hon)

MINISTER OF STATE FOR WATER

Acknowledgements

On behalf of the Ministry of Water and Environment, I extend my sincere appreciation to the Global Environment Facility (GEF) for the financial support, provided through the United Nations Environment Programme (UNEP) as the implementing agency, towards the preparation of Uganda's Second Biennial Update Report (SBUR).

The preparation of this report involved a dedicated team of national experts who contributed to the compilation of information on Uganda's National Circumstances, Greenhouse Gas Inventory (NGHG), Mitigation Actions and their impacts, as well as the domestic Monitoring, Reporting and Verification (MRV) system. I wish to acknowledge and thank Mrs. Margaret Athieno Mwebesa, Commissioner - Climate Change, and the technical staff of the Climate Change Department, for their effective coordination and leadership throughout the process.

My deep gratitude goes to Hon. Sam Cheptoris, Minister of Water and Environment, Hon. Beatrice Anywar, Minister of State for Environment, and Hon. Aisha Sekindi, Minister of State for Water, for their invaluable political guidance. I also wish to express appreciation to Members of Parliament, particularly the Parliamentary Standing Committee on Climate Change, led by Hon. Lawrence Biyika Songa, for their continued support.

The Ministry is equally grateful to the various Government Ministries, Departments and Agencies, Local Governments, Civil Society Organizations (CSOs), Academia, Ardent Consultancy Services Limited, reviewers and individuals whose contributions were instrumental in the development of this report.

Eng. Gilbert Kimanzi

For: PERMANENT SECRETARY

Executive Summary

Uganda as a Party to the UNFCCC since 1992 ratified both the Kyoto Protocol (2002) and the Paris Agreement (2016). With support from GEF through UN Environment, Uganda prepared its Second Biennial Update Report (SBUR) to meet UNFCCC reporting obligations. The country has also previously submitted three National Communications, a REDD+ report, and its First Biennial Update Report.

National Circumstances

The Republic of Uganda is a landlocked country in East African with a diverse topography, including highlands, rift valleys, fresh water bodies and various mountain ranges bordered to the east by Kenya, to the north by South Sudan, to the west by the Democratic Republic of the Congo, to the south-west by Rwanda, and to the south by Tanzania.

Uganda's population as of the 2024 census was 45,905,417 persons, reflecting an average annual growth rate of 2.9 percent since the last Census in 2014.

Agriculture is the backbone of the economy, employing approximately 73% of the population. Industry is emerging, led by agro-processing and cement production. Biomass dominates energy use, with hydropower as the main electricity source. The transport sector relies heavily on roads, with infrastructure development underway.

National GHG Inventory

Uganda's Greenhouse Gas Inventory (1995–2019), developed for the Second Biennial Update Report, covers emissions and removals from the Energy, Agriculture, Forestry and Other Land Use (AFOLU), Waste, and the Industrial Processes and Product Use (IPPU) sectors.

Total greenhouse gas emissions rose from 43,875 Gg CO_2e in 1995 to 112,137 Gg CO_2e in 2019. AFOLU sector is the largest emitter (76%), followed by Waste (14.5%) and Energy (9.1%), while IPPU contributed just 0.4%.

The major greenhouse gases reported on include; carbon dioxide (CO2), methane (CH4) and nitrous oxide (N^2O). Precursor gases like NMVOCs, CO, NOx, and SO2 were also included in the inventory report, with NMVOCs being the highest at 2,687.6 Gg. Recalculations used updated data and IPCC AR5 global warming potentials.

The country's greenhouse gas inventory improvement plan proposes to addresses key capacity gaps through a phased approach, focusing on strengthening data collection, data management systems, improving quality control, establishing a technical review team, and enhancing data accuracy through targeted studies.

Mitigation Actions and their Effects

The information on progress of mitigation actions and their effects covers the priority mitigation actions and policies the country is implementing through NDCs, status of participation in international market mechanisms, including REDD+ activities.

By 2023, Uganda had issued over 33 million carbon credits through both compliance (CDM) and voluntary (VCM) markets, with the majority of VCM credits under the Gold Standard. Uganda also qualified for Green Climate Fund results-based payments by submitting its REDD+ Technical Annex, demonstrating commitment to forest-based emission reductions.

Domestic Measurement, Reporting, and Verification (MRV)

Uganda has made significant progress in greenhouse gas (GHG) measurement, with improved institutional capacity and data management, especially in the IPPU sector. An MRV tool was developed to track mitigation actions, though it is not yet fully operational. Challenges remain in documenting support needs and tracking climate finance, with existing databases requiring improvements for better usability and reporting.

Support Received, Constraints and Gaps, and Related Financial, Technical, and Capacity Needs

Uganda has mobilized approximately USD 942 million for 38 climate projects, with most funding from international sources. To meet its NDC targets, Uganda plans to cover 30% of these costs domestically and 70% from external support, requiring an estimated USD 2.5 billion annually. However, significant technical and capacity gaps persist, particularly in GHG data management, institutional coordination, and climate action implementation, posing challenges to achieving national climate goals and the SDGs.

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List of Acronyms

AFOLU	Agriculture Forestry and Other Land Use
ASL	Above sea levels
BAU	Business As Usual
BOD	Biochemical oxygen demand
BRT	Mass Rapid Transport
BUR	Biennial update reports
CBA	Cost-benefit analysis
CCD	Climate Change Department
CCPC	Climate Change Policy Committee.
CDM	Clean Development Mechanism.
CH4	Methane
CO	Carbon monoxide
CO2	Carbon dioxide
CO2eq	Carbon dioxide equivalent
COD	Chemical Oxygen Demand.
DNA	Designated National Authority
ERA	Electricity Regulatory Authority
FREL	Forest Reference Emission Level
FRLS	Forest Reference Levels
FSSD	Forestry Sector Support Department
GDP	Gross Domestic Product
GHG	Greenhouse gas
HEP	Hydroelectric power supply
IICS	Improved Institutional Cook Stoves
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
KCCA	Kampala Capital City Authority
ktoe	kilo tonne of oil equivalent

kWh	kilo Watt hour
LC	Local Council
LPG	Liquefied Petroleum Gas
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MEMD	Ministry of Energy and Mineral Development.
MoFPED	Ministry of Finance, Planning and Economic Development
MoLG	Ministry of Local Government
MRV	Measurement, Reporting and Verification
MSW	Municipal solid waste
MtCO2eq/yr	Metric tonne carbon dioxide equivalent per year.
MoTIC	Ministry of Trade, Industry and cooperative
MW	mega watt
MWh	Mega watt hour
MoWT	Ministry of Works and Transport
N_2O	Nitrous oxide
NAMAs	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NBS	National Biomass Study
NCCAC	National Climate Change Advisory Committee
NCCP	National Climate Change Policy
NDC	Nationally Determined Contribution
NEMA	National Environment Management Authority,
NFA	National Forestry Authority,
NGO	Non-governmental Organisation
NMVOC	Non-methane volatile organic compounds
NWSC	National Water and Sewerage Corporation,
OPC	Ordinary Portland Cement
PCE	Policy Committee on Environment

PFCC-U	Parliamentary Forum on Climate Change-Uganda
PoA	Program of Activities
PPA	Power Purchase Agreement
QA	Quality Assurance
QC	Quality Control
REDD+	Reduced Emissions from Deforestation and Forest Degradation+
SNC	Second National Communication
SO2	Sulphur dioxide
THF	Tropical High Forests
TNA	Technology Needs Assessment
toe	Tonne of oil equivalent
UBOS	Uganda Bureau of Statistic
UCA	Uganda National Climate Change Finance Analysis
UGX	Uganda shillings
UNDP	United Nations Development Program
UNMA	Uganda national Meteorological Authority,
URA	Uganda Revenue Authority
UTGA	Uganda Timber Growers Association
VCS	Verified Carbon Standard

1.0 NATIONAL CIRCUMSTANCES

1.1 Introduction

The Republic of Uganda has completed its Second Biennial Update Report (SBUR), demonstrating its commitment to fulfilling the obligations stipulated in Article 12 of the United Nations Framework Convention on Climate Change (UNFCCC). Following the requirements set forth by the UNFCCC for Biennial Update Reports (BURs), Uganda prepared this document based on the guidelines outlined in Decision 17/CP.8 and Decision 2/CP.17.

To facilitate the successful implementation of the SBUR project, Uganda received support from the Global Environment Facility (GEF) through the UN Environment. This includes updates since the FBUR of the national circumstances and institutional framework, the national greenhouse gas inventory, mitigation actions and their associated impacts, an overview of the domestic measurement, reporting, and verification (MRV) practices, identification of constraints and existing gaps, and an account of the support both received and still required.

1.2 Convention Obligations and Reporting Requirements

The fundamental objective of the UNFCCC is to achieve stabilization of the concentration of greenhouse gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Uganda signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, ratified the Kyoto Protocol in 2002, and ratified the Paris Agreement in 2016. As a party to the Convention, Uganda has developed several policies, laws, and actions for the implementation of the Convention, albeit with very limited progress. Uganda is one of the countries seriously affected by the effects of climate change. The government has developed and implemented several adaptation and mitigation measures mainly from external sources and, to some extent, from its domestic resources.

Uganda has demonstrated its compliance with the reporting requirements of the United Nations Framework Convention on Climate Change (UNFCCC) by diligently submitting its reports. Uganda submitted its first National Communication in 2002, its second National communication in 20014 and its Nationally Determined Contribution in 2015/2016. Following this, Uganda submitted its first Biennial Update Report and third National Communication in 2019 and 2022, respectively. As a non-Annex I Party, Uganda adheres to its obligation of providing a comprehensive account of the measures already taken or planned for the implementation of the Convention. In doing so, the country takes into consideration its shared but differentiated responsibilities, in consideration of its capacities, as well as its specific national and regional development priorities, objectives, and circumstances.

According to the commitments specified in Article 4.1 of the UNFCCC, non-Annex I Parties may provide information concerning programs that encompass efforts to mitigate climate change and facilitate adequate adaptation to it. These provisions offer an avenue for countries like Uganda to outline their initiatives towards combatting climate change and addressing its impacts. Consequently, Uganda has contributed to the collective efforts of the international community to tackle the challenges posed by climate change.

1.3 Institutional, legal, and procedural arrangements

1.3.1 Institutional Arrangements for Climate Change

The National Climate Change Policy of 2015 established the NCCAC, chaired by the Minister of Water and Environment. NCCAC is a high-level technical multi-sectoral stakeholder representation that provides independent technical advice to the Policy Committee on Environment and the Minister on climate change science, technologies, interventional programs on climate change, and best practices for risk assessment, enhancement of the adaptive capacity to potential impacts of climate change and the establishment and achievement of the set targets.

Leadership for climate finance is assigned to MoFPED and is thus the National Designated Authority of the Green Climate Fund. The Climate Change Act (2021) distributes clear lines of climate change responsibilities across various entities, with a focus on collaboration between national and local levels.

The National Climate Change Policy distinguishes two key institutional functions: coordination and implementation. The coordination role is vested with CCD, whereas the implementation role is vested with MDAs and District Local governments.

Various ministries department and government agencies (MDAs) are responsible for compiling data, analysing trends, and preparing reports on specific sectors covered in the BUR. In addition, lead climate change MDAs establish mitigation, adaptation, and compatibility standards, measures, and performance levels for responding to climate change matters that relate to the mandate of the respective lead agencies.

Within Local government, the Natural Resources Department of a district is designated as the department responsible for climate change matters in the district, while the District Environment and Natural Resources Committee, established under section 27 of the National Environment Act, 2019, is designated as the committee responsible for climate change matters in the district.

Lower Local Government Climate Change Committees are appointed on the advice of the District Environment and Natural Resources Committee. The lower local government climate change committees are responsible for climate change matters in their local jurisdictions

1.3.2 Legal Policy Framework for Climate Change

Uganda's national response to climate change is anchored in both legal frameworks and dedicated institutions. Uganda's National Climate Change Policy (NCCP), 2015 is the country's foundational policy document that laid the groundwork for integrating climate change into national planning. It formed the basis for Uganda's NDCs (Nationally Determined Contributions), Climate Change Act (2021), National Adaptation Plan (NAP) and the Climate Change Mechanism Regulations (2025)

The National Climate Change Act (2021) together with the Climate Change Mechanisms Regulations (2025) form a comprehensive legal framework to operationalize national and international climate commitments. The Act stands as the cornerstone legislation, giving legal force to international agreements like the UN Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement. It establishes a legal basis and a clear framework that outlines the roles and responsibilities of various entities involved in climate actions. The regulations define verifier roles, project pathway and emissions trading protocols.

1.4 Country Profile

Geographic Profile

Uganda is a landlocked East African country that lies between longitudes 29° 34' E and 35° 0' E, and latitudes 4° 12' N and 1° 29' S. It borders Kenya, Tanzania, Rwanda, the Democratic Republic of Congo (DRC) and South Sudan to the east, south, southwest and the north respectively. The country is largely situated on a plateau averaging 1,100 m above sea level (ASL) that slopes steadily downwards towards the South Sudan plains.

The plateau has varied topography, ranging from basins, low-altitude rift valleys, and mountains. The plateau has five significant river basins: Lake Victoria, Victoria Nile, Aswa River, Kidepo Valley, and Lake Kyoga. The Kidepo is a critical source of water in the Karamoja semi-arid region characterized by seasonal rivers and streams that provide water during the rainy seasons. Lake Victoria is one of the world's largest lakes (69,000 km2). Lake Edward, Lake George and the Albert Nile are in the western Rift Valley, which is part of the Great Rift Valley, a geological fault system that stretches over 6,000 km from Syria to Mozambique. The Albert Nile flows sluggishly northwards to South Sudan.

Major mountains are the Rwenzori Massif (5,111m ASL) along the border with the DRC in the west and the Elgon Mountain (4,321m ASL) along the border with Kenya in the east. In the north between Uganda and South Sudan lies Imatong mountain (3,029m ASL), while in the northeast at the border with Kenya lies Moroto mountains (3,085m ASL). In the south western highlands are Mgahinga (4,127m ASL). Uganda has more than half of the world's mountain gorilla population found in Mgahinga National Park and the densely forested part of Bwindi Impenetrable National Park (which is about 35km from Mgahinga).

Climate

The central and southern region of Uganda is generally plateau of above 1,000 m ASL and is classified as Tropical Montane under the IPCC world climate zonation. The region has two distinct rainy seasons (bimodal rainfall), with the first rainy season from March to May and the second one from September to November. This region generally has over 1,200 mm per annum and falls under the Tropical Montane Moist sub category.

Further north, the elevation falls below 1,000 ASL, and it gets drier (less than 1,200 mm per annum). The region generally has a single rainy season from April to October. This area is categorized as Tropical Dry and includes the far north eastern semi-arid parts of Karamoja, where annual precipitation may fall below 900 mm.

In the in high-altitude areas of Elgon, Rwenzori, and the south western highlands temperatures may drop to 10°C. Wetter areas with over 750 mm per annum are classified as Warm Temperate wet. Those with less than 750 mm per annum are classified as Warm Temperate dry. The IPCC zonation is important in the estimation of emissions and removals under the Agriculture, Forestry, and Other Land Use (AFOLU) sector.

Population

The total population of Uganda increased by 11.3 million persons from 34.6 million persons in 2014 to 45.9 million persons in 2024. The annual population growth rate was estimated at 2.9% per annum (UBOS, 2024). This is a relatively youthful population with over 40% aged below 14

years. Uganda's ranking in the UNDP's Human Development Index improved from 0.505 points in 2018 to 0.532 points in 2022, but it is still low.

Uganda's population is considered largely rural, with approximately 81% of the population engaged mostly in subsistence agriculture in rural areas (UBOS, 2024). However, within the last two decades, there has been considerable urbanization, with the urban population increasing from 13% in 2002 to 23% in 2024 (UBOS, 2015; 2024). The largest and fastest-growing urban centre is the capital, Kampala, with a population of 1.9 million in 2024 (UBOS, 2024).

Uganda hosts one of the largest refugee populations in Africa. The refugee population was estimated to be over 805,589 people in 2024, mainly coming from the neighbouring countries of South Sudan, DR Congo, Somalia, and Burundi (UBOS, 2024). Their influx further strains already limited social services in refugee settlements (UNHCR, 2022), including land degradation and increased emissions from land use.

Economy

Uganda is a low-income developing country with a Gross Domestic Product (GDP) of approximately $60 billion and GDP per capita of around $1,146 in 2024. GDP per capita increased from 1,042 USD in the financial year (FY) 2021/22 to 1,093 USD in the FY 2022/23 (UBOS 2023). The Services sector is the leading contributor to GDP, accounting for 42.4% of the overall GDP in FY 2022/23, followed by Industry (26%), Agriculture, forestry & fishing contributed 23.8% and, Taxes on products (7.9 %).

Agriculture remains the backbone of the economy, directly or indirectly employing over 70% of the labour force (World Bank, 2022; Bank of Uganda, 2023). External trade is dominated by exports of agricultural products, namely coffee, fish, and tea (Bank of Uganda, 2023). Other important export crops include cotton, maize, beans, and tobacco (National Bureau of Statistics of Uganda, 2023). Important external trade minerals are gold and cobalt (Bank of Uganda, 2023).

Uganda has committed to becoming an upper-middle-income country by 2040 through ambitions outlined in the Third National Development Plan (NDP III) 2020/21–2024/25 and the Fourth National Development Plan (NDP IV). NDP IV covers FY 2025/26 – 2029/30 and is a pivotal framework in the journey toward Vision 2040 and national transformation. It provides a bold, strategic blueprint to fasttrack Uganda's industrialization, economic transformation, and prosperity. It is anchored in five strategic objectives and a clear growth path—with flagship programs and private-sector participation. This will require disciplined implementation, improved governance, infrastructure development, and effective risk management.

Energy Sources

Total primary energy consumption in Uganda was estimated at 7,056 ktoe in 2022, according to the Ministry of Energy and Mineral Development (MEMD). About 90% of the total primary energy consumption is generated through biomass, i.e., firewood (78.6%), charcoal (5.6%), and crop residues (4.7%).

Total electricity generation increased from 4,414 GWh in 2019 to 6,032 GWh in 2022, with per capita consumption of about 150 kWh. Although installed electricity increased from 2019 by about 64%, reaching 2,048 MW by 2024, access to grid electricity remains low at only 26.7% nationally, despite government efforts to expand generation and transmission infrastructure. Uganda plans to

increase the distance of transmission lines from approximately 3,385 km as of December 2022 to 4,354 km by 2025.

Energy use

The consumption of petroleum products is estimated to be increasing at 15% per annum, from 0.7 million m^3 in 2010 to 1.98 m^3 in 2022, according to the MEMD (Statistical Abstract, 2023). Currently, all petroleum products are imported (mainly through Kenya and Tanzania), with diesel and petrol accounting for the largest share of petroleum product demand. Plans towards developing a natural gas pipeline from Tanzania to Uganda to supply natural gas for the iron and steel industry, as well as for domestic and commercial uses, are underway.

The transport sector is the major consumer of petroleum products and plays an important role in Uganda's economy by facilitating the movement of people and goods across the country. It is divided into sub-sectors based on transport modes of road, railway, water, and air.

To address the energy sector challenges and build on existing opportunities, Uganda is developing an Energy Transition Plan (ETP) that intends to modernize and expand the energy sector rapidly to meet national ambitions. These include providing universal access to electricity and cleaner cooking by 2030, modernizing and diversifying the energy mix and promote its efficient use across all sectors, ensuring secure and affordable energy supply, mitigating energy emissions in line with Uganda's NDC climate commitments and, positioning Uganda as an energy hub for the East African region

Industrial Sector

Uganda's industrial sector is young but growing fast. The industrial sector is the largest consumer of electricity by about 64% (Statistical Abstract, 2023), which is generally a clean source of energy. It is estimated that the industrial sector accounts for about 18% of biomass consumption (MEMD, 2014) and thus contributes significantly to emissions associated with land use change. Uganda's cement industry employs a diversified energy mix, combining imported coal, biomass residues, and renewable electricity.

Land resource

According to the National forestry Authority land cover estimates od 2023, open water covers 37,850 km^2 which is about 16% of Uganda's total area of approximately 241,550 km^2. Permanent wetlands lands (mainly papyrus) were estimated at 203,707 km^2, about 4% of the land area (i.e. open water excluded). Prominent wetlands include the Kyoga Basin wetlands, Victoria Nile wetlands, and Albert wetlands.

Area under cropland was estimated at 112,873 km^2 while rangelands (i.e., bush and grassland) were estimated at 53,685 km^2, which is 55% and 26% of the land area respectively. Forests were estimated to cover 25,687 km^2, about 12.6% of the land area.

Forest in Uganda are further categorized into three broad strata of woodlands, Tropical High Forests and forest plantations. Woodlands take the largest share forested area and is estimated covet 7% of land area followed by tropical High Forests (3%) and forest plantations (2%).

Tropical High Forests or rain forests are multi-layered or multi-storey natural woody formations also known as Medium altitude evergreen rainforests with main canopy heights of 30–45 meters (Langdale-Brown et al, 1964). They are generally rich in species biodiversity and may have shrubs on the forest floor and lianas in the upper canopy.

Woodlands or open dry forests are mainly composed of drought-tolerant tree species *(e.g., Combretum, Terminalia, Albizia, Daniellia)*, the canopy is open (trees do not form a continuous closed cover), tree height is lower than wet evergreen forests but may grow up to 20 meters for large individuals. According to the National Biomass study (2009), the minimum height is 4 metre.

Forest plantations are either coniferous comprised pinus and cypress species or Broad-Leaved plantations. Common broadleaved plantations in Uganda are predominantly Eucalyptus spp, *Maesopsis eminii, Acacia mearnsii, some Markhamia Lutea.* Teak plantations or woodlots are common in areas with prolonged dry season in the northern part of the country.

There have been important changes in Uganda's land use since 1990, when Uganda made its first wall-to-wall mapping. The greatest change was the conversion from forest to agricultural land, with natural forest covering 24% of land area in 1990, being reduced to 10% in 2015. According to the Forest Reference Emissions Level (FREL 2018), Uganda lost over 760,000 hectares of natural forests from 2000 to 2015, with a deforestation rate of 2% per year (MWE 2018). The highest loss of forest occurred on private land. Protected areas under the Uganda Wildlife Authority (UWA) had the lowest rate of deforestation over the years.

2.0 NATIONAL GHG INVENTORY

2.1 Introduction

The summary updates of the national GHG inventory results in the SBUR are reported consistent with decision 2/CP.17 and according to the guidelines for the preparation of national communication from Parties not included in Annex I to the Convention contained in the annex to decision 17/CP.8. Full details of the results, the methodologies and the steps followed will be provided in the accompanying National Inventory Report (NIR).

The National Greenhouse Gas Inventory (NGI) for Uganda's SBUR covers the period 1995 to 2019. The SBUR builds on data that was used for the First BUR and the Third National Communication (TNC). Recalculations have been conducted on GHG emission estimates for 1995-2017 for sectors where new datasets became available and where it was possible to have methodological changes. In addition, the latest GHG inventory estimates for 2018-2019 have been added. The IPCC Fifth Assessment Report (AR5) 100-year time horizon GWPs were used to report the CO2 equivalent of the emissions.

The GHG inventory incorporates anthropogenic emissions by sources and removals by sinks of Carbon Dioxide (CO2), Methane (CH_4), Nitrous Oxide (N_2O) in the Energy, Agriculture, Forestry, and Other Land Uses (AFOLU), and Waste sectors and Fluorocarbons (F-gases) in the Industrial Process and Product Use (IPPU) sector. The precursor gases include nitrogen oxides (NOX), carbon monoxide (CO), non-methane organic volatile compounds (NMVOCs), and sulphur dioxide (SO_2).

The Climate Change Department (CCD) in the Ministry of Water and Environment, coordinates the overall preparation of the national GHG inventory. As the coordinating body in the GHG inventory, the CCD constituted technical working groups for Energy, Transport, AFOLU, IPPU and Waste to support data collection and compilation of the GHG estimates.

The CCD ensures that the delivery of the inventory is timely, of excellent quality, and, above all, meets international standards. The CCD also manages QA/QC practices and improvement plans.

2.2 Description of Activity Data and Methodological Approaches

2.2.1 Activity Data on Energy

The activity data used for estimating greenhouse gas emissions from energy and transport are mainly derived from the national energy balance prepared by the Ministry of Energy and Mineral Development (MEMD). The energy balance provides data that is mostly used for the reference approach, while the statistical abstract disaggregates data to sector-level usage. The manufacturing industries and construction is the subsector that mostly requires further disaggregation.

The Ministry of Works and Transport (MoWT), together with Uganda Revenue Authority (URA), provides information on vehicle imports. The fleet of vehicles on the roads, however, is not well documented. This introduces high level of uncertainty in the estimation of emissions from road transport.

The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) provides information on energy use within the sector, though with high level of uncertainty. Uganda Civil Aviation Authority (UCAA) provides data on international aviation and in 2023 started recording data on domestic aviation.

Emissions from domestic aviation are not covered in the SBUR reporting period for this GHG inventory.

Uganda, like most of the developing countries, depends on biomass for most of its thermal energy needs. The household sector is the leading sector in biomass energy consumption. Under the IPCC categorisation, household (residential) and commercial institutions are grouped under "other sectors".

2.2.2 Activity data on Industrial Processes and Product Use (IPPU)

The Ministry of Trade, Industry, and Cooperatives (MTIC) provides data on industrial production, which is mainly cement and lime production. There is an increasing production of cement and clinker to meet the growing need for cement in the booming construction industry. The number of cement industries is increasing to meet the local demand and for export to the neighbouring countries. There are prospective industries, such as iron and steel, which may develop in the future. The use of lubricants is still very low. MTIC is the main source of data for IPPU. Currently MTIC provides data on refrigeration, which enables the assessment of emissions from Hydro Flora Carbons.

2.2.3 Agriculture Activity Data

Activity data for agriculture is mainly from the Ministry of Agriculture Animal Industries and Fisheries (MAAIF) and the Uganda Bureau of Statistics (UBOS).

2.2.3.1 Livestock Activity data

Livestock populations were estimated based on the 2008 and 2021 livestock censuses. Livestock population between 2008 and 2001 was based on interpolation of data from the two censuses. Livestock estimates from 1995 to 2007 were based on extrapolation.

Cattle were subdivided into two sub-groups, Dairy and Other cattle. Exotic and crossbreed cows that yield 1,300 kg[1] of milk per year, or more, were classified as Dairy. Other cattle include all the cows that produce less than 1,300kg of milk per year, and the rest of the multi-purpose cattle. The ***"other cattle"*** were further classified as Nganda, Ankole, Zebu, and multi-purpose exotic/cross breeds. Enhanced Tier 1 emission factors of 76 kg and 52 kg CH_4/head/year were applied for enteric fermentation for Dairy cattle and other cattle sub-categories (Table 2-1).

Data was further disaggregated to sub-region level, considering factors like homogeneity in temperature, breeds, and management practices. The geographical zones are assigned annual average temperatures from the World Bank climate change knowledge portal country database. Characterisation of other livestock (non-cattle) was based on the level of productivity, i.e., low productivity and high productivity for each livestock species.

Small ruminants and swine were each categorized under "High production" and "low production" based on weight using the enhanced Tier 1 IPCC approach. Exotic/ cross breeds with relatively higher weights were characterized as ***"high production",*** and the indigenous breeds with relatively lower weighs were characterized as "low production" (table 2-1).

1 IPPC milk yield are normally estimated in kg. However, there is no big difference using litres or kg given that the density is almost 1. Ranging from 1.026 g/cm3 to 1.035 g / cm3

Table 2-1: Tier 1 enhanced livestock characterisation and application of Emission Factors

Subcategory	System	Parameter for categorization	Weight (kg)	Source (Weights)	kgCH4/ Head/yr
Dairy	Dairy cows	Milk Yield (>1,300 kg/year	450	ILRI PCSL project	76
Other cattle	Nganda	Multi-purpose/ Breed	247	Masaba et al, 2024	52
Other cattle	Ankole	Multi-purpose/ Breed	330	FAO survey (Unpublished)	52
Other cattle	Zebu-Karamoja	Multi-purpose/ Breed	160	FAO survey (Unpublished)	52
Other cattle	Zebu-Teso	Multi-purpose/ Breed	200	FAO survey (Unpublished)	52
Other cattle	Exotic	Multi-purpose/ Breed	400	ILRI PCSL project	52
Goats	High production system	Animal weight	50	Expert Judgement/ Kabiriz, 2022	9
Goats	Low production system	Animal weight	28	Nantongo et al., 2024, FAO 1991	5
Sheep	High production system	Animal weight	65	Expert Judgement	9
Sheep	Low production system	Animal weight	45	Expert Judgement	5
Swine	High production system	Animal weight	72	Expert Judgement	1.5
Swine	Low production system	Animal weight	52	Kampire et al., 2023	1

2.2.3.2 Activity data on manure

]Manure Management: Data requirements for the Tier 1 approach for manure emissions include livestock population, animal weight, and manure management systems. In the IPCC software, the same data structure (sub-categorises) used under enteric fermentation is adopted for manure management. The animal weights used for each sub-category are presented in Table 2-1. The proportion of livestock manure under different manure management systems, for each livestock species, was adapted from Manure management surveys that have been carried out in the country, though they have not been published yet.

Nitrogen applied to soils: Estimating direct nitrous oxide (N2O) emissions from soils requires data on annual inorganic nitrogen applications and nitrogen inputs from crop residues. The annual inorganic nitrogen applied is determined by calculating the difference between nitrogen-based fertilizer imports and exports for a given year. This data has been compiled by the International Fertilizer Development Centre (IFDC) using official trade statistics obtained from the Uganda Revenue Authority, in collaboration with the Ministry of Agriculture, Animal Industry and Fisheries

(MAAIF). The information can be accessed online at Africa Fertilizer, this data is available from 2011 to 2023. Additionally, the nitrogen content of fertilizers is calculated based on their declared nitrogen composition. To estimate the nitrogen content across diverse fertilizer types (of different nitrogen composition) and quantities, weighted means were employed, and the total nitrogen was used as input data.

To estimate nitrogen inputs from applied crop residues, data on the area of harvest and the yield of crops are required. This data was obtained from the FAOSTAT database (https://www.fao.org/faostat/en/#data/QCL), a database with various major crops produced in Uganda, and from this database, 1995 to 2019 data was filtered. The area under cultivation and harvested yield variables were utilized to estimate nitrogen in crop residue following IPCC equations 11.6 and 11.7.

Urea Application: Data was obtained from the IFDC (AfricaFertilizer) site, where official trade statistics were obtained from the Uganda Revenue Authority, in collaboration with the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), available for years 2011 to 2023.

Aggregate Sources Lime Application: This data is available from 2018 to 2022; the lime is captured as limestone and dolomite, and respective emission factors were used.

2.2.3.3 Land Representation

Uganda has a substantial archive of land use cover maps of five mapping epochs of 1990, 2000, 2005, 2010, and 2015. These maps are based on the 13 land uses, by the National Biomass Study (NBS). Land use cover mapping is done by the mapping unit of the National Forestry Authority (NFA). Estimation of biomass stocks is conducted by the inventory unit of NFA. NFA has now developed the capacity to update maps every two years. The forest inventory update can take between 5 to 10 years, depending on the availability of resources.

Traditionally, NFA used the map subtraction approach to estimate change in land use, but it is gradually transitioning into a sample-based area estimation approach. Biomass stock changes are estimated using Tier 1, where the rate of land conversion and or the rate of wood extraction versus the rate of replenishment (annual increment or growth) is captured into IPCC 2006 software. Conversion from land with high biomass stock to one of low stock, e.g., Tropical High Forest (THF) to cropland, results in net emissions. Conversely, converting grassland or cropland to forest plantation will, over time, result in net carbon sequestration and act as a sink.

In Uganda, wood that is extracted from areas under Uganda Wildlife Authority (UWA)'s jurisdiction is negligible and is thus assumed to be zero. Emissions from forest land are thus estimated in forests that are presumed to have significant biomass stock changes, such as Tropical High forest, Woodland, and Forest Plantations outside UWA areas. However, area under UWA is included for completeness.

UBOS and NFA published data on timber and fuelwood extraction for the period 2012 to 2016 was used. Where annual estimates were not available, linear regressions was applied to fill the data gaps. The AFOLU sector Working Group estimated that 50% of fuelwood and wood needed for charcoal production was harvested from forest land and the balance from non-forest land.

Biomass stock coefficients (Emission Factors) are derived from Uganda's National Forest Inventory and are provided in Table 2-2. Where values were not available, IPCC Tier 1 default values were selected for the relevant forest type. For changes in mineral soils carbon stocks, the IPCC default stock change factor for soils were applied (IPCC 2006, Vol 4, Ch 4, pg 4.42).

Table 2-2: Land categories and associated biomass stocks. Source: NFI 2019, Forest Types: FREL 2009; NBS 2002 report.

Land Use Sub-category	Above-ground Biomass	Annual Above-ground Biomass Growth
Unit	[Mg d.m. ha-1]	[Mg d.m. ha-1 yr-1]
Forest Land – Tropical High Forest	230	1 to 4*
Forest Land – Tropical High Forest (Degrades)	100	
Forest Land – Woodlands	20 – 40	5*
Forest Land – Forest Plantations	57	13
Cropland – Subsistence Cropland (perennial)	12	-
Grassland – Rangeland (open and bush grassland)	10 – 15	2
Wetlands – Wetland	0	NA
Settlements	0	NA
Other Land	0	NA
Wetlands – Open Water	0	NA

**The figures were adjusted to IPPC default values. The NBS data was biased towards high population density areas where forests have a high level of disturbance and thus high levels of regrowth and annual increment. The growth rate in less disturbed areas is expected to be close to the IPCC default value of 1.5 Mg d.m. ha-1 yr-1, AFOLU SWF.*

2.2.4 Activity Data on waste production and disposal

The waste sector is one of the areas where emissions may increase as soon as the oil and gas industries develop. Currently, there are three types of wastes generated in Urban areas, namely solid waste, domestic wastewater and industrial wastewater. Some waste might be burnt in open air or incinerated. Part of waste might undergo biological treatment (e.g composting) but there is paucity of data on waste that undergoes this process. Currently, most of the emissions come from solid waste and wastewater discharge in the urban centres.

The emissions from solid waste depend on the composition and treatment at management facilities. Information on solid waste generation and disposal is provided by urban authorities, a major one being the Kampala Capital City Authority (KCCA). Per capita solid waste production and composition of solid waste in is mainly informed by studies conducted by UBOS and researchers.

NEMA, KCCA and the National Water and Sewerage Corporation (NWSC) are major sources of data on domestic wastewater and industrial wastewater treatment and discharge. The Directorate of Water Resources in the Ministry of Water and Environment is responsible for issuing water abstraction and wastewater (effluent) discharge permits. The three agencies coordinate and provide other important information needed to estimate emissions from waste water such as degradable organic component (BOD) and Chemical Oxygen Demand (COD).

Biological treatment of waste is applicable to several waste categories including Industrial waste, Municipal Solid waste and Sewage Sludge. With financial support from the World Bank, NEMA established Municipal Solid Waste (MSW) compositing plants in 12 municipalities. Most data on biological treatment of solid waste is provided by NEMA.

2.2.5 Assessment of Completeness of Activity Data

Uganda's ultimate goal is to estimate and report on all relevant categories of sources, sinks, and gases. Availability and reliability of activity data for the relevant source categories is used as an indicator of completeness of Uganda's NGHI using the following assessment criteria (Table 2-3):

Table 2-3: Score for Assessing Completeness

M	Measured (metered or any other regular measurement)
MP	Measured partially (measurement does not cover the entire source category)
DM	Derived from other measurements (based on statistics or special studies, may not adequately represent the source category.
EO	Estimated from Other (estimated or interpolated from a one-off survey)
EJ	Expert judgment (available statistics do not adequately cover the source category; adjustments made based on experts in key institutions and academia)
X	Not known and not estimated.
F	For future consideration, not relevant today, but considered a very important source soon (within 5 years)

Table 2-4 shows that most source categories in the energy sector are measured apart from charcoal production, which is based on special studies. Energy use in the manufacturing industries and construction is not disaggregated but grouped under the non-specified industries. Data on imports of vehicles is now readily available, but there is still a challenge in having a complete data set on the fleet of vehicles (total vehicles on the road).

Uganda has just published the livestock census data, which is a major improvement in the estimation of emissions from Agriculture. The land use sub-sector ranks highest in having regular monitoring of activity data (Table 2-4).

Data on cement and lime production is currently regularly collected. Little or no activity data is available on other industrial processes. The industrial sector is still young in Uganda, and this partly explains the lack of activity data in these source categories.

Waste disposal is a major issue in cities, and this explains why activity data is only available in municipalities.

Table 2-4: Uganda's GHG state of completeness in terms of Activity Data

Sector & Sub Sector	Activity Data Requirements - IPCC 2006	Description	State
ENERGY			
Fuel combustion activities / Energy industries			
Electricity Generation	Mass or Volume fuel consumed per kWH	Data available and well-documented	M
Combined Power & Heat	Mass or Volume fuel consumed per kWH	Data available and well-documented at CHP facilities	M
Petroleum Refining	To be assessed on commencement of commercial production		F

Sector & Sub Sector	Activity Data Requirements - IPCC 2006	Description	State
Manufacture of Solid Fuel (Charcoal)	Mass or Volume fuel consumed per unit of Charcoal produced	Data on charcoal production and use is based on special studies	DM
Manufacturing Industries	Consumption (Mass or Volume) and Conversion factor (TJ/UNIT output)	Data not desegregated to capture individual industries	DM
Fuel combustive activities / Transport			
Transport\Civil Aviation	Aggregate fuel consumption domestic and international aviation. Fuel use at LTO and cruise for detailed systems	Aviation fuel consumption is available in national energy statistics and the energy balance, however excludes domestic aviation data for years prior to 2023.	DM
Transport\Road\Rail	Fuel consumed by fleet category (distance and or tonnage)	Data on the fleet of vehicles is incomplete thus emissions cannot be computed by the sub-sector	DM
Transport\Water & Other	Fuel consumed by water transport category and others (distance and or tonnage)	Data on the fleet of vehicles is incomplete. Thus, emissions cannot be computed by the sub-sector; estimates were made based on the national energy balance for 2015.	DM
IPPU			
Mineral Industry			
Cement	Data on cement clinker production, import, and export is available in national statistics. Clicker import data is available.	All data is available	M
Lime	There is no activity data for lime in the national statistics.	Industrial lime is monitored by URA records. Artisanal lime is not well-documented	M
Product Uses as Substitutes for Ozone-Depleting Substances	Currently data is available agents emissions from mobile Air Conditioning and refrigeration, and fire protection	Documentation yet to be well streamlined. There is a request for capacity building in this field	DM

Sector & Sub Sector	Activity Data Requirements - IPCC 2006	Description	State
AFOLU			
Livestock			
Enteric Fermentation	Livestock population data from 1995 to 2007 was extrapolated from 2008 livestock census. The livestock between 2008 and 2019 was interpolated from the 2008 and 2021 livestock census.	Data for categorising cattle into Dairy and other was based on milk yield. Dairy cattle produce >1300 kg per year	M
Manure Management (Ch4 and N2O Direct)	Manure management systems disaggregated by key breed categories for each livestock species	Manure management systems based on surveys and expert judgement	EO
Aggregate Sources Lime Application	Annual amount of lime application categorized into Dolomite and Limestone	IFDC database (https://africafertilizer.org/#/en), https://africafertilizer.org/#/en	M and EJ
Aggregate Sources Urea Application	Annual amount of urea application	Fertilizer imports \ Exports compiled by IFDC and MAAIF (www.africafertilizer.org) coupled with expert judgement.	M and EJ
N2O From Managed Soils (Direct)	Annual organic and chemical fertilizer application (Tones) and N fraction in fertilizer	Fertilizer imports \ Exports compiled by IFDC and MAAIF (www.africafertilizer.org) coupled with expert judgement.	M and EJ
N2O From Managed Soils (Indirect)	Annual organic and chemical fertilizer application (Tones) and fraction that volatilizes	Fertilizer imports \ Exports compiled by IFDC and MAAIF (www.africafertilizer.org) coupled with expert judgement.	M and EJ
Land			
Land remaining the same land	Wood extraction and or change in biomass in land remaining the same	Based on periodic satellite image interpretation and analysis, Wood extraction statistics	M
Land conversions	Spatially explicit data on land conversions and biomass stocks	Based on periodic satellite image interpretation and analysis	M
Aggregate sources burning	The area burnt, fuel available for burning, and EF burning by land strata	Burnt area estimated based on NASA data on burnt area, active fire also provides clues	DM

Sector & Sub Sector	Activity Data Requirements - IPCC 2006	Description	State
N2O from Manure (Indirect)	Annual nitrogen excretion and fraction of N that volatilizes	Expert judgement \ IPCC default values	M and EJ
CH4 Rice Cultivation	Annual rice area cultivated or harvested by flood management and agricultural inputs	FAOSTAT - harvested area	DM and EJ
Waste			
Managed Disposal Sites	Degradable Organic Carbon (DOC) and Methane fraction of waste by population and waste type (food, paper, textile, sludge, industrial waste, nappies, etc.)	DOC provided by NEMA and DRW, Activity Data partly available in key Municipalities	MP
Unmanaged and uncategorized Disposal Sites	Degradable Organic Carbon (DOC) and Methane fraction of waste by population and waste type (food, paper, textile, sludge, industrial waste, nappies, etc.)	DOC provided by NEMA and DRW, Activity Data partly available in key Municipalities	DM and EJ
Biological Treatment	Waste category amount (food, paper, textile, sludge, industrial waste, nappies, etc) treated mainly by municipalities (anaerobic and or Composite systems)	NEMA has Activity Data of composting sites	MP
Waste Incineration	Amount of waste incinerated by (food, paper, textile, sludge, industrial waste, nappies, etc), fraction of dry matter content, the fraction of carbon in dry matter, fraction of fossil carbon in total carbon	UBOS has estimates	MP
Open Burning	Population by region, fraction of population that burns waste, Kg waste /person/day, fraction burnt (compared to treated), days in a year	Data not available	EJ
Waste Water treatment and discharge (Domestic and Industrial)	Low \ High income rural and urban (discharge pathways i.e., sewer type, latrine by depth, latrine type, lagoon type)	Data is partially available. Provided by NEMA and DWR	M and MP

2.2.6 Methodological approach and emission factors applied.

The methods described in the 2006 IPCC guidelines were used to compute emissions/removals for each category. In most sectors, tier 1 IPCC methodology was used, but a higher tier methodology was used when national emission factors (EFs) and detailed activity data exist. For example, the livestock sector used Teir 1 enhanced characterization relating EFs to milk productivity.

Apart from the forestry sector, where country-specific coefficients are applied (i.e., carbon stocks), the computation of GHG emissions is based on default emission factors as provided in the IPCC guidelines. Thus, in many instances, the Tier 1 approach and default values are applied (Table 2-5). Uganda has no chemical and electronic industry. Emissions from these industries current do not occur.

Table 2-5: Methodological tiers and emission factors for emission/removal categories

IPCC Code	Emission Sources/Removal Categories	CO2		CH4		N2O		PFCs		HFCs	
		Meth	EF	Meth	EF	Meth	EF	Meth	EF	Meth	EF
1.A	Fuel Combustion	T1	D	T1	D	T1	D				
1.A1	Energy Industries	T1	D	T1	D	T1	D				
1.A2	Manufacturing Industries and Construction	T1	D	T1	D	T1	D				
1.A3	Transport	T1	D	T1	D	T1	D				
1.A4	Other Sectors	T1	D	T1	D	T1	D				
1. B	Fugitive Emissions	NE	NE	NE	NE						
1.B1	Solid Fuels			T1	D						
1.B2	Oil and Natural Gas	NE	NE	NE	NE						
1.B3	Other Emissions from Energy Production	NO	NO	NO	NO						
2.A	Mineral Products	T1	D								
2.B	Chemical Industry	NO	NO	NO	NO						
2.C	Metal Production			NE	NE						
2.D	Non-Energy Products from Fuels and Solvents Use	T1	D								
2.E	Electronics Industry									NO	NO
2.F	Product Uses as Substitutes for Ozone-Depleting Substances									T1	D
3.A	Livestock			T1	D		T1	D			
3.B	Land	T 1 , T2	CS	T1	D						
3C	Aggregate sources and non-CO2 emissions sources on land	T1	D	T1	D	T1	D				
4.A	Solid waste disposal			T1	D						
4.B	Biological Treatment of Solid Waste			T1	D	T1	D				

IPCC Code	Emission Sources/Removal Categories	CO2		CH4		N2O		PFCs		HFCs	
4. C	Incineration and Open Burning of Waste	T1	D	TI	D	T1	D				
4. D	Wastewater Treatment and Discharge			TI	D	T1	D				

Key: **CS**= Country-Specific, **NE**= Not Estimated, **NO**=Not Occurring, **D**=Default IPCC methodology and emission factor, **EF**= Emission Factor, Meth=Methods, T1, T2 - Levels of Tiers

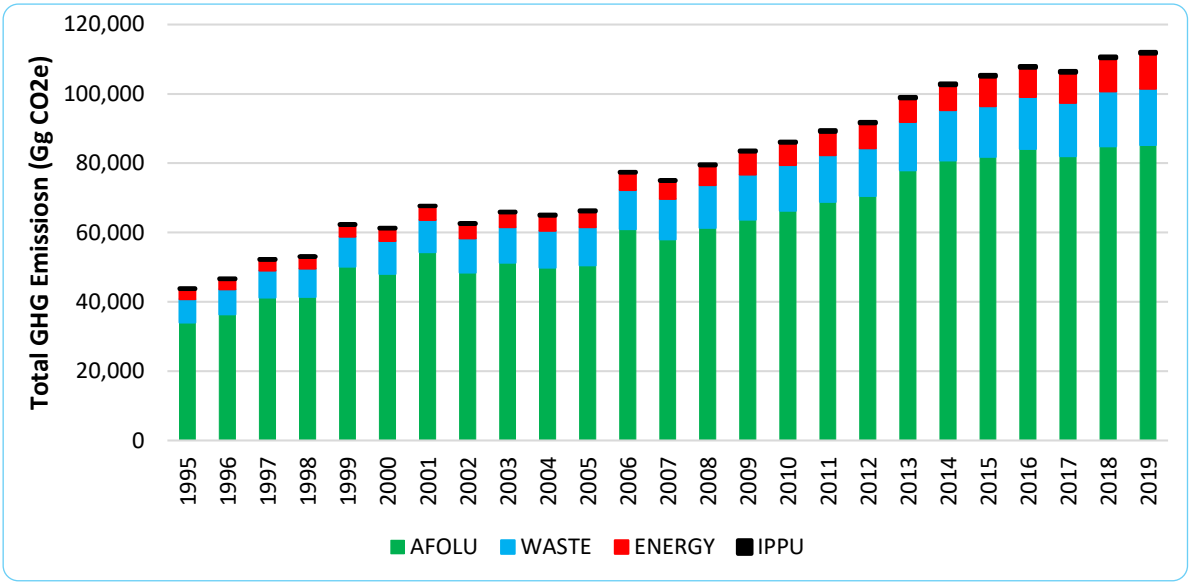
2.3 Overview of GHG Emissions and Sinks

2.3.1 Uganda's total GHG trends

Over the last 25 years (1995 to 2019), Uganda's net greenhouse gas emissions have increased from 43,8775 Gg to 112,137 Gg CO2e, an average increase of 6.2% per annum (Figure 2-1). IPPUU and Energy have had the highest increase at 10.3% and 9.7% per annum respectively. AFOLU increased at 6% per annum while the waste sector had the lowest increment at 5.7% per annum. From 1995 to 2019, AFOLU has been a major source of emissions, accounting for about 76% of the total emissions in 2019. From 1995 to 2019, the waste has been the second-largest source of emissions, contributing an average of 14.5% of the total emissions in 2019. The energy sector has, on average, contributed 8%, and IPPU less than 0.5% (Figure 2-1).

Previous greenhouse gas inventories in Uganda indicated that the energy sector was second AFOLU in emissions. In absolute terms there is no difference in energy emissions estimates between the previous greenhouse gas inventory compared to the SBUR. The main difference is that emissions from the waste sector have increased because of the improvements in estimating domestic wastewater treatment and discharge.

Figure 2-1.Total GHG emissions Trend per sector for the period 1995-2019



2.3.2 Key gases and sources

The AFOLU sector remained a major source of greenhouse gases (76%), contributing 92% of CO_2, 55% of methane CO_2e and 78% of nitrous oxide CO_2e (Table 2-6). Carbon dioxide was mainly from the land use subsector, attributable to forest degradation and deforestation. The major source of methane (CH_4) was enteric fermentation from ruminant animals, while the major source of N_2O was burning, manure management and N_2O from managed soils. The energy sector was the third most important source of emissions (9.1%) accounting for 7% of total CO_2 emissions and 14% of total N_2O emissions. The waste sector was the second most important source of emissions (14.5%) accounting 35% of total CH_4 emissions and 11% of N_2O. CH_4 emissions in the waste sector were mainly from waste wate treatment and discharge (form domestic water and industries) and, solid waste disposal.

IPPU contributed the least emissions but was the only source of hydrofluorocarbons (HFCs) attributable to industrial processes and products that use substitutes for ozone-depleting substances (Table 2-6).

Table 2-6: Key gases, in Gg CO_2e, and sources (2019)

Category	CO_2e Gas								Total by sector	
	Net CO_2	% gas	CH_4	%gas	N_2O	%gas	HFCs	% gas	Sector CO_2e	Sector %
Total National Emissions and Removals	60,603	100%	45,445	100%	5,990	100%	118	100%	112,156	100%
Energy	4,522	7%	4,839	11%	816	14%	0	0%	10,177	9.1%
Industrial Processes and Product Use	369	1%	0	0%	-	0%	118	100%	487	0.4%
Agriculture, Forestry, and Other Land Use	55,704	92%	24,875	55%	4,671	78%	0	0%	85,251	76%
Waste	8	0.01%	15,731	35%	502	8%	0	0.00%	16,241	14.5%

Precursor gases are presented in the common reporting table (Table 2-7) and these include nitrogen oxide (NOx), carbon monoxide (CO), non-methane organic volatile compounds (NMVOCs), and sulphur dioxide (SO2). Among the precursor gases, NMVOCs, generated from fuel combustion activities and aggregate sources on land was the highest, estimated at 2,687.6 Gg. Other precursor gases were CO (1,648.5 Gg) and NOx (83.2 Gg) from fires and fuel combustion activities. SO_2, generated from fuel combustion activities was the list, estimated 10.9 Gg.

Table 2-7: Common reporting table for greenhouse gas emissions in 2019

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)			
Categories	**Net CO2**	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**NF3**	**Nox**	**CO**	**NMVOCs**	**SO2**
Total National Emissions and Removals	60603.5	1527.2	22.6	117.5	N/E	N/A	N/A	83.2	1648.5	2686.6	10.9
1-Energy	4521.7	172.8	3.1	N/A	N/A	N/A	N/A	77.8	1556.9	2686.6	10.9
1.A-Fuel Combustion Activities	4521.7	172.8	3.1					77.8	1556.9	2686.6	10.9
1.B-Fugitive emissions from fuels	NE	NE	NE					NA	NA	NA	NA
1.C-Carbon dioxide Transport and Storage	NO							NO	NO	NO	NO
2-Industrial Processes and Product Use	369.5	NA	NA	117.5	NA	NA	NA	NA	NA	NA	NA
2.A-Mineral Industry	369.4	NA	NA					NA	NA	NA	NA
2.B-Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C-Metal Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.D-Non-Energy Products from Fuels and Solvent Use	0.02	NA	NA					NA	NA	NA	NA
2.E-Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F-Product Uses as Substitutes for Ozone Depleting Substances				117.5	NE	NA	NA	NA	NA	NA	NA
2.G - Other Product Manufacture and Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H-Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Agriculture, Forestry, and Other Land Use	55704.4	888.4	17.6	NA	NA	NA	NA	5.5	91.7	NA	NA
3.A-Livestock		876.6	10.4					NA	NA	NA	NA
3.B-Land	55688.6							NA	NA	NA	NA
3.C-Aggregate sources and non-CO2 emissions sources on land	15.8	11.8	7.2					5.5	91.7	NE	NA
3.D-Other	NA	NA	NA					NA	NA	NA	NA
4-Waste	7.9	466.0	1.9	NA	NA	NA	NA	NA	NA	NA	NA
4.A-Solid Waste Disposal		271.8						NA	NA	NA	NA
4.B-Biological Treatment of Solid Waste		5.6	0.3					NA	NA	NA	NA
4.C-Incineration and Open Burning of Waste	7.9	0.1	0.002					NA	NA	NA	NA
4.D-Wastewater Treatment and Discharge		188.4	1.6					NA	NA	NA	NA
4.E-Other (please specify)	NA	NA	NA					NA	NA	NA	NA
5-Other	NE	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)			
Categories	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NF3	Nox	CO	NMVOCs	SO2
5.A-Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			NE					NA	NA	NA	NA
5.B-Indirect CO2 emissions from the atmospheric oxidation of CH4, CO and NMVOC	NE							NA	NA	NA	NA
5.C - Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items (5)											
International Bunkers	344.3	0.0	0.0	NA	NA	NA	NA	NA	NA	NA	NA
1.A.3.a.i - International Aviation (International Bunkers)	344.3	0.002	0.01					NA	NA	NA	NA

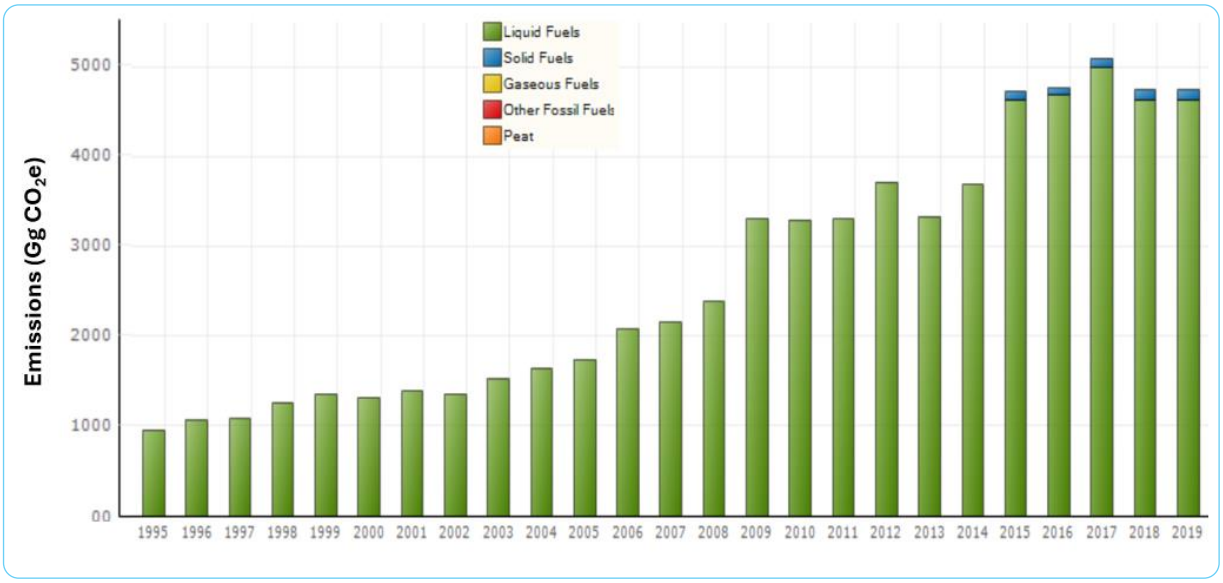
2.4 National GHG Inventory Results by Sector

2.4.1 Energy sector

2.4.1.1 Results based on the Reference Approach

As in indicated in the Third National Communication, there was a sudden increase in emissions in 2009, 2012 and another increase in 2015. The 2009 peak coincides with the commissioning of the Namanve (Jacobsen) thermal power electricity generation plants of 2008. For about four years from 2011, the Namanve plant was operating at its full 50 MW capacity continuously for 24 hours. This possibly explains why increased but erratic emissions in this period. In the period 2015 to 2019, emissions have fluctuated between 4,700 Gg and 5,087 Gg, with liquid fuels contributing to over 98% of the emissions (Figure 2-2).

Figure 2-2. Fuels related emissions trends (reference approach).



2.4.1.2 Results Based on the Sectoral Approach

Energy (fuel Combustion activities)

Emissions in the energy sector is from four major sub categories of energy industries, accounting for 16% of the emissions, manufacturing industries and construction (11%), transportation (27%) and other sectors (45%).

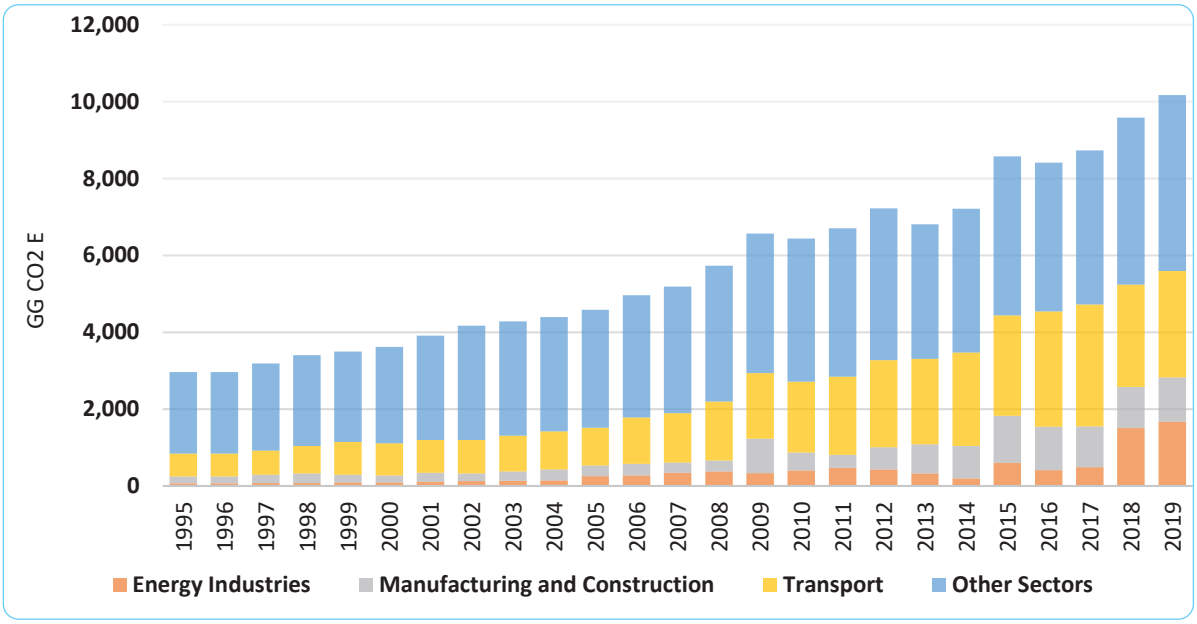
The other sectors subcategory is comprised of the household sector, commercial and institutional sector and, off road combustive activities in agriculture and forestry plus fishing (mobile combustion). Within the other sector subcategory, CH_4 from burning biomass based fuels (charcoal and wood) in households and to some extent in commercial and institutional sectors accounts for over 70% of emissions (in terms of CO_2e). Carbon dioxide emissions from the other sub sector is mainly from combustion of liquid fuels in fishing, off road forestry and agriculture activities and to some limited extent use of LPG for cooking.

From 1995 to 2019, emissions from the energy sector have increased from 2,966 Gg CO_2e to 20,174 Gg CO_2e which an increment of 10% per annum. From 1995 to 2019, the share contribution from the transport sector has increased from 20% to 27% while the share of the 'other sectors' has in general decreased from 70% to 54%. Emissions from the transport sub sector are mainly in form of CO_2 (98%) with CH_4 and N_2O accounting for 1% each. The transport sub sector is also a major source of emissions in the entire energy sector accounting for 60% of the CO_2 emissions.

Under the energy industries subsector, fuel combustion from thermal electricity generation greatly fluctuated during Uganda's energy shortage period 2011 to 2015. For example, there was a sudden increase in emissions from thermal electricity power generation from 2009 coinciding with commissioning of thermal electricity generators. This was to cater for the shortfall in Hydro Electricity generation due the reduced volumes of water in Lake Victoria.

From 1995 to 2019, emissions from the manufacturing industries and construction have increased six-fold from 178 to 1,151 Gg CO_2e which is an average 22% per annum (figure 2-5). This increase in emissions is influenced by increased demand of fuels by industries, the cement industry being among the major industries.

Figure 2-3: Trends, Gases, and sources in the energy sector (1995 to 2019)



2.4.1.3 Comparison of reference approach to the sectoral approach

Overall, CO2 fuel emissions between the reference approach and sectoral approach have a difference of 5% (Table 2-8) which indicates that they are not significantly different. As explained in section 2.1 of the data sources, the statistical abstract disaggregates data on energy consumption to different sectors, but it is not detailed enough. The allocation of energy fuel types is thus not very accurate. For example, the reference approach does not capture information on coke, while the sector approach does not include aviation gasoline (table 2-8).

Table 2-8. Comparison of the CO_2 fuel emission reference approach with the sectoral approach (2019)

Reference Approach			Sectoral Approach		
Fuel	**Apparent Consumption (TJ)**	**CO2 Emissions (Gg)**	**Energy Consumption (TJ)**	**CO2 Emissions (Gg)**	**CO2 Emissions (%)**
Aviation Gasoline	4569	320			100%
Gas/Diesel Oil	30483	2258	32857	2435	7.27%
Liquefied Petroleum Gases	284	18	2721	172	89.6%
Motor Gasoline	24999	1732	30576	1887	8.2%
Other Kerosene	2146	154	1980	28	-441.7%
Residual Fuel Oil	1849	143	40	0	100%
Coke Oven Coke / Lignite Coke	0	0	902	0	0%
Other Bituminous Coal	1199	113	11	0	100%
Overall	**65529**	**4739**	**69088**	**4522**	**5%**

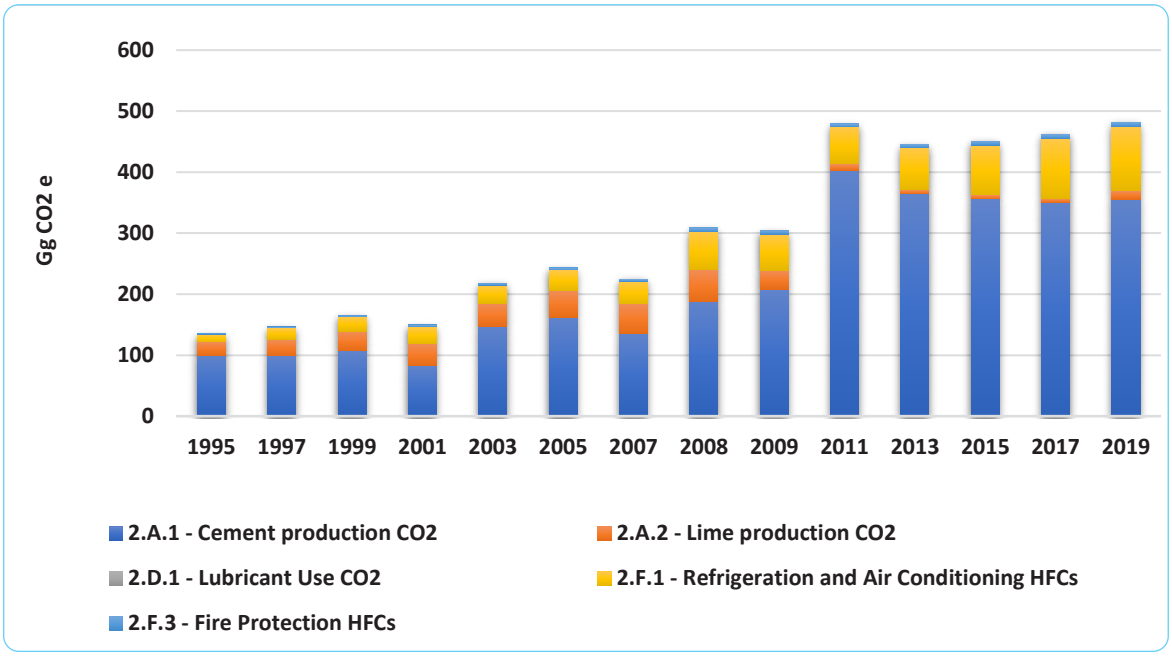
2.4.2 The Emissions from the Industrial Processes and Product Use (IPPU)

Emissions from IPPU are mainly CO_2 and from cement and lime production. From 1995 to 2019, CO_2 from cement production continued to rise, contributing to 74% of total IPPU emissions, reaching a peak of 84% in 2011. On the other hand, emissions from lime production have reduced over time, with the share contribution to IPPU falling from over 20% in 2007 to 1% in 2019.

In 2015, CO2 emissions from cement and lime production combined are estimated at 363 Gg CO_2e, which is 35% higher than estimates the First BUR. Given that the same emission factors are used the difference in emissions is solely due to updated data from the MTCI. Increased emissions are due to increased cement production which is driven by the growth in the building and construction industry.

Included in the SBUR are emissions of HFCs from substitutes of Ozone Depleting Substances (mainly fire protection and refrigeration substances). In 1995, HFC emissions were estimated at 13.7 Gg CO_2e. In 2015, HFCs were estimated at 87.9 Gg CO_2e, rising to 112 Gg CO_2e in 2019, an average increase of 5.4% per annum (Figure 2-4). Major sources of these emissions are mobile Air Conditioning and refrigeration, and Stationary Air Conditioning, estimated at 105 Gg CO_2e, and fire protection agents at 7 Gg CO_2e. CO_2 emissions from lubricant use are estimated to constitute less than 0.003% of the total IPPU emissions.

Figure 2-4: Emissions trends IPPU, 1995 to 2019

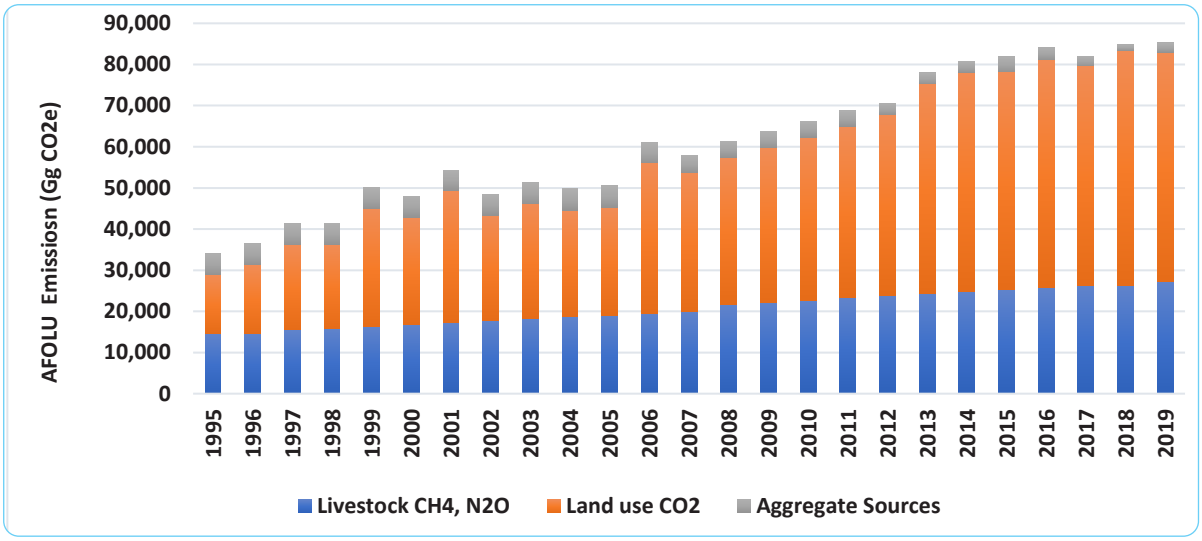


2.4.3 Overview AFOLU Sector

From 1995 to 2019, emissions from the AFOLU sector rose from about 34,070 Gg to 85,251 Gg CO_2e. Due to the change is estimating emissions, especially in the livestock sector, total AFOLU emissions are higher than in the TNC and FBUR. However, the rate of increase in emissions is on average lower at 6.0% compared to 7.3% in the TNC and in BUR.

The land use change and forestry was the leading sources in the AFOLU sector accounting for 60% of the total emissions followed by methane and nitrous oxide emissions from livestock at 34% (figure 2-5). Aggregate sources and non CO_2 from land accounted for 7% of the AFOLU sector. This is mainly from burning of woodlands and rangelands and nitrous oxides from managed soils.

Figure 2-5: Emission trends in AFOLU (1995 to 2019)



2.4.4 Emissions attributable to livestock and manure management

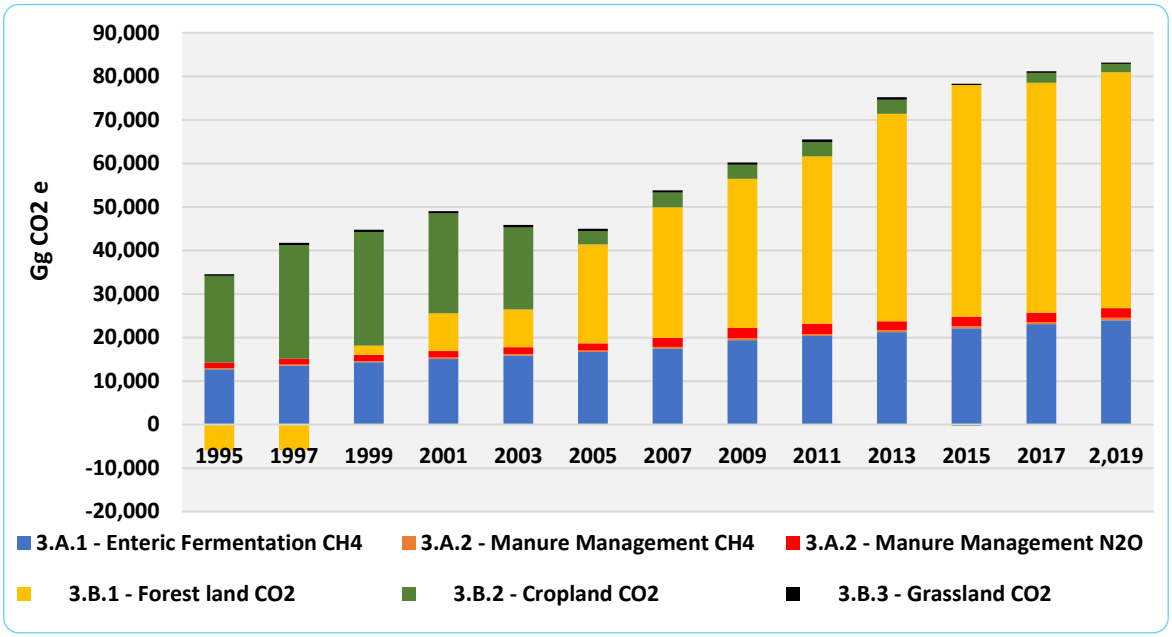
Methane from enteric fermentation from ruminant animals rose from about 12,718 Gg CO_2e in 1995 to 23,932 Gg CO_2e in 2019 (Figure 2-6), the increase is a result of the increasing livestock population. CH_4 from enteric fermentation in 2015 is almost double the estimates of the FBUR. This is attributable to the enhanced categorization of the cattle population, which necessitates recalculations of previous estimates. For instance, enteric emission factors for dairy and other cattle in FBUR were 46 and 31 kgCH_4/Head/yr, while in SBUR, the emission factors were 76 and 52 kgCH_4/Head/yr, respectively.

Compared to the FBUR estimates, N_2O and CH_4 from manure management are slightly lower. This is attributable to new studies that show that the percentage of animal manure in dry lots (which have relatively low emission factors) is much higher than previously estimated. Emissions in the livestock sector (methane and nitrous oxides combined) rose from Gg 14,610 Gg CO_2e to 27,312 Gg CO_2e, an average of 3% per annum.

2.4.5 Emissions from land

From 1995 to 2019, greenhouse gas emissions were predominantly carbon dioxide from deforestation and forest degradation. CO_2 emissions from land use rose from 14,389 Gg CO_2e to 55,689 Gg CO_2e, which is an overall average increase of 11% per annum.

Figure 2-6: Emission trends from livestock and Land use 1995 to 2019



2.4.6 Emissions from Aggregate sources and non-CO2 emissions sources on land

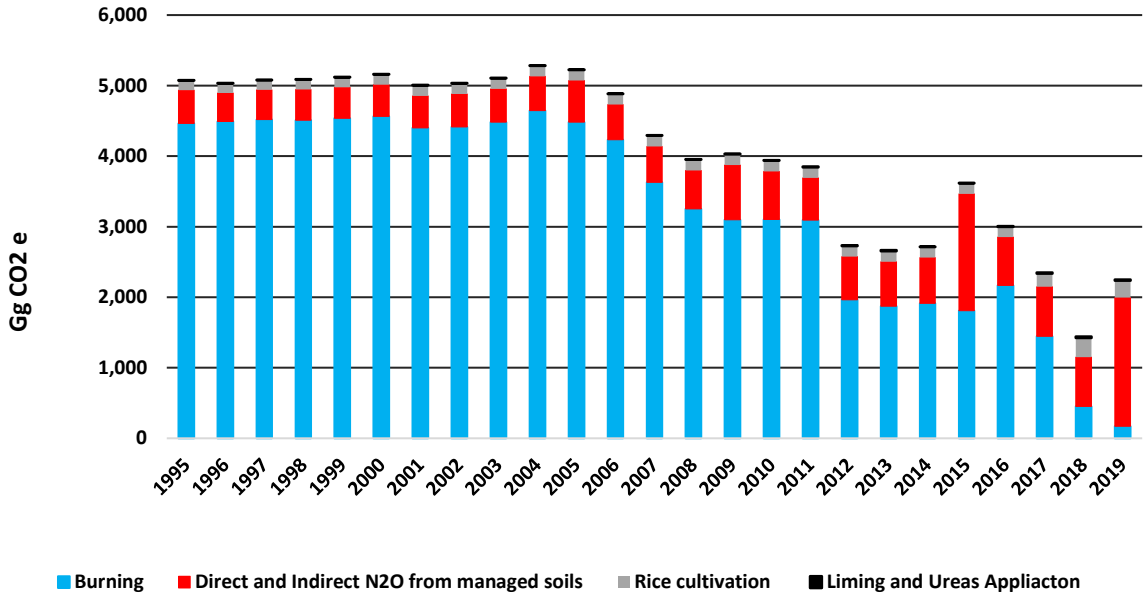
Aggregate sources and non-CO_2 emissions sources on land are mainly CH_4 and N_2O from fires and burning of crop residues. Emissions from fires based on MODIS are considered reliable from year 2000 onwards. Even then, because of the course spatial resolution (i.e., 500 m by 500 m pixel), estimates have a big error margin. Estimation of burnt area has greatly improved with the availability of sentinel 2 images from European Space Agency (ESA) in 2016. The discussion of emissions from fires therefore focus on the period 2016 on wards.

Reliability of historical data notwithstanding, there has been a general downward trend in emissions from fires from 1995 to 2014, followed by sharper decline from 2017 to 2019. This might be due to a combination of factors such as increased awareness on effects of fires, increased enforcement of bylaws on fires by local governments and most important reduced area of freely accessible rangelands that are prone to wildfires.

In 2016, CH_4 and N_2O emissions from fires are estimated 2,166 Gg CO_2e accounting for 72% of total aggregate sources and non CO2 emissions on land. In the subsequent years, emissions from fires are estimated to have declined to 1,446 Gg, 450 Gg and 168 Gg CO_2e in year 2017, 2018 and 2019 respectively. As result of this, the contribution of emissions from fires to total aggregate sources on land declined to 62%, 31% and 7% respectively.

In the same period, the share of nitrous oxides increased from 30%, to 49% and 81% respectively. The share of methane emissions from rice cultivation fluctuated from 8%, 19% and down to 11%. Contributuon from urea and lime application combined remained very low at 1% and below (figure 2-7).

Figure 2-7: Emission trends for aggregate sources on land (1995 to 2021)



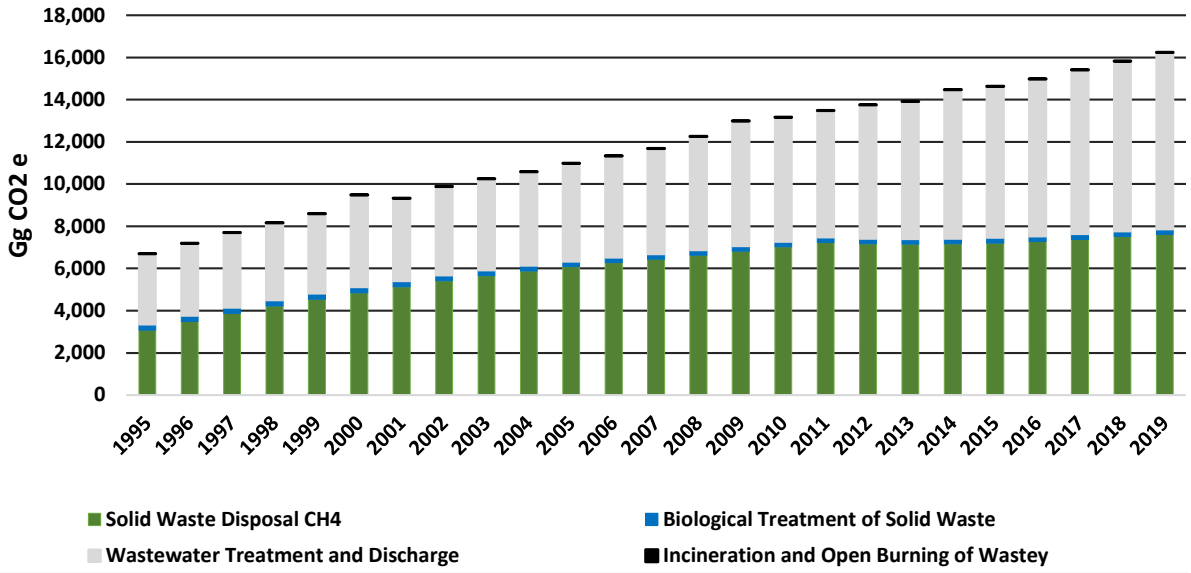
2.4.7 The Waste Sector

From 1995 to 2019 emissions from wastewater treatment rose from 3,352 Gg CO_2e to 8,370 Gg CO_2e, with an average increment of 6% per annum. The emissions from wastewater treatment account 52% emissions in the waste sector. Increase in the share of emissions from wastewater treatment is attributable to modification of the software that allows better capturing of domestic wastewater treatment for both rural and urban population. In the same period, emissions from solid waste disposal rose from 3,071 Gg CO_2e to 7,612 Gg CO_2e, an average annual increment of 5.9%.

The most common biological treatment of waste is composting of solid waste and to some limited extent, anaerobic biogas digestion waste (mainly animal waste and wastewater) for generation of biogas (CH_4 and CO_2) energy for cooking and slurry for agriculture application. Biological treatment of waste is an important mitigation activity given that is has low emissions. Biological treatment of waste is estimated to account for 2% of the total emissions of the waste sector.

Incineration and open burning of waste generates methane, nitrous oxides and carbon dioxide. From 1995 to 2019, emissions from incineration and open burning of waste have increased from 7 Gg CO_2e to 11 Gg CO_2e, an increment of about 2% per annum. Overall contribution of emissions to the waste sector has remained at 0.1%.

Figure 2-8: Emissions trends from the waste sector (1995 to 2019)



2.5 Key Category Analysis

According to the Good Practice Guidance 2000, key categories are those that contribute 95 % of the total annual emissions when ranked from the largest to the smallest emitter. A key source is prioritized within the national inventory system because its estimate significantly influences a country's total inventory of direct GHGs in terms of the absolute level of emissions, the trend in emissions, or both (IPCC, 2000).

Eleven key sources that contribute 95% of the emissions are listed in Table 2-9. Ranked from the largest to the smallest sources of emissions, CO_2 from Forest Land, Remaining Forest land (i.e., forest degradation), followed by CH_4 from Enteric Fermentation, CO_2 from Land Converted to Forest land, CH_4 from solid waste disposal and CH_4 wastewater Treatment and Discharge are major sources. Use of biomass fuels in households and institutions is also a major source of CH_4, while manure management is a key source of N_2O.

Table 2-9: Level Assessment of Key Categories 2019

IPCC Category	Greenhouse gas	2019 Absolute emissions	Contribution to the level	Cumulative Total contribution
3.B.1.a Forest land Remaining Forest land	CO_2	63582	49.6%	49.6%
3.A.1 Enteric Fermentation	CH_4	23932	18.7%	68.2%
3.B.1.b Land Converted to Forest land	CO_2	9394	7.3%	75.6%
4.A Solid Waste Disposal	CH_4	7612	5.9%	81.5%
4.D Wastewater Treatment and Discharge	CH_4	5274	4.1%	85.6%

IPCC Category	Greenhouse gas	2019 Absolute emissions	Contribution to the level	Cumulative Total contribution
1.A.4 Other Sectors - Biomass - solid	CH_4	3458	2.7%	88.3%
3.A.2 Manure Management	N_2O	2768	2.2%	90.5%
1.A.3.b Road Transportation - Liquid Fuels	CO_2	2730	2.1%	92.6%
3.B.2.b Land Converted to Cropland	CO_2	1491	1.2%	93.7%
1.A.1 Energy Industries - Biomass - solid	CH_4	1293	1.0%	94.8%
3.C.4 Direct N2O Emissions from managed soils	N_2O	1216	0.9%	95.7%

Using trend analysis, the ten sources that contribute 95% of the emissions are listed in Table 2-10. The Degradation of forest remaining forest, land that is converted into cropland (i.e. deforestation), and the degradation of crops are major sources of CO_2. Major sources of CH_4 are enteric fermentation, burning of rangelands and in crop land, and wastewater treatment and discharge. Major sources of N_2O are burning and manure management.

Table 2-10: Key categories using trend assessment for the period 1995 - 2019.

IPCC Category	Greenhouse gas	Base year Estimate (1995)	Latest Year Estimate (2019)	% Contribution to Trend	Cumulative Total of Trend
3.B.1.a Forest land Remaining Forest land	CO_2	-5900	63582	40.7%	40.7%
3.B.2.b Land Converted to Cropland	CO_2	12954	1491	20.7%	61.4%
3.B.2.a Cropland Remaining Cropland	CO_2	6958	6	11.7%	73.1%
3.B.1.b Land Converted to Forest land	CO_2	0	-9394	6.3%	79.4%
3.A.1 Enteric Fermentation	CH_4	12718	23932	5.2%	84.6%
3.C.1 Burning	CH_4	2417	91	4.0%	88.6%
3.C.1 Burning	N_2O	2048	77	3.4%	92.0%
4.D Wastewater Treatment and Discharge	CH_4	3154	5274	1.7%	93.7%
1.A.3.b Road Transportation - Liquid Fuels	CO_2	589	2730	0.8%	94.6%
3.A.2 Manure Management	N_2O	1576	2768	0.8%	95.3%

2.6 Uncertainty Assessment

The IPCC guidelines require that inventory estimates be reported with an uncertainty range, at least using a tier 1 uncertainty analysis across the sectors that is generated by the IPCC software. Uganda used the IPCC tool for Approach 1 uncertainty analysis to quantify the uncertainty of the GHG inventory for 1995 and 2019.

The AFOLU sector involves a wide variety of biological processes, land types, and management practices, while Waste generation and treatment methods vary widely by country and region. The current version of the IPCC software does not automatically calculate uncertainty for the Agriculture, Forestry, and Other Land Use (AFOLU) and waste sectors. Therefore, SBUR did not consider uncertainty assessment for AFOLU and the waste sector. The uncertainty in the trend in emission for Energy and IPPU, was estimated at 14.03%. Total inventory uncertainty for the two sectors is estimated 8.76% (Table 2-11).

Table 2-11: IPCC software generated Uncertainty assessment (1995 to 2019).

2006 IPCC Categories	**1995 emissions or removals ($Gg\ CO_2e$)**	**2019 emissions or removals ($Gg\ CO_2e$)**	**Contribution to Variance by Category in 2019**	**Uncertainty in trend to total national emissions (%)**
1-Energy	**3,103**	**12,122**	**76.7**	**196.1**
2-Industrial Processes and Product Use	**136**	**487**	**0.1**	**0.8**
3-Agriculture, Forestry, and Other Land Use	**34,070**	**85,251**	**-**	**-**
4-Waste	**6,705**	**13,557**	**-**	**-**
Total	**44,013**	**111,417**	**76.8**	**196.9**
Uncertainty		**111,417**	**Total inventory: 8.76**	**Trend: 14.03**

2.7 QA/QC Protocols

In greenhouse inventory management, the Climate Change Department has the responsibility to generally oversee the QA/QC procedures in the inventory and perform the following routines:

- Ensures that the sector teams follow the QC checklist.
- Collect and review the completeness checklist submitted by the sector inventories.
- Organise technical reviews of the inventory both in-country and at the international level.
- Follow up with the implementation of the recommendations in the previous review.
- Revive the roles of the QA/QC lead institution.

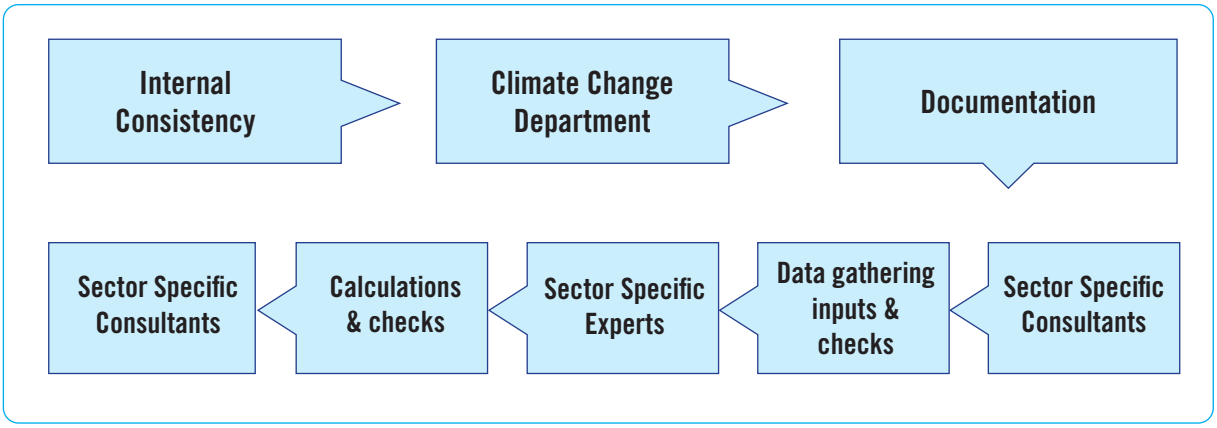
Uganda followed the tier 1 general quality control procedures described in Table 2-12 for compilation of the SBUR GHG inventory.

Table 2-12: List of QC procedures followed in the inventory.

QC Tasks	Description of Specific Tasks
Internal Consistency	Ensured that the total GHG emissions equal the sum of the individual emissions from the sectors and categories
	Confirmed that the total GHG emissions equal the sum of the emissions by gas.
	Compared data in the tables to calculation spreadsheets and the text to confirm that all reported emissions estimates, activity data, and emission factors are the same
	Ensured that parameters used in multiple categories (e.g., the population of livestock or the quantity of lubricant use is consistent across categories
	Confirmed that the emissions data is reported in a manner consistent with the calculation tables in the non-Annex 1 National Communications Reporting Guidelines
Documentation	Created back-ups of all documentation in hard and soft copies and uploaded files in the data hub
Data gathering, input, and checks	Checked assumptions and criteria for selecting activity data and emission factors are well documented
	Checked for transcription errors in data input and reference
Data gathering, input, and checks	Checked assumptions and criteria for selecting activity data and emission factors are well documented
	Checked for transcription errors in data input and reference
Calculation Checks	Checked methodological and data changes resulting in recalculations
	Checked that emissions/removals are calculated.
	Compared current inventory estimates to previous ones for each category. If there are significant changes or deviations from expected trends, re-check estimates and explain any large differences. Significant changes in emissions or removals from previous years may indicate possible input or calculation errors.

Uganda's QC follows a cyclic consultation process among the key stakeholders involved in the inventory development. This approach involves internal consistency, documentation, data gathering, input, checks, and calculations in the illustration below (figure 2-9).

Figure 2-9: QC Process and consultations



2.8 National Inventory Improvement Plan (NIIP)

Based on the constraints and gaps listed under the assessment of completeness of activity data (AD) in section 2.2.2 and the assessment of methodological approach and emission factors used in section 2.2.3, a list of the most urgent improvements has been identified. The overview of Uganda's capacity needs for improvement is listed below, with specific needs that can be addressed in a phased approach during subsequent greenhouse inventories.

- Strengthen the capacity of data-providing institutions in GHG data collection, data archiving, and retrieval systems
- Improve quality control (QC) measures in data collection, especially in key categories or sub-categories and document uncertainties. Reasons: Uncertainties in Key sources may lead to gross under or over estimating of the country's current or future GHG emissions estimates.
- Establish an independent technical review team of experts to provide quality assurance before the UNFCCC's international review process.
- Need of sectors to move from expert judgment to carrying out surveys/studies in order to improve GHG data accuracy.

2.8.1 Immediate plans (two to three years)

Capacity building on GHG inventory data provides institutions with the ability to keep up with the updates of the IPCC 2006 software and reporting requirements of the Paris Agreement. Key action points include.

- Initiate quality control QC measures in sectors where data is being collected and measured.
- Establish data validation protocols in GHG inventory data providing institutions.
- Continuously encourage sectors to move from expert judgment or data estimates to annual or periodic data measurements and surveys.
- Build on the existing capacity and make the necessary improvements in land use change data analytics.
- Upgrade data archiving and retrieval systems
- In the long run, embed GHG compilation in job descriptions of personnel involved in data collection and archiving for GHG inventory.

2.8.2 Mid-term to long-term plans (5 to 10 years)

Put in place mechanisms for improving data collection and documentation in sectors where data is missing or is considered inadequate, especially key emitting sectors. Key activities include the following:

- Refine data collection methods and achieve success in the wastewater treatment and solid waste management sectors.
- Refine data collection methods and apply them in industries and road transport.
- Develop a system to improve the assessment of manure management systems
- Improve the existing QA/QC system to reduce uncertainty and improve inventory quality.
- Find the necessary resources to establish fully-fledged GHG inventory units in each of the data-compiling institutions.

3.0 MITIGATION ACTIONS AND THEIR EFFECTS

3.1 Updates of Mitigation Actions

The information in the SBUR provides updates on the GHG mitigation actions and policies. The information on progress covers (a) Priority mitigation actions through the implementation of Uganda's NDC, (b) updates on policy, regulatory actions, and mitigation goals, and (c) status of participation in international markets for mitigation actions, including REDD+ activities. Uganda's NDC documents the mitigation targets and strategies to achieve them, spanning 2020 to 2030. NAMAs that did not define methodological approaches, assumptions, and targets became difficult to implement and could not attract funding. These are not included in the SBUR.

In line with the requirements under the Paris Agreement (2015), Uganda submitted its nationally determined contributions (NDCs). In the updated NDC (MWE 2022), Uganda presents an ambitious economy-wide mitigation target in 2030 of 24.7% reduction below the Business As Usual (BAU), a progression from the 22% reduction target communicated in the first NDC in 2016.

Tables 3-1, 3-2, 3-3, 3-4 and 3-5 summarize quantifiable emission reduction actions envisaged under Uganda's NDC. Total emission reduction by 2030 is estimated at 24.3 $MtCO_2e$ with reduction in the agriculture and land use sector estimated at 14.97 Mt CO_2e (table 3-1), accounting for about 61.6% of the total quantifiable emission reductions.

Table 3-1: Summary of Mitigation Actions in the NDC for land use and agriculture

Sub-sectors	Mitigation action	Description and impact
Land use and Agriculture subsectors	Sustainable Land Use Management and Agroforestry. Running Out of Trees (ROOTs) campaign, aiming to plant 40 million trees annually and REDD+ strategic interventions. Private sector has pledged support through funding and participation	Estimated emission reduction of 1.2 $MtCO_2e$ by 2030.
	Rainwater harvesting and irrigation. Investments in micro, medium solar-powered irrigation systems and large-scale irrigation systems to reduce new farmland expansion and deforestation	Estimated emission reduction of 1.6 $MtCO_2e$ by 2030.
	Green house cultivation of Vegetables 2030 in rural and semi-urban households improve soil carbon build-up and reduce deforestation (reduce need for agricultural land Expansion)	Estimated emission reduction of 0.3 $MtCO_2e$ by 2030
	Commercial small-holder and community bioenergy woodlots	Estimated emission reduction 2.9 $MtCO_2e$ by 2030.
	Commercial small-holder and community poles & timber plantations (with coffee agroforestry)	Estimated emission reduction of 0.37 $MtCO_2e$ by 2030

Sub-sectors	Mitigation action	Description and impact
	Reduce wood demand from natural forests by providing wood from commercial transmission pole and timber plantations and charcoal production	Abatement potential of approximately 5 $MtCO_2e$ by 2030.
	Natural forest regeneration. Rehabilitate 100,000 hectares of forest areas through collaborative forest management approaches and has	Estimated emission reduction of 0.3 $MtCO_2e$ by 2030.
	Promote improved cattle breeds and feeds, improve water availability for livestock through constructing water dams and valley tanks, and establish fodder agroforestry plantations for zero grazing and stall-feeding.	Estimated to result in 2.9 MtCO2e emission reduction by 2030.
	Increase wetland coverage from 8.9% in 2020, to 9.57% by 2025, and 12% by 2030 through demarcation, gazettement, and restoration of degraded wetlands.	Estimated emission reductions of 0.4 $MtCO_2e$ by 2030
	Sub Total	**14.97 $MtCO_2e$ by 2030**

Fuel switching, increase in the share of renewable energy, reduction in energy loses, use of improved charcoal kilns, introduction of bio latrines in schools, use of more efficient devices in non-mobile fuel combustion activities is estimated to result in emission reduction of 3.06 $MtCO_2e$ (table 3-2) which is about 12.6% of anticipated total reduction in all the sectors by 2030.

Table 3-2: Summary of Mitigation Actions in the NDC for Energy combustion activities in energy production, transmission and use at households, commercial enterprises and institutions)

Sub-sectors	Mitigation action	Description and impact
Energy generation	Renewable energy generation, with increase renewable energy generation (bagasse, solar and wind) to the grid	Estimated emission reductions of approximately 0.0003 $MtCO_2e$ by 2030.
	Reduction in transmission and distribution losses	Estimated reductions of 0.00001 MtCO2e by 2030.
	Improved efficiency of charcoal production. Improved charcoal kilns linked to bioenergy woodlots. Replace 12% charcoal conversion kilns with 75 % wood to charcoal conversion efficient kilns	Estimated emission reduction of 3.85 $MtCO_2e$ by 2030.
Improved cook stove efficiency	50% of schools/institutions to be using improved charcoal cookstoves thus reducing forest degradation	Estimated emission reduction of 0.02 $MtCO_2e$ by 2030.
Switching to cleaner fuels	Fuel switching by increasing LPG use 15% of the energy mix and pressure electric stoves by 35% of the energy mix by 2030	Estimate emission reductions of 1.09 $MtCO_2e$ by 2030

Sub-sectors	Mitigation action	Description and impact
Increased Access to electricity	Increased electricity access for households	Emission reductions from avoided forest degradation estimated at 0.02 $MtCO_2e$ by 2030.
Waste to energy in Green Cities	This measure is aimed at introducing biogas digesters in cities and schools. Biogas digesters will be fed by waste from bio latrines and used for lighting and cooking	Estimated emission reduction of by 0.04 $MtCO_2e$ by 2030.
	Sub Total	**5.01 $MtCO_2e$ by 2030**

Envisaged interventions in the transport sector include; road transport fuel efficiency, fuel blending, promotion of cleaner fuels (e- mobility), development of Non- Motorized Transport (NMT), rehabilitation of 61 km for freight transit of passenger rail Meter Gauge Railway (MGR) by 2030. Emission reduction in the transport subsector is estimated at 3.06 $MtCO_2e$ (Table 3-3), about 12.6% of total anticipated emissions reductions.

Table 3-3: Summary of Mitigation Actions in the NDC in the Transport subsector

Mobile energy consumption. Transport sector.	Road transport fuel efficiency by improving the national fleet database, frameworks, and fuel standards and regulatory framework of the sub-sector	Estimated emissions reductions of 1.86 $MtCO_2e$ by 2030.
	Fuel switching by through improved fuel standards, efficiency and promotion of cleaner fuels (including blending)	Estimated emission reduction of 0.54 $MtCO_2e$ by 2030.
	Development of Non- Motorized Transport (NMT) infrastructure in Greater Kampala other urban areas across Uganda	Estimated emission reduction of 0.66 $MtCO_2e$ by 2030.
	MGR – Meter Gauge Railway rehabilitation (61 km) for freight transit of passenger rail. Estimated to have 22% of fuel economy improvement of diesel locomotives	Estimated emission reduction 0.0005 $MtCO_2e$ by 2030.
	Sub Total	**3.06 $MtCO_2e$ by 2030**

The waste sector anticipated to result in emissions reduction of 1.1 $MtCO_2e$ by 2030 (table 3-4) mainly from infrastructure development under the green cities drive in the large municipalities. This is estimated at 1.04 $MtCO_2e$, about 4.5% of the anticipated NDC emissions reductions by 2030.

Table 3-4. Summary of Mitigation Actions in the NDC for the waster sector

Sub-sectors	Mitigation Measure	Description and Impact
Green Cities infrastructure development	This measure will target infrastructure development under in green development in the large municipal areas	Estimated emission reduction of 1.1 $MtCO_2e$ by 2030.
	Sub Total	**1.1 $MtCO_2e$ by 2030**

Cement production, mainly production of clinker (limestone), accounts for most of the emissions in the IPPU sector. Among the NDC targeted mitigation is the substitution of clinker (a fraction) with fly- ash in the mineral mix during cement production. This is anticipated to result into an emission reduction 0.14 Mt CO_2e (table 3-5), about 0.6% of the total anticipated emission reductions by 2030.

Table 3-5: Mitigation Actions in the NDC in the cement industry (under IPPU)

Sub-sectors	Sub-sector	Description
Main Mitigation Measure	Clinker substitution in cement production. This measure aims to substitute clinker in pozzolana cement production with less carbon intensive fly-ash or slag	This measure has a potential to reduce the emissions by approximately 0.14 $MtCO_2e$ by 2030.

3.2 Policies, Actions, and Measures Supporting Mitigation Goals

Uganda has several national and sector policies that support climate mitigation, adaptation, and the achievement of sustainable development outcomes. However, most of these are still being discussed and refined. The table presents key ones that have a direct relationship with the proposed mitigation actions and measures (Table 3-6).

Table 3-6: Policy measures and supporting mitigation actions

Policy measure	Mitigation Action	Status	Measure
Energy and Mineral Sector Development Plan	Notes that industrial energy use can be reduced by 10% simply by employing best practice measures	Planned	
Minimum Energy Performance Standards for products	A voluntary programme is in place to increase the efficiency of products entering the market. 12 standards in place, 1 testing equipment	Implemented (voluntary)	Bulbs
Revolving Loan Facility for the Uptake of Improved Institutional Cook Stoves in Ugandan Schools	The full implementation of this project will see more than 18,000 primary schools, almost 3,000 secondary schools, and about 50 tertiary schools from all over the country provided with improved cookstoves (Ministry of Water and Environment, 2019)	Implemented	
Energy Sector Development Plan	Aims to "Promote the adoption of improved institutional kilns, ovens, and stoves in all educational institutions, hospitals, and prisons" (Ministry of Energy and Mineral Development, 2015)	Planned	

Policy measure	Mitigation Action	Status	Measure
REDD+ Strategy and Action Plan	Strategy Option 5: Energy-efficient cooking stoves are concerned with replacing traditional firewood and charcoal stoves with more efficient technologies. It is aimed at households and institutional users (educational institutions, restaurants and cafeterias, hospitals, prisons, industries, and other similar entities) (Ministry of Water and Environment, 2017).	Planned	
Minimum Energy Performance Standards for products	A voluntary programme is in place to increase the efficiency of products entering the market. 12 standards in place, 1 testing equipment	Implemented (voluntary)	
Biomass Energy Strategy	It is estimated that improved brickmaking and lime production kilns could reduce energy demand by 45% in 2040 relative to current efficiency levels. It is estimated that 40% of biomass needs could come from sustainable sources by 2040.	Planned	LPG
Third National Development Plan (NDP III)	It has a goal to increase access to and consumption of clean energy. One of the key results associated with this goal is to put a mechanism for increased uptake LPG.	Implemented	LPG
Third National Development Plan (NDPIII)	The NDPIII intends to "promote uptake of alternative and efficient cooking technologies". It includes a target to reduce the share of biomass energy used for cooking from 85% in 2017/18 to 50% in 2024/25 (and increase the share of clean energy used for cooking from 15% in 2017/18 to 50% in 2025/25). It also includes the target to 'increase national LPG uptake from the current 1 per cent to 8 per cent on the energy balance.'	Planned	

Policy measure	Mitigation Action	Status	Measure
Fourth National Development Plan (NDP IV)	Uganda's Fourth National Development Plan (NDP IV), covering FY2025/26 to FY2029/30, is a strategic blueprint aimed at propelling the nation toward middle-income status and achieving Uganda Vision 2040. It emphasizes sustainable industrialization, inclusive growth, employment, and wealth creation The five strategic objectives are: • Sustainably increase production, productivity, and value addition in sectors like agriculture, industry, minerals, oil & gas, tourism, ICT, and financial services. • Enhance human capital development across the entire life cycle. • Support the private sector to drive growth and create jobs. • Build and maintain strategic sustainable infrastructure in transport, housing, energy, water, industry, and ICT. • Strengthen good governance, security, and the role of the State in development	Planned	
Energy Service Company (ESCO) Programme	There are plans for an ESCO program targeting the industry sector.	Planned	
Charcoal to Power initiative	This initiative aims to replace the use of traditional biomass for cooking with low-carbon electricity in households and institutions (ERA, 2021[2])	Planned	
Rural Electrification Strategy and Plan (RESP)	The Rural Electrification Strategy aims to enhance grid access in rural areas (with the goal of 100% access to electricity by 2040), which will support actions to reduce the use of biomass as an energy source.	Implemented	
Biomass Energy Strategy	65,000 improved cookstoves are already disseminated every year	Implemented	
REDD+ Strategy and Action Plan	Strategic option 2 includes the sub-option of Improved charcoal kilns linked to bioenergy woodlots. This assumes 100,000 more efficient kilns. Strategy Option 3 includes the sub-option of Improved charcoal kilns linked to timber plantation sites. This assumed 15,000 more efficient kilns (Ministry of Water and Environment, 2017[3]).	Planned	

2 Ibid.
3 Ministry of Water and Environment (2017). REDD+ Strategy and Action Plan. Accessed at: https://www.mwe.go.ug/sites/default/files/library/Final%20-%20Uganda%20REDD%2B%20Strategy%20and%20Action%20Plan-October%202017.pdf

3.3 Status report on participation in international market mechanisms

Uganda has been one of the most active countries in the international market mechanism and started with implementing the Kyoto Protocol's Clean Development Mechanism (CDM). Although international support has focused on the capacity of MDAs, Uganda's mitigation actions are largely private sector-led. In 2023, a total of over 33 million carbon credits are estimated to have been issued in Uganda, with majority of the credits (70%) under Clean Development Mechanism (CDM) and the balance under Voluntary Carbon Market (VCM) standards and Plan vivo standards. Listed carbon credits from CDM (CDM: Project Activities) including Program of activities (PoAs) were 12.5 Million in 2023 (table 3-7).

Under the VCM, most projects were registered under the Gold standard (GS), accounting for 10.6 million credits, followed by VERRA/Voluntary Carbon Standards (VCS) and about 3.6 million credits VCU). Plan vivo had issued 2.4 million credits from small holder farmers by 2023.

Table 3-7: Annual and cumulative CER insurance CDM and PoAs projects in Uganda; Source;

Year	Issuance	Cumulative
2012	1,398,267	1,398,267
2013	1,463,026	2,861,293
2014	52,562	2,913,855
2015	1,951,275	4,865,130
2016	2,250,900	7,116,030
2017	2,783,813	9,899,843
2018	889,338	10,789,181
2019	749,067	11,538,248
2020	20,095	11,558,343
2021	105,679	11,664,022
2022	19,609	11,683,631
2023	830,726	12,514,357

Source: https://cdm.unfccc.int/Projects/projsearch.html

It is estimated that total CDM credits were in the range of 21 Million CERs, in 2023 or early 2024 though CERs from some projects were not yet listed /fully tracked. In terms of numbers, most of the projects under implementation between 2010 and 2023 were in the AFOLU sector (table 3-8) followed by renewable energy, particularly small hydropower (5).

In terms of credits, one large scale hydroelectric power accounted for 60% of total issued CERs followed by improved cook stoves in households (17%). Energy saving in improved water purification and energy transmission account for 9% and 5% of the CERs respectively. The renewable energy and forestry sectors were among the most active in mitigation actions (table 3-8). Small hydro power generation hydro electric power generation and the reforestation (small scale) each accounted for about 3% the total CERs. Table 3-8 gives a summary of CDM projects by sector in Uganda.

Table 3-8: Uganda's Involvement in International Market Mechanisms

Sector	No of projects	CER issuance	Per
AFOLU Reforestation	6	431,309	3%
Energy Residential	2	2,134,088	17%
Energy Institutional	2	90,275	1%
Energy water purification	2	1,128,907	9%
Energy distribution	1	628,860	5%
Renewable Energy Generation (HEP)- Small	5	434,806	3%
Renewable Energy Generation(HEP)-Large	1	7,510,442	60%
Municipal Waste Compost	1	16,549	0.1%
Waste Methane avoidance	1	139,121	1%
Total	**21**	**12,514,357**	**100%**

Other standalone CDM projects include three biomass energy, landfill gas, wastewater treatment, domestic lighting, and biodiesel projects (UNFCCC, CDM Website, 2019).

3.3.1 REDD+ Activities

In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities: reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks, sustainable management of forests; and enhancement of forest carbon stocks. Data and information on REDD+ are to be reported as "technical annexes" to the BURs. The inclusion of REDD+ as part of the Annex in the BUR is Voluntary and applicable only to those developing country Parties seeking to obtain and receive payments for results-based actions.

As a result of submitting the REDDD+ technical Annex as part of the FBUR submission, Uganda has been listed among the countries that will receive GCF results-based payments under the second window. Uganda has started the process of developing a GCF funding proposal. In event that this funding is secured, Uganda intends to invest substantial resources to ensure proper and transparent monitoring of mitigation actions, tracking of support needed and received in a transparent and verifiable manner.

4.0 INFORMATION ON DOMESTIC MEASUREMENT, REPORTING, AND VERIFICATION (MRV)

4.1 Progress in the implementation of MRV

Implementing the National CBIT project, funded by the Global Environment Facility (GEF) through Conservation International (CI), strengthened some of the weaknesses of Uganda's MRV system, mainly in institutional coordination. Key achievements of the Uganda CBIT project are presented in Table 4-1.

Table 4-1: Key MRV achievements with the CBIT project support

Objectives	Key achievements of the Uganda CBIT Project
Establishing institutional arrangements for a robust national system for GHG emission inventories and MRV systems (Component 1)	a. Institutional arrangements for a robust GHGI and MRV with the coordinating agency and five sectors were initiated.
	b. Inter-ministerial Cooperation Agreements signed among ten ministries, including
	c. Six data sharing MoUs for GHG data collection, processing, and transmission (NFA, NEMA, MEMD, MoWT, MAAIF, MTIC)
	d. Technical guide on GHG data sharing approved and signed as Annex to MoU
	e. Integrating Gender in GHGI and MRV operations -Established gender focal points in 5 sector hubs and Developed a procedure manual on generating gender disaggregated information in GHG inventory
Build capacity of key stakeholders to collect, process, and feed data into the GHG emissions inventory system and (Component 2)	a. The training involved 81 participants, 55 from six lead sector institutions and 26 from other institutions.
	b. A total of 62 individuals successfully finished the course; 35% were women and graduated as National GHGI Experts.
	c. Equipment procured for five sector Hubs, CCD, and AfrII
	d. Protocols and tools developed for four sectors
	e. Over 80 people sensitized and trained on GHGI and MRV
	f. Exposure &/ international trips (COP 24, COP 25) 33% women
	g. 81 officials sensitized on GHGI, domestic MRV, and IPCC requirements 55 from CCD, MAAIF, NEMA, MoWT,

Objectives	Key achievements of the Uganda CBIT Project
	MEMD, MTIC; 10 from non-state actors and the rest from other institutions
	h. Information and knowledge sharing through policy briefs, status reports, and fact sheets. All reports and knowledge-sharing materials are uploaded to the CCD MWE, AfrII websites, and the CBIT global coordination platform. Links below for access to the documents
	• http://ccd.go.ug/cbit/#
	• https://www.afrii.org/publications-2/
	• https://www.cbitplatform.org/projects/strengthenin
	Paris Paris
Test and piloting the GHG emission inventory and MRV system (Component 3)	a. Six sector GHG inventories (2016-2019) developed
	b. Handed over the six sectors of 2016-2019 GHGI to the CCD-MWE to integrate it into the national GHGI and MRV systems
	c. Trained CCD staff to manage the Uganda MRV portal and link the portal to the National Integrated MRV tool being developed at CCD-MWE
	d. The established sector hub teams with the sector focal points and gender focal points to be engaged in GHGI and MRV

4.2 MRV Implementation Progress

4.2.1 Measuring greenhouse gases

Uganda's capacity to measure greenhouse gas emissions has progressively improved. Personnel in key institutions are aware of the data requirements for the GHG inventory. Impressive progress has been achieved in the Ministry of Industry by establishing a unit that regularly updates data and compiles GHG for the sector.

With the release of new livestock census data, more reliable emissions estimates can be achieved for the livestock subsector. The National Forest Authority (NFA) is obligated to provide information on land use and forestry statistics and is continuously improving the approach to generating statistics on land use change. Results on using sample-based area estimates (SBAE) in generating change statistics are yet to be released.

The Ministry of Trade, Industry, and Cooperatives (MoTIC) has made tremendous improvements in compiling data on industrial pollution. The Ministry of Works and Transport collects data on new motor vehicles, is updating the motor vehicle database and plans to start a motor vehicle inspection.

4.2.2 Tracking Mitigation Actions and Effects

With support from UNDP, the Ministry of Water and Environment developed an MRV tool that is intended to track mitigation actions and their effects in all sectors. This tool still needs to be fully operational.

Though all new government programmes in Uganda need to have a climate change mitigation/adaptation component, designing and documenting the projects is still challenging.

There is a lot of mitigation actions, especially in the private sector. This information is available on international registries. Discussions on developing a registry for all mitigations are being discussed under the newly formulated Climate Change regulations.

4.2.3 Reporting on the country's needs and tracking support received.

There is still a big challenge regarding the documentation and tracking of the country's needs and the support received. Uganda has established a Climate Financing Unit in the Ministry of Finance and Economic Development. Mitigation and adaptation projects are listed on the website. However, much still needs to be done to track the finances required and received. Uganda has received technical support from several international agencies under bilateral arrangements. This information can be gathered from various project documents, but a system for tracking all these initiatives is yet to be put in place.

5.0 INFORMATION ON SUPPORT RECEIVED, CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL, AND CAPACITY NEEDS

5.1 Financial Inflows

Climate financing in Uganda is predominantly from international sources, such as multilateral and bilateral funds. Uganda is making an effort towards having local/regional financing directed towards climate action. Uganda Development Bank Limited, a key local financier, is in the process of greening its funding instruments.

The climate finance unit (CFU) indicates that Climate financing in Uganda is currently about USD 942 million, distributed in the implementation of 38 Adaptation and Mitigation projects. However, improvements still need so that a user can filtered the database and summarise the data by project category, source and amount of funds received or anticipated and state of project implementation.

5.2 Support received

The government of Uganda and many donors have committed resources and offered technical support to Uganda to meet the cost of various activities addressing climate change. Most of the support Uganda received came through several development aid channels. Data on financial contributions from GEF, Annex II Parties, multilateral/bilateral agencies, and the Government of Uganda were obtained from the Ugandan Ministry of Finance—Table 5-1 shows details.

Table 5-1: Climate Support to Uganda

Project Name	Description	Implement. Agency	Sector	Climate Objective	Amount	Duration
Strengthening the Adaptive Capacity and Resilience of Communities in Uganda's Watersheds	The project aims to build the adaptive capacity of rural communities and reduce their vulnerability to climate change and variability through integrated watershed management, climate-resilient infrastructure, and sustainable agriculture. The project will be implemented in the Bukedea district, within the Awoja catchment downstream of the sub-catchments of Sironko, Simu-sisi, Muyembe, and Sipi.	**AfDB**	**Multi-sector**	**Adaptation**	**USD 9,781,415**	**2019-2022**

Project Name	Description	Implement. Agency	Sector	Climate Objective	Amount	Duration
Climate Resilient Livelihood Opportunities for Women Economic Empowerment (CRWEE) in Karamoja and West Nile Regions of Uganda	The project focuses on advancing rural women's economic empowerment to address gender inequalities, female subordination, discrimination and poverty in households. The project will target beneficiaries from 8 districts in West Nile: Arua, Adjumani, Zombo, Yumbe, Koboko, Nebbi, Maracha, and Moyo; and four districts in Karamoja: Moroto, Abim Nakapiripirit and Napak. Over 52,500 people are to benefit.	**FAO**	**Social Development, Agriculture, Water and Environment**	**Adaptation**	**USD 8,968,448**	**2018-2023**
Global Climate Change Alliance Plus (GCCA+): Scaling up Agriculture Adaptation to Climate Change in Uganda	The project aims to strengthen rural populations' inclusive, gender-responsive, and climate-smart resilience depending on agricultural production systems in the cattle corridor, over 9 districts; Nakasongola, Luwero, Nakaseke, Mubende, Kiboga and Sembabule, Kalungu, Gomba and Lyantonde to benefit.	**FAO**	**Agriculture**	**Adaptation and Mitigation**	**USD 9,197,600**	**2018-2023**

Project Name	Description	Implement. Agency	Sector	Climate Objective	Amount	Duration
Strengthening the Capacity of Institutions in Uganda to Comply with the Transparency Requirements of the Paris Agreement.	The project aims to establish institutional arrangements (government, CSOs, private sector, etc.) for a robust national system for GHG emission inventories and MRV systems, build the capacity of key stakeholders to collect, process, and feed data into the GHG emissions inventory system, and support testing and piloting the GHG emission inventory and MRV system.	**CI/AFRII**	**Multi-sector**	**Cross-cutting: capacity building**	**USD 1,100,000**	**2017-2020**
Energy for Rural Transformation Project (Phase III)	The project aims to increase access to electricity in rural areas of Uganda and reduce greenhouse gas emissions. The project will support access to electricity for public institutions (100 post-primary schools, 276 health clinics, and 15 water pumping stations) in rural areas and reduce Co_2 emissions due to the reduction/avoidance of diesel-based electricity. About 850,000 persons are expected to benefit generation.	**World Bank**	**Energy**	**Mitigation**	**USD 8,200,000**	**2016-2020**

Project Name	Description	Implement. Agency	Sector	Climate Objective	Amount	Duration
NAMA on Integrated Waste Management and Biogas in Uganda	The project aims to provide environmental benefits and reduce greenhouse gas emissions from improper and inadequate management and treatment of wastewater and organic waste in towns, municipalities and the agro-processing industry in Uganda. The project will support the establishment of enabling market conditions, institutional strengthening and capacity building for improved waste management and promotion of MSW-based biogas systems, support demonstration and investment in integrated wastewater treatment and biogas plants and scale up the use of biogas technologies in other municipalities.	**UNDP**	**Multi-sector**	**Mitigation**	**USD 2,170,030**	**2016-2020**
Food-IAP: Fostering Sustainability and Resilience for Food Security in Karamoja Sub Region	The project aims to contribute to enhancing long-term environmental sustainability and resilience of food production systems in the Karamoja Sub-Region (Kaabong, Kotido, Moroto, and Nakapiriprit Districts)	**UNDP/FAO**	**Agriculture**	**Adaptation**	**USD 7,139,450**	**2017-2020**

5.3 Constraints and Gaps and Related Financial, Technical and Capacity Needs

5.3.1 Financial needs

The implementation of the Nationally Determined Contributions (NDCs), Uganda Government planned to provide 30 percent of the required funds, while 70 percent was to be accessed from international sources (MWE, 2015). MWE also estimated that Uganda will require US$ 2.5 billion annually for 15 years from 2015 to address the impacts of climate change, which continues to have negative effects on development efforts. The funding is also expected to help Uganda overcome the impacts of climate change challenges, which are likely to hamper its contribution to the achievement of Sustainable Development Goals (SDGs).

5.3.2 Technological needs

Uganda's technological needs have not greatly changed since the TNA assessment that was funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UN Environment). The key technology priorities for each sector for mitigating and adapting to climate change that were identified are presented in Table 5-2.

Table 5-2: Key technologies prioritized for adaptation and mitigation

	Sectors	Priority Technologies
Adaptation	Agriculture	a. Responsive agricultural extension b. Community irrigation systems c. Crop breeding for climate change adaptation
	Water	a. Deep well extraction b. Rainwater harvesting c. Surface runoff harvesting
	LULUCF and Forestry	a. Promotion of Farmer Managed Natural Regeneration (FMNR) for forest landscape restoration b. Integrated pest management in forest plantations through promoting mixed-species plantations c. Promoting forest-based enterprises e.g. beekeeping/apiary; butterfly farming, fruit tree production, ecotourism
Mitigation	Energy	a. Solar rooftop system b. Efficient institutional cook stoves c. Bio-latrines for institutions (using biogas technology)

5.3.3 Capacity needs and support received.

CCD has continuously facilitated addressing of capacity gaps of key institutions that provide GHG data with support from RCMRD, UNEP, GEF, and the Rainforest Coalition. Under the REDD+ program, FAO has continuously provided capacity to the NFA to collect and analyse activity data and improve estimation of carbon stocks forests and other land uses.

Uganda's technical and capacity needs are still enormous. Climate change capacity needs in GHGI compilation range from coordination at high levels of government to shortcomings in data collection and inadequate skills in the implementation of climate change activities at lower levels. Overarching issues and needs include streamlining GHG data management and institutional arrangements, strengthening the national GHG inventory system, training in IPCC guidelines and use of IPCC 2006 software. The updated version of the IPCC 2006 software incorporates use

the Tier 2 approach in GHG compilation for Agriculture, Forestry, and other land use (AFOLU) which demands more detailed data on land use conversion and requires more investment human resource and skilling development.

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APPENDICES

Appendix I: Non-Annex 1 Reporting Table 1

Inventory year 2019

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			
Categories	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NF3
Total National Emissions and Removals	60603.5	1623.0	22.6	117.5	N/A	N/A	N/A
1 - Energy	4521.7	172.8	3.1	N/A	N/A	N/A	N/A
1.A - Fuel Combustion Activities	4521.7	172.8	3.1	N/A	N/A	N/A	N/A
1.A.1 - Energy Industries	74.5	46.2	1.2				
1.A.2 - Manufacturing Industries and Construction	1005.2	2.3	0.3				
1.A.3 - Transport	2730.4	0.8	0.1				
1.A.4 - Other Sectors	708.4	123.6	1.5				
1.A.5 - Non-Specified	3.2	0.0	0.0				
1.B - Fugitive emissions from fuels	NE	NE	NE	NA	NA	N/A	N/A
1.B.1 - Solid Fuels	NA	NA	NA				
1.B.2 - Oil and Natural Gas	NE	NE	NE				
1.B.3 - Other emissions from Energy Production	NO	NO	NO				
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						
1.C.2 - Injection and Storage	NO						
1.C.3 - Other	NO						
2 - Industrial Processes and Product Use	369.5	NE	NE	117.5	NE	N/A	N/A
2.A - Mineral Industry	369.4	NA	NA	NA	NA	N/A	N/A
2.A.1 - Cement production	355.6						
2.A.2 - Lime production	13.9						
2.A.3 - Glass Production	NA						
2.A.4 - Other Process Uses of Carbonates	NA						
2.A.5 - Other (please specify)	NA	NA	NA				
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO						
2.B.2 - Nitric Acid Production			NO				
2.B.3 - Adipic Acid Production			NO				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				
2.B.5 - Carbide Production	NO	NO					
2.B.6 - Titanium Dioxide Production	NO						
2.B.7 - Soda Ash Production	NO						
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			
Categories	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NF3
2.B.9 - Fluorochemical Production				NO	NO	NO	N/A
2.B.10 - Hydrogen Production	NO	NO	NO				
2.B.11 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	NE	NE	NA	NA	NA	N/A	0.0
2.C.1 - Iron and Steel Production	NE	NE					
2.C.2 - Ferroalloys Production	NA	NA					
2.C.3 - Aluminium production	NA				NA		
2.C.4 - Magnesium production	NO					N/A	
2.C.5 - Lead Production	NA						
2.C.6 - Zinc Production	NO						
2.C.7 - Rare Earths Production	NO				NO		
2.C.8 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	0.0	NA	NA	NA	NA	N/A	N/A
2.D.1 - Lubricant Use	0.0						
2.D.2 - Paraffin Wax Use	NE						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	NA	NA	NA				
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor			NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display			NO	NO	NO	NO	NO
2.E.3 - Photovoltaics				NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	117.5	NE	N/A	N/A
2.F.1 - Refrigeration and Air Conditioning				110.0	NE		
2.F.2 - Foam Blowing Agents				NE	NE		
2.F.3 - Fire Protection				7.5	NE		
2.F.4 - Aerosols				NE	NE		
2.F.5 - Solvents				NE	NE		
2.F.6 - Other Applications (please specify)				NA	NE	N/A	N/A
2.G - Other Product Manufacture and Use	NA	NA	NA	NE	NE	N/E	N/A
2.G.1 - Electrical Equipment					NA	N/A	
2.G.2 - SF6 and PFCs from Other Product Uses				NE	NE	N/E	
2.G.3 - N2O from Product Uses			NA				
2.G.4 - Other (Please specify)	NA	NA	NA	NA	NA	N/A	N/A
2.H - Other	NE	NE	NE	NA	NA	N/A	N/A
2.H.1 - Pulp and Paper Industry	NE	NE	NE				
2.H.2 - Food and Beverages Industry	NE	NE	NE				
2.H.3 - Other (please specify)	NA	NA	NA	NA	NA	N/A	N/A

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			
Categories	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NF3
3 - Agriculture, Forestry, and Other Land Use	**55704.4**	**888.4**	**17.6**	**NA**	**NA**	**N/A**	**N/A**
3.A - Livestock	**0.0**	**876.6**	**10.4**	**NA**	**NA**	**N/A**	**N/A**
3.A.1 - Enteric Fermentation		854.7					
3.A.2 - Manure Management		21.9	10.4				
3.B - Land	**55688.6**	**NA**	**NA**	**NA**	**NA**	**N/A**	**N/A**
3.B.1 - Forest land	54187.8						
3.B.2 - Cropland	1497.3						
3.B.3 - Grassland	3.5						
3.B.4 - Wetlands	NE						
3.B.5 - Settlements	NE						
3.B.6 - Other Land	NA						
3.C - Aggregate sources and non-CO_2 emissions sources on land	**15.8**	**11.8**	**7.2**	**NA**	**NA**	**N/A**	**N/A**
3.C.1 - Burning	NA	3.3	0.3				
3.C.2 - Liming	4.6						
3.C.3 - Urea application	11.2						
3.C.4 - Direct N_2O Emissions from managed soils			4.6				
3.C.5 - Indirect N_2O Emissions from managed soils			0.8				
3.C.6 - Indirect N_2O Emissions from manure management			1.5				
3.C.7 - Rice cultivation		8.6					
3.C.8 - CH_4 from Drained Organic Soils		NE					
3.C.9 - CH_4 from Drainage Ditches on Organic Soils		NE					
3.C.10 - CH_4 from Rewetting of Organic Soils		NE					
3.C.11 - CH_4 Emissions from Rewetting of Mangroves and Tidal Marshes		NA					
3.C.12 - N_2O Emissions from Aquaculture			NE				
3.C.13 - CH_4 Emissions from Rewetted and Created Wetlands on Inland Wetland Mineral Soils		NE					
3.C.14 - Other (please specify)	NA	NA	NA				
3.D - Other	**NE**	**NA**	**NA**	**NA**	**NA**	**N/A**	**N/A**
3.D.1 - Harvested Wood Products	NE						
3.D.2 - Other (please specify)	NA	NA	NA				
4 - Waste	**7.9**	**561.8**	**1.9**	**NA**	**NA**	**N/A**	**N/A**
4.A - Solid Waste Disposal		271.8					
4.B - Biological Treatment of Solid Waste		5.6	0.3				
4.C - Incineration and Open Burning of Waste	7.9	0.1	0.002				

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			
Categories	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NF3
4.D - Wastewater Treatment and Discharge		284.2	1.6				
4.E - Other (please specify)	NA	NA	NA				
5 - Other	NE	NA	NE	NA	NA	N/A	N/A
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			NE				
5.B - Indirect CO2 emissions from the atmospheric oxidation of CH4, CO and NMVOC	NE						
5.C - Other	NE	NA	NA	NA	NA	N/A	N/A
Memo Items (5)							
International Bunkers	344.3	0.002	0.01	NA	NA	N/A	N/A
1.A.3.a.i - International Aviation (International Bunkers)	344.3	0.002	0.01				
1.A.3.a.i - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOX and NH3			NA				
1.A.3.a.i - Indirect CO2 emissions from the atmospheric oxidation of CH4, CO and NMVOC	NE						
1.A.3.d.i - International water-borne navigation (International bunkers)	NA	NA	NA				
1.A.3.d.i - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOX and NH3			NE				
1.A.3.d.i - Indirect CO2 emissions from the atmospheric oxidation of CH4, CO and NMVOC	NE						
1.A.5.c - Multilateral Operations	NA	NA	NE	NA	NA	N/A	N/A
1.A.5.c - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOX and NH3			NE				
1.A.5.c - Indirect CO2 emissions from the atmospheric oxidation of CH4, CO and NMVOC	NE						

Appendix II: Non-Annex 1 Reporting Table 2

Inventory year 2019

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	61,285.8	1,717.9	31.9	117.5	0	0	256.2	4551.2	2686.6	10.9
1-Energy	4,447.2	172.8	3.1	-	-	-	77.8	1556.9	2686.6	10.9
1.A-Fuel Combustion Activities	4,447.2	172.8	3.1				77.8	1556.9	2686.6	10.9
1.B-Fugitive emissions from fuels	NE	NE	NE				NA	NA	NA	NA
1.C-Carbon dioxide Transport and Storage	NA						NA	NA	NA	NA
2-Industrial Processes and Product Use	369.5	NA	NA	117.5	NA	NA	NA	NA	0.0	NA
2.A-Mineral Industry	369.4	NA	NA				NA	NA	NA	NA
2.B-Chemical Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.C-Metal Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.D-Non-Energy Products from Fuels and Solvent Use	0.02	NA	NA				NA	NA	NA	NA
2.E-Electronics Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F-Product Uses as Substitutes for Ozone Depleting Substances				117.5	NA	NA	NA	NA	NA	NA
2.G-Other Product Manufacture and Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H-Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 - Agriculture, Forestry, and Other Land Use	56,461.2	982.9	26.9	NA	NA	NA	178.5	2994.4	0.0	0.0
3.A-Livestock		876.6	10.4				NA	NA	NA	NA
3.B-Land	56,461.2]						NA	NA	NA	NA
3.C-Aggregate sources and non-CO2 emissions sources on land	NA	106.3	16.5				178.5	2994.4	NE	NA
3.D-Other	NA	NA	NA				NA	NA	NA	NA

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
	Net CO2	CH4	N2O	HFCs	PFCs	SF6	NOx	CO	NMVOCs	SO2
4-Waste	7.9	561.8	1.9	NA	NA	NA	NA	NA	NA	NA
4.A-Solid Waste Disposal		271.8					NA	NA	NA	NA
4.B - Biological Treatment of Solid Waste		5.6	0.3				NA	NA	NA	NA
4.C - Incineration and Open Burning of Waste	7.9	0.1	0.0				NA	NA	NA	NA
4.D - Wastewater Treatment and Discharge		284.2	1.6				NA	NA	NA	NA
4.E - Other (please specify)	NA	NA	NA				NA	NA	NA	NA
5 - Other	NE	NA	NE	NA	NA	NA	NA	NA	NA	NA
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			NE				NA	NA	NA	NA
5.B - Indirect CO2 emissions from the atmospheric oxidation of CH4, CO and NMVOC	NE						NA	NA	NA	NA
5.C - Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items (5)										
International Bunkers	344.3	0.002	0.010	NA	NA	NA	NA	NA	NA	NA
1.A.3.a.i - International Aviation (International Bunkers)	344.3	0.002	0.010				NA	NA	NA	NA

Appendix III: First National Communication Emissions Estimates, 1995

No.	GREENHOUSE GAS SOURCE AND SINK CATEGORY	CO2 (Gg)	CH4 (Gg)	N2O (Gg)	NOX	CO	NMVO C
	Total (Net) National Emission						
1	All Energy (Fuel Combustion + Fugitive)						
	A Fuel Combustion	* 708.610					
	Energy & Transformation including	--	--	--	--	--	--
	Industry (SIC)	--	0.207	0.053	--	--	--
	Transport	507.150	0.126	0.540	3.950	27.270	4.990

No.	GREENHOUSE GAS SOURCE AND SINK CATEGORY	CO2 (Gg)	CH4 (Gg)	N2O (Gg)	NOX	CO	NMVO C
	Commercial/Institutional	63.000	--	--	--	--	--
	Residential	114.140	--	--	--	--	--
	Agriculture/Forestry	0.979	0.001	0.014	0.000	0.006	0.002
	Other (UEB Generators)	1.483	0.001	0.000	0.021	0.010	0.004
	Biomass Burned for Energy	13,763.000	74.520	4.704	22.810	822.930	--
	B Fugitive Fuel Emission						
	Oil Natural Gas Systems						
	Coal Mining						
2	Industrial Processes	--	--	--	--	--	--
	A. Iron and Steel	--	--	--	--	--	--
	B Non-Ferrous Metals						
	C Inorganic Chemicals						
	D Organic Chemicals						
	E non-metallic Mineral Products	43,4300.000					
	F Other (Foam)	0.070					
3	Solvent Use						
	A Paint Application	--	--	--	--	--	0.935
	B Degreasing and Dry Cleaning						0.057
	C Chemical Products Manufacture/Processing	--	--	--	--	--	--
	D Other	--	--	--	--	--	--
4	Agriculture						
	A Enteric Fermentation	--	197,400		--	--	--
	B Animal Wastes	--	7.050	--	--	--	--
	C Rice Cultivation	--	23.536	--	--	--	--
	D Agriculture Soils (Fertiliser Use)			0.002			
	E Agricultural Waste Burning	# 264.500	1.780	0.380	8.540	37.050	--
	F Savannah Burning	# 72,130.0	960.000	40.000	1,165.000	16,830.000	--
5	Lands Use Change and Forestry						
	A Forest clearing & On-Site Burning of Cleared Forest	2,834.750	1.971	0.014	0.319	17.243	--
	B Grassland conversion	6,641.900	4.015	--	--	--	--
	C Abandonment of Managed Lands	--	--	--	--	--	--
	D Managed (Forests Removals)	1,354.000	--	--	--	--	--
6	Waste						
	A Landfills	--	2.926	--	--	--	--
	B Waste water	--	--	--	--	--	--
	C Other (Pit Latrines)	--	1.600	--	--	--	--

* - Total emission

\# - Part of the natural cycle

Appendix IV: Second National Communication Emissions Estimates, 2014

SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (Gg)								
GREENHOUSE GAS SOURCE AND SINK	CO_2	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
CATEGORIES	Emissions	Removals						
Total National Emissions and Removals	11,759	-1,651	520	55	104	3,947	299	4
1 Energy	1,212		146	2	60	2,592	297	4
A Fuel Combustion (Sectoral Approach)	1,212		146	2	60	2,592	297	4
1 Energy Industries	48							
2 Manufacturing Industries and Construction	102		1		3	47	1	
3 Transport	808				8	55	10	
4 Other Sectors	254		145	2	49	2,491	285	4
5 Other (please specify)								
B Fugitive Emissions from Fuels								
1 Solid Fuels	NO							
2 Oil and Natural Gas	NO							
2 Industrial Processes	159						2	
A Mineral Products	159							
B Chemical Industry	NO			NO				
C Metal Production	NO			NO				
D Other Production	NO						2	
E Production of Halocarbons and Sulphur								NE
Hexafluoride								
F Consumption of Halocarbons and Sulphur								
Hexafluoride								
G Other (please specify)								
3 Solvent and Other Product Use	NE			NE				
4 Agriculture			272	52	12	222		
A Enteric Fermentation			230					
B Manure Management			11	1				

SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (Gg)								
C Rice Cultivation			22					
D Agricultural Soils				51				
E Prescribed Burning of Savannas			6		3	159		
F-Field Burning of Agricultural Residues			3		9	63		
G Other (please specify)								
5 Land-Use Change & Forestry	10,387	-1,651	69	1	32	1,132		
A Changes in Forest and Other Woody								
Biomass Stocks	6,373	-467						
B Forest and Grassland Conversion	3,501	-993						
CAbandonment of Managed Lands		-192						
D CO2: Emissions and Removals from								
Soil	513							
E Other (Non CO2 due to fires)			69	1	32	1,132		
6 Waste			33	NE				
A Solid Waste Disposal on Land			31					
B Wastewater Handling			2	NE				
C Waste Incineration	NE							
D Other (please specify)			NE	NE				
7 Other (please specify)								
Memo Items								
International Bunkers	96							
Aviation	96							
Marine								
CO2 Emissions from Biomass	30,419							

Appendix V: Third National Communication Estimates (Non- AFOLU Annexes)

Energy Sectoral Table (2017)

	Emissions (Gg)						
Categories	**CO2**	**CH4**	**N2O**	**NOx**	**CO**	**NMVOCs**	**SO2**
1-Energy	4743.4401	123.362	2.023	50.067	1821.844	2747.329	6.91
1.A - Fuel Combustion Activities	4743.4401	123.362	2.023	50.067	1821.844	2747.329	6.91
1.A.1 - Energy Industries	122.77629	11.093	0.223	0.7853	398.105	94.25381	0.82
1.A.1.a - Main Activity Electricity and Heat Production	122.77629	0.00497	1E-03	0.2353	0.02502	0.00381	0.82
1.A.1.a.i - Electricity Generation	122.77629	0.00497	1E-03	0.2353	0.02502	0.00381	0.82
1.A.1.a.ii - Combined Heat and Power Generation (CHP)				0	0	0	0
1.A.1.a.iii - Heat Plants				0	0	0	0
1.A.1.b - Petroleum Refining				0	10	0	0
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries		11.088	0.222	0.55	388.08	94.25	0
1.A.1.c.i - Manufacture of Solid Fuels		11.088	0.222	0.55	388.08	94.25	0
1.A.1.c.ii - Other Energy Industries				0	0	0	0
1.A.2 - Manufacturing Industries and Construction	928.00804	2.06009	0.277	11.56	39.88	20.5	2.09
1.A.2.a - Iron and Steel				0	0	0	0
1.A.2.b - Non-Ferrous Metals				0	0	0	0
1.A.2.c - Chemicals				0	0	0	0
1.A.2.d - Pulp, Paper and Print				0	0	0	0
1.A.2.e - Food Processing, Beverages and Tobacco				0	0	0	0
1.A.2.f - Non-Metallic Minerals				0	0	0	0
1.A.2.g - Transport Equipment				0	0	0	0
1.A.2.h - Machinery				0	0	0	0
1.A.2.i - Mining (excluding fuels) and Quarrying				0	0	0	0
1.A.2.j - Wood and wood products				0	0	0	0
1.A.2.k - Construction				0	0	0	0
1.A.2.l - Textile and Leather				0	0	0	0
1.A.2.m - Non-specified Industry	928.00804	2.06009	0.277	11.56	39.88	20.5	2.09
1.A.3 - Transport	3103.5289	0.8325	0.153	17.121	76.107	2432.781	0.034
1.A.3.a - Civil Aviation				0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers) (1)							
1.A.3.a.ii - Domestic Aviation				0	0	0	0
1.A.3.b - Road Transportation	3103.5215	0.8325	0.153	16.151	74.895	12.781	0
1.A.3.b.i - Cars	1486.8064	0.54666	0.071	4.69	30.91	3.87	0
1.A.3.b.i.1 - Passenger cars with 3-way catalysts				0	0	0	0

	Emissions (Gg)						
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	1486.8064	0.54666	0.071	4.69	30.91	3.87	0
1.A.3.b.ii - Light-duty trucks	696.8931	0.17051	0.035	3.14	16.56	1.69	0
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts				0	0	0	0
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	696.8931	0.17051	0.035	3.14	16.56	1.69	0
1.A.3.b.iii - Heavy-duty trucks and buses	761.83396	0.0401	0.04	7.979	1.812	0.459	0
1.A.3.b.iv - Motorcycles	157.98806	0.07523	0.007	0.342	25.613	6.762	0
1.A.3.b.v - Evaporative emissions from vehicles				0	0	0	0
1.A.3.b.vi - Urea-based catalysts	0			0	0	0	0
1.A.3.c - Railways	0.00741	3E-07	6E-08	0.97	1.212	2420	0.034
1.A.3.d - Water-borne Navigation				0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers) (1)							
1.A.3.d.ii - Domestic Water-borne Navigation				0	0	0	0
1.A.3.e - Other Transportation				0	0	0	0
1.A.3.e.i - Pipeline Transport				0	0	0	0
1.A.3.e.ii - Off-road				0	0	0	0
1.A.4 - Other Sectors	589.1269	109.377	1.37	20.6	1307.752	199.7938	3.965
1.A.4.a - Commercial/Institutional	131.46857	4.13314	0.041	2.8586	9.8781	5.1165	0.185
1.A.4.b - Residential	173.274	105.203	1.327	17.551	1297.693	194.6553	3.569
1.A.4.c - Agriculture/Forestry/Fishing/ Fish Farms	284.38433	0.04104	0.002	0.191	0.181	0.022	0.212
1.A.4.c.i - Stationary				0.154	0.172	0.02	0.212
1.A.4.c.ii - Off-road Vehicles and Other Machinery	197.48213	0.0285	0.002	0.037	0.009	0.002	0
1.A.4.c.iii - Fishing (mobile combustion)	86.9022	0.01254	8E-04	0	0	0	0
1.A.5 - Non-Specified	0	0	0	0	0	0	0
1.A.5.a - Stationary	0	0	0	0	0	0	0
1.A.5.b - Mobile	0	0	0	0	0	0	0
1.A.5.b.i - Mobile (aviation component)				0	0	0	0
1.A.5.b.ii - Mobile (water-borne component)	0	0	0	0	0	0	0
1.A.5.b.iii - Mobile (Other)				0	0	0	0
1.A.5.c - Multilateral Operations (1)(2)							
1.B - Fugitive emissions from fuels	0	0		0	0	0	0
1.B.1 - Solid Fuels	0	0		0	0	0	0
1.B.1.a - Coal mining and handling	0	0		0	0	0	0
1.B.1.a.i - Underground mines	0	0		0	0	0	0
1.B.1.a.i.1 - Mining	0	0		0	0	0	0

1.B.1.a.i.2 - Post-mining seam gas emissions	0	0		0	0	0	0
1.B.1.a.i.3 - Abandoned underground mines				0	0	0	0
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	0	0		0	0	0	0
1.B.1.a.ii - Surface mines	0	0		0	0	0	0
1.B.1.a.ii.1 - Mining	0	0		0	0	0	0
1.B.1.a.ii.2 - Post-mining seam gas emissions	0	0		0	0	0	0
1.B.1.b - Uncontrolled combustion and burning coal dumps				0	0	0	0
1.B.1.c - Solid fuel transformation				0	0	0	0
1.B.2 - Oil and Natural Gas				0	0	0	0
1.B.2.a - Oil				0	0	0	0
1.B.2.a.i - Venting				0	0	0	0
1.B.2.a.ii - Flaring				0	0	0	0
1.B.2.a.iii - All Other				0	0	0	0
1.B.2.a.iii.1 - Exploration				0	0	0	0
1.B.2.a.iii.2 - Production and Upgrading				0	0	0	0
1.B.2.a.iii.3 - Transport				0	0	0	0
1.B.2.a.iii.4 - Refining				0	0	0	0
1.B.2.a.iii.5 - Distribution of oil products				0	0	0	0
1.B.2.a.iii.6 - Other				0	0	0	0
1.B.2.b - Natural Gas				0	0	0	0
1.B.2.b.i - Venting				0	0	0	0
1.B.2.b.ii - Flaring				0	0	0	0
1.B.2.b.iii - All Other				0	0	0	0
1.B.2.b.iii.1 - Exploration				0	0	0	0
1.B.2.b.iii.2 - Production				0	0	0	0
1.B.2.b.iii.3 - Processing				0	0	0	0
1.B.2.b.iii.4 - Transmission and Storage				0	0	0	0
1.B.2.b.iii.5 - Distribution				0	0	0	0
1.B.2.b.iii.6 - Other				0	0	0	0
1.B.3 - Other emissions from Energy Production				0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.1.a - Pipelines	0			0	0	0	0
1.C.1.b - Ships	0			0	0	0	0
1.C.1.c - Other (please specify)	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.2.a - Injection	0			0	0	0	0
1.C.2.b - Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0

IPPU Sectoral Table (2017)

Categories	(Gg)			CO2 Equivalents(Gg)						
	CO2	CH4	N2O	HFCs	PFCs	SF6	NOx	CO	NMVOCs	SO2
2 - Industrial Processes and Product Use	349.777756	0	0	86.5445184	0	0	0	0	1.766	0
2.A - Mineral Industry	349.76526	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	343.44895						0	0	0	0
2.A.2 - Lime production	6.31631						0	0	0	0
2.A.3 - Glass Production	0						0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0	0	0	0	0	0	0	0	0	0
2.A.4.a - Ceramics	0						0	0	0	0
2.A.4.b - Other Uses of Soda Ash	0						0	0	0	0
2.A.4.c - Non Metallurgical Magnesia Production	0						0	0	0	0
2.A.4.d - Other (please specify) (3)	0						0	0	0	0
2.A.5 - Other (please specify) (3)							0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0						0	0	0	0
2.B.2 - Nitric Acid Production			0				0	0	0	0
2.B.3 - Adipic Acid Production			0				0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0				0	0	0	0
2.B.5 - Carbide Production	0	0					0	0	0	0
2.B.6 - Titanium Dioxide Production	0						0	0	0	0
2.B.7 - Soda Ash Production	0						0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0	0	0	0	0	0	0	0	0
2.B.8.a - Methanol	0	0					0	0	0	0
2.B.8.b - Ethylene	0	0					0	0	0	0
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	0	0					0	0	0	0
2.B.8.d - Ethylene Oxide	0	0					0	0	0	0
2.B.8.e - Acrylonitrile	0	0					0	0	0	0
2.B.8.f - Carbon Black	0	0					0	0	0	0
2.B.9 - Fluorochemical Production	0	0	0	0	0	0	0	0	0	0
2.B.9.a - By-product emissions (4)				0			0	0	0	0
2.B.9.b - Fugitive Emissions (4)							0	0	0	0
2.B.10 - Other (Please specify) (3)							0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0					0	0	0	0
2.C.2 - Ferroalloys Production	0	0					0	0	0	0
2.C.3 - Aluminium production	0				0		0	0	0	0
2.C.4 - Magnesium production (5)	0					0	0	0	0	0
2.C.5 - Lead Production	0						0	0	0	0
2.C.6 - Zinc Production	0						0	0	0	0

Categories	(Gg)			CO2 Equivalents(Gg)						
	CO2	CH4	N2O	HFCs	PFCs	SF6	NOx	CO	NMVOCs	SO2
2.C.7 - Other (please specify) (3)							0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use (6)	0.012496	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0.012496						0	0	0	0
2.D.2 - Paraffin Wax Use	0						0	0	0	0
2.D.3 - Solvent Use (7)							0	0	0	0
2.D.4 - Other (please specify) (3), (8)							0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor (9)				0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display (9)					0	0	0	0	0	0
2.E.3 - Photovoltaics (9)					0		0	0	0	0
2.E.4 - Heat Transfer Fluid (10)					0		0	0	0	0
2.E.5 - Other (please specify) (3)							0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	86.5445184	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning	0	0	0	81.3600538	0	0	0	0	0	0
2.F.1.a - Refrigeration and Stationary Air Conditioning				10.0710388			0	0	0	0
2.F.1.b - Mobile Air Conditioning				71.289015			0	0	0	0
2.F.2 - Foam Blowing Agents				0			0	0	0	0
2.F.3 - Fire Protection				5.18446458	0		0	0	0	0
2.F.4 - Aerosols				0			0	0	0	0
2.F.5 - Solvents				0	0		0	0	0	0
2.F.6 - Other Applications (please specify) (3)				0	0		0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment	0	0	0	0	0	0	0	0	0	0
2.G.1.a - Manufacture of Electrical Equipment					0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment					0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment					0	0	0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses	0	0	0	0	0	0	0	0	0	0
2.G.2.a - Military Applications					0	0	0	0	0	0
2.G.2.b - Accelerators					0	0	0	0	0	0
2.G.2.c - Other (please specify) (3)					0	0	0	0	0	0
2.G.3 - N2O from Product Uses	0	0	0	0	0	0	0	0	0	0
2.G.3.a - Medical Applications			0				0	0	0	0
2.G.3.b - Propellant for pressure and aerosol products			0				0	0	0	0

Categories	(Gg)			CO2 Equivalents(Gg)						
	CO2	CH4	N2O	HFCs	PFCs	SF6	NOx	CO	NMVOCs	SO2
2.G.3.c - Other (Please specify) (3)			0				0	0	0	0
2.G.4 - Other (Please specify) (3)							0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	1.766	0
2.H.1 - Pulp and Paper Industry							0	0	0	0
2.H.2 - Food and Beverages Industry							0	0	1.766	0
2.H.3 - Other (please specify) (3)							0	0	0	0

Waste Sectoral Table (2017)

Categories	Emissions [Gg]						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
4 - Waste	8.890702223	289.4106651	3.01666614	0	0	0	0
4.A - Solid Waste Disposal	0	200.3847562	0	0	0	0	0
4.A.1 - Managed Waste Disposal Sites				0	0	0	0
4.A.2 - Unmanaged Waste Disposal Sites				0	0	0	0
4.A.3 - Uncategorised Waste Disposal Sites				0	0	0	0
4.B - Biological Treatment of Solid Waste		21.26922	1.2761532	0	0	0	0
4.C - Incineration and Open Burning of Waste	8.890702223	0.482351841	0.007070788	0	0	0	0
4.C.1 - Waste Incineration	1.711646933	2.23624E-06	0.000124723	0	0	0	0
4.C.2 - Open Burning of Waste	7.179055289	0.482349605	0.006946065	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	67.27433708	1.733442152	0	0	0	0
4.D.1 - Domestic Wastewaster Treatment and Discharge		61.89365498	1.733442152	0	0	0	0
4.D.2 - Industrial Wastewater Treatment and Discharge		5.380682098		0	0	0	0
4.E - Other (please specify)				0	0	0	0

Appendix VI: Third National Communication Emission Estimates (AFOLU)

AFOLU Sectoral Table (2017

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
		CH_4	N_2O	N_0x	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	56473.87634	609.814302	29.63283197	18.14123898	362.6138046	0
3.A – Livestock	0	574.2351049	0.80985781	0	0	0
3.A.1 - Enteric Fermentation	0	551.176479	0	0	0	0
3.A.1.a – Cattle	0	449.703567	0	0	0	0
3.A.1.a.i - Dairy Cows		45.180878		0	0	0
3.A.1.a.ii - Other Cattle		404.522689		0	0	0
3.A.1.b – Buffalo		0		0	0	0
3.A.1.c – Sheep		20.98989		0	0	0
3.A.1.d – Goats		76.557535		0	0	0
3.A.1.e – Camels		0.0092		0	0	0
3.A.1.f – Horses		0		0	0	0
3.A.1.g - Mules and Asses		0		0	0	0
3.A.1.h – Swine		3.916287		0	0	0
3.A.1.j - Other (please specify)		0		0	0	0
3.A.2 - Manure Management (1)	0	23.05862594	0.80985781	0	0	0
3.A.2.a – Cattle	0	14.031312	0.320940142	0	0	0
3.A.2.a.i - Dairy cows		0.982193	0.035428756	0	0	0
3.A.2.a.ii - Other cattle		13.049119	0.285511385	0	0	0
3.A.2.b – Buffalo		0	0	0	0	0
3.A.2.c – Sheep		0.8395956	0	0	0	0
3.A.2.d – Goats		3.36853154	0.252665096	0	0	0
3.A.2.e – Camels		0	0	0	0	0
3.A.2.f – Horses		0	0	0	0	0
3.A.2.g - Mules and Asses		0	0	0	0	0
3.A.2.h – Swine		3.916287	0.196122242	0	0	0
3.A.2.i – Poultry		0.9028998	0.04013033	0	0	0
3.A.2.j - Other (please specify)		0	0	0	0	0
3.B – Land	56469.95849	0	0	0	0	0
3.B.1 - Forest land	43065.17496	0	0	0	0	0

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
3.B.1.a - Forest land Remaining Forest land	43457.19593			0	0	0
3.B.1.b - Land Converted to Forest land	-392.02097	0	0	0	0	0
3.B.1.b.i - Cropland converted to Forest Land	-136.9137			0	0	0
3.B.1.b.ii - Grassland converted to Forest Land	-242.71478			0	0	0
3.B.1.b.iii - Wetlands converted to Forest Land	-11.06424			0	0	0
3.B.1.b.iv - Settlements converted to Forest Land	-1.32825			0	0	0
3.B.1.b.v - Other Land converted to Forest Land	0			0	0	0
3.B.2 – Cropland	10611.34191	0	0	0	0	0
3.B.2.a - Cropland Remaining Cropland	0			0	0	0
3.B.2.b - Land Converted to Cropland	10611.34191	0	0	0	0	0
3.B.2.b.i - Forest Land converted to Cropland	10470.44519			0	0	0
3.B.2.b.ii - Grassland converted to Cropland	137.8989333			0	0	0
3.B.2.b.iii - Wetlands converted to Cropland	0			0	0	0
3.B.2.b.iv - Settlements converted to Cropland	2.99706			0	0	0
3.B.2.b.v - Other Land converted to Cropland	0.000733333			0	0	0
3.B.3 – Grassland	2727.190088	0	0	0	0	0
3.B.3.a - Grassland Remaining Grassland	0			0	0	0
3.B.3.b - Land Converted to Grassland	2727.190088	0	0	0	0	0

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
3.B.3.b.i - Forest Land converted to Grassland	2575.058255			0	0	0
3.B.3.b.ii - Cropland converted to Grassland	150.8165817			0	0	0
3.B.3.b.iii - Wetlands converted to Grassland	0			0	0	0
3.B.3.b.iv - Settlements converted to Grassland	1.589921667			0	0	0
3.B.3.b.v - Other Land converted to Grassland	-0.27467			0	0	0
3.B.4 – Wetlands	0	0	0	0	0	0
3.B.4.a - Wetlands Remaining Wetlands	0	0	0	0	0	0
3.B.4.a.i - Peatlands remaining peatlands	0		0	0	0	0
3.B.4.a.ii - Flooded land remaining flooded land				0	0	0
3.B.4.b - Land Converted to Wetlands	0	0	0	0	0	0
3.B.4.b.i - Land converted for peat extraction			0	0	0	0
3.B.4.b.ii - Land converted to flooded land	0			0	0	0
3.B.4.b.iii - Land converted to other wetlands				0	0	0
3.B.5 – Settlements	55.89136667	0	0	0	0	0
3.B.5.a - Settlements Remaining Settlements	0			0	0	0
3.B.5.b - Land Converted to Settlements	55.89136667	0	0	0	0	0
3.B.5.b.i - Forest Land converted to Settlements	52.82603333			0	0	0

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
3.B.5.b.ii - Cropland converted to Settlements	3.065333333			0	0	0
3.B.5.b.iii - Grassland converted to Settlements	0			0	0	0
3.B.5.b.iv - Wetlands converted to Settlements	0			0	0	0
3.B.5.b.v - Other Land converted to Settlements	0			0	0	0
3.B.6 - Other Land	10.36016667	0	0	0	0	0
3.B.6.a - Other land Remaining Other land				0	0	0
3.B.6.b - Land Converted to Other land	10.36016667	0	0	0	0	0
3.B.6.b.i - Forest Land converted to Other Land	0.716833333			0	0	0
3.B.6.b.ii - Cropland converted to Other Land	0			0	0	0
3.B.6.b.iii - Grassland converted to Other Land	9.445333333			0	0	0
3.B.6.b.iv - Wetlands converted to Other Land	0			0	0	0
3.B.6.b.v - Settlements converted to Other Land	0.198			0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land (2)	5.06	35.57919703	28.82297416	18.14123898	362.6138046	0
3.C.1 - Emissions from biomass burning	0	11.68714922	1.067087537	18.14123898	362.6138046	0
3.C.1.a - Biomass burning in forest lands		1.446719636	0.132091793	2.453133296	40.88555494	0

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
3.C.1.b - Biomass burning in croplands		2.7535945	0.25141515	2.9930375	110.14378	0
3.C.1.c - Biomass burning in grasslands		7.387968	0.6745536	12.527424	208.7904	0
3.C.1.d - Biomass burning in all other land		0.098867081	0.009026994	0.167644181	2.794069688	0
3.C.2 - Liming	0			0	0	0
3.C.3 - Urea application	5.06			0	0	0
3.C.4 - Direct N2O Emissions from managed soils (3)			20.87808211	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			6.877804514	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0	0	0	0
3.C.7 - Rice cultivation		23.89204781		0	0	0
3.C.8 - Other (please specify)				0	0	0
3.D - Other	-1.142149251	0	0	0	0	0
3.D.1 - Harvested Wood Products	-1.142149251			0	0	0
3.D.2 - Other (please specify)				0	0	0

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