Republic of Kiribati

First Biennial Update Report (BUR1) to the United Nations Framework Convention on Climate Change

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Environment and Conservation Division, with assistance of CLIMAGRIC Ltd
Ministry of Environment, Lands and Agricultural Development

Foreword

"I appeal to my fellow leaders around the world to stand in solidarity to protect the future of our people, notably our younger generations. We must be accountable for the impacts of our own emissions. We must take actions now before it is too late.''

Climate change is a major existential threat to Kiribati as a Small Island Developing State (SIDS), Least Developed Country (LDC), and as a low-lying atoll state and to the people of Kiribati in terms of their national security, survival, and existence. Climate change is and will adversely impact all aspects of society and the three pillars of sustainable development (environment, social, cultural, and economy) in Kiribati. It has and will continue to hinder national efforts to pursue and achieve sustainable development. Importantly, the government and people of Kiribati have been, and will continue to be mentally affected as well as physically apprehensive by risks brought in or imposed due to climate change, extreme events, slow onset events, and sea level rise, now and in the future.

Kiribati is recognized as one of the non-annex Party to the United Nations Framework Convention on Climate Change (UNFCCC), and the Kyoto Protocol (KP). As a responsible Party of the international community, Kiribati ratified the Paris Agreement in 2016. As a UNFCCC State Party, Kiribati has met its national obligations by submitting its Nationally Determined Contributions (Kiribati – NDCs) and, the Initial and Second National Communications. Kiribati is currently finalizing its first Biennial Update Report (BUR) and Third National Communication.

Kiribati's emissions of greenhouse gases are insignificant compared to global averages for countries or on per capita basis. However, Kiribati has greater interest to see that global actions to reduce emissions and mitigate climate change do not fail. State Parties to the UNFCCC are taking actions and commitments to reduce their emissions according to their Nationally Determined Contributions (NDCs). Kiribati is committed to achieve its targets on reducing emissions to mitigating climate change, as outlined in the recently submitted Kiribati NDCs.

The BUR report seeks to update the Third National communication by describing our National circumstances, Greenhouse gas inventory, Mitigation actions and their effects, proposal on our domestic Measuring, Reporting and Verification (MRV) system, as well as Financial, Technology and Capacity Building Support received and needed.

My sincere appreciation to everyone, who contributed to develop and finalize Kiribati's 1st Biennial Update Report to the UNFCCC. As the MELAD HM, I also welcome potential development partnerships from this report and I look forward to a fruitful collaboration with all of you.

Te Mauri, Te raoi ao te Tabomoa !

Honorable Minister. Mr. Tokaibure Rabaua
Minister of Environment, Lands, and Agricultural Development (MELAD)
18th March 2025

Acknowledgements

The Government of Kiribati through the Ministry of Environment, Lands and Agricultural Development (MELAD) would like to thank the Global Environment Fund (GEF) and United Nations Environment Program (UNEP) for funding and facilitating the development of Kiribati's 1st Biennial Update Report (BUR1).

The successful completion of this report has been made possible through the work of Climagric Ltd from Mauritius to provide the necessary support for preparing the mitigation, MRV, Constraints and Gaps, and Support received and needed chapters, as well as consolidating and preparing the BUR drafts.

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- Mark Andrew (Kiribati Land Transport Authority)
- Kabuati Nakabuta (Agriculture & Livestock Division – MELAD)
- Nenenteiti Teariki Ruatu (Environment & Conservation Division – MELAD)

MELAD is also grateful for the inputs of the Kiribati National Experts Group (KNEG), which add value to the further review of the BUR itself. Our gratitude to the Government of Kiribati's Cabinet for their final approval and endorsement of Kiribati's 1st Biennial Update Report for submission to the United Nations Framework Convention on Climate Change.

Finally, our sincere thanks to the persistence and patience of the BUR Project Coordinator (Ms. Raeterenga Kiaitoka) for her excellent effort in facilitating the completion of this BUR report, with all key stakeholders at the national level.

Kam bati n rabwa ao kam a aitau !

This report is dedicated to Late Mr Nakibae Teuatabo. His hard work in the field of climate change in Kiribati has contributed to various achievements for the Environment and Conservation Division. His great leadership in guiding and mentoring the team towards contributing in the completion of BUR1 will always be valued and remembered.

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Abbreviations and Acronyms

Abbreviation	Definition
%	Percentage
^{0}C	Degrees Celsius
^{0}F	Degrees Fahrenheit
AD	Activity Data
ADB	Asian Development Bank
ADO	Automotive Diesel Oil
AF	Adaptation Fund
AFD	Agence Française de Développement
AFOLU	Agriculture, Forestry and Other Land Use
AKA	Airport Kiribati Authority
ALD	Agriculture & Livestock Division
AR5	Fifth Assessment Report
AUD	Australian Dollar
AUSAID	Australian Agency for International Development
Avgas	Aviation gasoline
BAU	Business as Usual
BIA	Bonriki International Airport
bm	Biomass
BOD	Biological Oxygen Demand
BTR	Biennial Transparency Report
BUR	Biennial Update Report
BUR1	First Biennial Update Report
cap	capita
CBD	Convention on Biological Diversity
CBO	Church Based Organizations
CBIT	Capacity Building Initiative for Transparency
CC&DRM	Climate Change and Disaster Risk Management
CCU	Climate Change Unit
Ch	Chapter
CH_4	Methane
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2 e	Carbon Dioxide Equivalent
COF	Carbon Oxidation Fraction
COP	Conference of Parties
COVID-19	Coronavirus Disease 2019
CORVI	Climate and Ocean Risk Vulnerability Index
CSO	Civil Society Organization
CXI	Cassidy International Airport
DCC	Development Coordinating Committee
dm	Dry Matter
DPK	Dual Purpose Kerosene

Abbreviation	Definition
DRM	Disaster Risk Management
DSM	Demand Side Management
E	Emission
EC	Electrical Conductivity
ECD	Environment and Conservation Division
EE	Energy Efficiency
EEZ	Exclusive Economic Zone
EF	Emission Factor
EIDM	Environmental Information & Data Management
EPU	Energy Planning Unit
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization
FAOSTATS	FAO Statistics
FI	Input Factor
FLU	Land Use Factor
FMG	Management Factor
FOLU	Forestry and Other Land Use
FRA	Forests Resource Assessments
GAC	Global Affairs Canada
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Green Environment Fund
GESIAP	Gender Equity and Social Inclusion Action Plan
Gg	Gigagram
GHG	Greenhouse Gas
GHGIMS	Greenhouse Gas Inventory Management System
GJ	Gigajoule
GOK	Government of Kiribati
GPG	Good Practice Guidance
GWh	Gigawatt hour
GWP	Global Warming Potential
ha	Hectare
HF	High frequency
HFC	HydroFluoroCarbon
HM	Honourable Minister
HWP	Harvested Wood Products
ICA	International Consultation and Analysis
ISO	International Organization for Standardization
IE	Included Elsewhere
INC	First National Communication
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
JSS	Junior Secondary School
KCA	Key Category Analysis

Abbreviation	Definition
KCCP	Kiribati Climate Change Policy
KDP	Kiribati Development Plan
KEMIS	Kiribati Environment Management Information System
kg	Kilogram
KIEP	Kiribati Integrated Environment Policy
KIER	Kiribati Integrated Energy Roadmap
KJIP	Kiribati Joint Implementation Plan
KLTA	Kiribati Land Transport Authority
km	kilometre
km^2	Square Kilometre
KMS	Kiribati Meteorological Services
KNEG	Kiribati National Expert Group
KNEP	Kiribati National Energy Policy
KNSL	Kiribati National Shipping Company
KOIL	Kiribati Oil Company Limited
KRCS	Kiribati Red Cross Society
KSSL	Kiribati Shipping Services Ltd
KUC	Kiribati Uniting Church
KV20	Kiribati 20-year Vision
kW	Kilowatt
kWh	Kilowatt-hour
KWMRRS	Kiribati Waste Management and Resource Recovery Strategy
kWp	Kilowatt photovoltaic
LDC	Least Developed Country
LDCF	Least Developed Country Fund
LED	Light Emitting Diode
LMD	Lands Management Division
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land Use Change and Forestry
m	metre
M&E	Monitoring and Evaluation
m^3	cubic metre
MCA	Multicriteria Analysis
MCF	Methane Conversion Factor
MCIC	Ministry of Commence, Industry and Cooperatives
MEAs	Multilateral Environmental Agreements
MELAD	Ministry of Environment, Lands and Agricultural Development
MELAD/ECD	Ministry of Environment, Lands and Agricultural Development – Environment and Conservation Division
MFED	Ministry of Finance and Economic Development
MFMRD	Ministry of Fisheries and Marine Resources Development
MHMS	Ministry of Health and Medical Services
MIA	Ministry of Internal Affairs
MICTD	Ministry of Information, Communication, Transport and Tourism
MICTTD	Ministry of Information, Communication, Transport and Tourism Development
MISE	Ministry of Infrastructure and Sustainable Environment

Abbreviation	Definition
MJ	Megajoule
MLHRD	Ministry of Labour and Human Resource Development
mm	millimetre
MOE	Ministry of Education
MPA	Marine Protected Areas
MPG	Modalities, Procedures and Guidelines
MPWU	Ministry of Public Works and Utilities
MRV	Measurement, Reporting and Verification
MSW	Municipal Solid Waste
MW	Megawatt
MWh	Megawatt-hour
MWp	Megawatt peak
MWYSA	Ministry of Women, Youth and Social Affairs
N	Nitrogen
N_2O	Nitrous Oxide
NA	Not Available
NC	National Communication
NC1	First National Communication
NC2	Second National Communication
NC3	Third National Communication
NCCHAP	National Climate Change Health Action Plan
NCD	Non Communicable Disease
NDC	Nationally Determined Contribution
NE	Not Estimated
NGO	Non Governmental Organization
NIIP	National Inventory Improvement Plan
NMVOC	Non Methane Volatile Organic Compound
NO	Not Occurring
NO_X	Other oxides of nitrogen
NSO	National Statistics Office
OB	Office of Te Beretitenti
ODA	Official Development Assistance
OOF	Other Official Flows
PA	Paris Agreement
PACTAM	Pacific Technical Assistance Mechanism
PET	Polyethylene terephthalate
PFC	PerFluoroCarbon
POIDIER	Promoting Outer Island Development through Integrated Energy Roadmap
PIPA	Phoenix Islands Protected Area
PPP	Private Public Partnership
PSCCC	Parliament Select Committee on Climate Change
PSO	Public Service Office
PUB	Public Utility Board
PV	PhotoVoltaic
QA	Quality Assurance

Abbreviation	Definition
QC	Quality Control
RA	Reference Approach
RAC	Refrigeration and Air Cooling
RE	Renewable Energy
RO	Reverse Osmosis
SA	Sectoral Approach
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
SF6	Sulphur Hexafluoride
SIDS	Small Island Developing State
SLIMPA	Southern Line Islands Marine Protected Area
SNC	Second National Communication
SO_2	Sulphur Dioxide
SPC-EDD	The Pacific Community – Economic Development Division
SREP	Secretariat of the Pacific Regional Environment Programme
SRO	Senior Responsible Officer
STSISP	South Tarawa Sanitation Improvement Sector Program
SWDS	Solid Waste Disposal Site
t	ton
TA	Technical Assistance
TACCC	Transparency, Accuracy, Completeness, Consistency and Comparability
TBC	To Be Confirmed
TBD	To Be Determined
TBE	To Be Estimated
TJ	Terajoule
TNC	Third National Communication
TTE	Technical Team of Experts
ULP	Unleaded Petrol
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
Vol	Volume
WB	World Bank
WHO	World Health Organization
WSEU	Water Sanitation and Engineering Unit
yr	Year

Executive Summary

ES 1. National circumstances and institutional arrangements

The submission of the BUR1 by the Government of Kiribati is mandatory for the country to fulfil its national obligations under Article 4, paragraph 1(a), and Article 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and decision 1/CP.16. The legal framework regarding climate change in Kiribati falls under the Environment Act 2021 and the Disaster Risk Management and Climate Change Act (DRMCCA) 2019.

Office of Te Beretitenti (OB) (Office of the President) has the overall responsibility to coordinate climate change policy issues. The Ministry of Finance and Economic Development (MFED) through the newly established Climate Change Division, is responsible for climate change finance with specific emphasis on securing external climate change funding from various Adaptation Funds (AF), the Green Climate Fund (GCF) and other funding windows as appropriate. The multi-sectoral Kiribati National Expert Group (KNEG) on Climate Change and Disaster Risk Management, is comprised of representatives (Director's level) from government and the private sector including Non-Government Organizations (NGOs), Civil Society Organizations (CSOs) and Church Based Organizations (CBOs). The KNEG is established under the DRMCCA 2019 to be the principal strategic coordination and technical advisory body for disaster risk management and climate change. The Ministry of Environment, Lands and Agricultural Development (MELAD) is the lead agency responsible for climate change science and technical implementations / interventions including environment and climate change nationally and externally funded interventions (in the form of initiatives and projects) to address inter-linked climate change impacts on the atolls' environment (land, sea, and air) of Kiribati at the national level through the Environment and Conservation Division (ECD). Kiribati is a small island state in the central Pacific, comprised of 32 low-lying atolls and 1 uplifted limestone island scattered over the four hemispheres, on latitude 1° 52' 15.31" North and longitude 157° 21' 45.36" West. Kiribati is recognized internationally as a Small Island Developing State (SIDS) and a Least Developed Country (LDC). It has a land area of 810.5 km^2, a coastline of 1,296 km and an Exclusive Economic Zone (EEZ) of 3.55 million km^2.

Due to its location, Kiribati experiences hot and humid conditions throughout the year. It has two main seasons, a wet one extending from November to April and a dry one lasting from May to October. The mean temperature is around 28-29 °C all year round while the maximum temperature varies around 31-32 °C except for Kiritimati where it is slightly lower (29-31 °C). The minimum temperature is around 24-25 oC (Kiritimati, Tarawa and Beru), except for Butaritari which is cooler by a few degrees due to its position relative to the ITCZ. The rainfall for Kiribati Islands ranges according to their geographical location. Kiribati Islands are strongly influenced by El Niño when the climate becomes warmer and rainier than normal while with La Niña, it becomes cooler and drier, leading to recurrent drought, which in these atolls devoid of streams, can cause major problems. Being practically at the equator, Kiribati is outside the cyclonic area but, being flat islands, they sometimes receive abnormal swells, especially when these are combined with high tides. Tropical Storm Bavi and TC Pam were the first twin cyclones ever documented by KMS bringing the most devastating impact to some parts of Kiribati including Arorae, Tamana and Tarawa as well.

The 2020 census recorded a total population of 119,438, of which 70,441 (59%) were urban dwellers and 48,997 (41%) rural. 58,904 (49%) were males and 60,534 (51%) females. The increase in population during the decade 2010 to 2020 is 16%. The unemployment rate did not change from 2010 to 2020 with 11% of the active workforce not having an economic activity.

In 2020, 93% of the urban population 15 years and above had attended school up to class 3 compared to 87% in rural areas. In that same year, 87% of the urban population aged 12 and above could read and write without difficulty compared to 76% in the rural areas.

Prior to the COVID-19 outbreak, Kiribati's economy performed well with an average annual real GDP growth of 4.75% during the period 2015 to 2019. In 2020 a decline of 0.5% was recorded. Strict border and containment restrictions and a sharp drop of 16% in fishing revenues were contributors to this decline. Real GDP per capita increased from AUD 1,612 in 2015 to AUD 1,749 in 2019.

Even though Kiribati is blessed with abundant indigenous energy resources from solar, wind, ocean, coconut copra and biomass, it is highly dependent on petroleum imports for electricity generation, transportation, and domestic uses. In 2019, the Kiribati (Gilbert Island Group) total final energy consumption was 1,523 TJ of which 54% was petroleum products and 46% from renewable sources, namely, 1% solar and 45% biomass (Personal Communication, MISE energy balance for 2019). The residential sector is the largest consumer of energy with a share of 52.0%, followed by the transport sector that used 17.6% while sea transport consumed 16%. As of 2019, electricity made up only 3.9% of households' energy consumption. More than 80% of household's energy consumption comes from biomass in the form of coconut residue and firewood (87.0%), petroleum products as kerosene (6.2%) and gasoline (2.9%) accounting for the remaining. Liquefied petroleum gas use is limited due to high costs, especially in comparison to subsidized kerosene prices. Gasoline was the major fossil fuel used with 42% share of consumption while diesel followed with 35% on national basis (Personal Communication, MISE energy balance for 2019).

Kiribati is serviced by air, maritime and road transportation. Two main international airports and seaports are serving international and domestic regular services. These two airports and a further 17 on outer islands are operated by the Airport Kiribati Authority (AKA). The Kiribati Ports Authority (KPA) is the main seaport available on South Tarawa, and it has a branch office stationed and operating on Kiritimati Island, which service the inhabited islands of the Line and Phoenix Groups. Kiribati is a big ocean nation with a total Exclusive Economic Zone of 3,441,810 km^2. The islands are scattered over the four hemispheres. Thus Kiribati faces an enormous geographical challenge of remoteness, isolation and distance. For example, the distance from the capital island, Tarawa, to the Phoenix Islands is 1,500 km and 3,300 km to the Line Islands. The islands are connected domestically via sea and air transportations. Domestic air services is frequent amongst the islands in the Gilbert Group, but is limited in the Line and Phoenix Groups. The road infrastructure is quite limited and consists of about 700 km of roadways of which the only tarred main road, in South Tarawa Island, is approximately 50 km long.

Kiribati imports a significant quantity of products to meet the local population needs. Most of the waste problems arrive from overseas as tin, bottles, plastic of all types, or cardboard packages. The materials produced locally are organic and the waste can be managed at the household level. Organic waste accounts for about 60% of total solid waste, making it the highest stream. There are three approved landfills on South Tarawa and Kiritimati Island has one approved dumpsite and one hazardous cell. Waste incinerations are mainly to treat medical and quarantine wastes. Kiribati practices recycling of lead-acid batteries, aluminium cans, and PET bottles and exported some 376 tonnes of these recyclables from 2005 to 2022. In 2019, about 50,000 litres of used oil were exported for recycling in New Zealand. Another important feature of waste treatment in Kiribati is composting used in domestic gardening needs. Approximately 60 tonnes of compost are produced annually.

There is no treatment system for sewage from the households that are collected by the sewerage system operated by the Public Utilities Board (PUB) on South Tarawa and Betio. The sewerage system only collects

sewage and discharges these directly into the ocean through five sea outfalls located at Nawerewere, Bikenibeu, Moroni High School compound, Bairiki, and Betio. Moroni High School Compound area has its own built sewerage system with its own sea outfall. Other sewerage systems that are not connected to the PUB system have their own on-site septic tanks. Households that are not connected to the PUB system have their own on-site septic or latrine system. They are serviced by the PUB vacuum truck to de-sludge their septic tanks when they are full and discharged into the PUB system for disposal into the ocean through the outfalls.

Undertaking agriculture, forestry, and livestock rearing and domestication in Kiribati is either very challenging or very expensive because of the infertile, very alkaline and coarse-textured soil, the limited land area, and limited fresh water. The size of each island varies and differs with most of the land areas either restricted to frequently less than 1 km^2 or characteristic widths often less than 1 km or not more than 2 km. Surface fresh water is scarce or non-existent in many islands due to the small size, low elevation, and high soil and regolith permeability, except Tabuaeran in the Northern Line Island Group.

The geography of Kiribati creates significant and unique human development and growth challenges, including access to safe, reliable fresh water and sanitation. Freshwater resources of Kiribati consist of rainwater, shallow unconfined groundwater generally within less than 2 m of the surface, imported water and desalination plants water. The raised island of Banaba uniquely has freshwater pools in subterranean caves that could serve as an emergency source of water in times of severe droughts.

Fishing is one of the most important economic activities of the country at the national, island, and local levels. Fishing and seaweeds' contribution to national GDP was estimated at AUD 25 million (10%) in 2019 compared to about AUD 16 million in 2015. The estimated exports of fish and fishery products were valued at AUD 180 million, tuna being the major species exported.

In Kiribati, high density housing, especially on South Tarawa as the capital island, facilitates easy transmission of infectious and other diseases outbreaks. Being an atoll, there is an acute freshwater security problem, which is exacerbated by increasing waste generation and pollution problems as well as fluctuating weather patterns due to climate change. Almost 80 to 90% of the total population rely on imported food grains such as rice, flour, and sugar, as their staple food sources. Non-communicable diseases are now recognized as the leading cause of health problems in Kiribati. In Kiribati, there is one main headquarter hospital located on South Tarawa, the capital island, which is the referral hospital with mini hospitals located on Betio and on Tabiteuea North in the southern part of the Gilberts Island and the hospital located on Kiritimati Island in the Line Group serves as the secondary referral hospital for inhabited islands in the Line and Phoenix Groups. These hospitals are supported by a network of 22 Health Centres and 82 village clinics. Medical supplies, medical equipment, and qualified medical doctors to adequately service the main and sub-hospital for the general public, including the outer islands medical health centres are limited.

Healthy coastal habitats are important in mitigating global climate change. Mangroves, seagrass beds, and coral reef ecosystems absorb and store large quantities of carbon dioxide, a greenhouse gas, from the atmosphere. These habitats, known as carbon sinks, contain large stores of carbon accumulated over hundreds of thousands of years. These ecosystems have important roles in the carbon cycle through atmospheric carbon dioxide (CO_2) sequestration and storage. These ecosystems are also protected under the Environment Act 2021.

Under the MELAD environment portfolio, GOK has invested in the establishment of marine protected areas (MPA) at the national and island levels under the Environment Amendment Act 2007, through the

PIPA in the Phoenix Islands Group in 2006, the Southern Line Islands Marine Protected Area (SLIMPA) in the Line Islands Group in 2020, and through the community based protected areas in several islands of the Gilbert Group.

Similarly, under the fisheries portfolio of the Ministry of Fisheries and Marine Resources Development (MFMRD), GOK has also equally invested in protecting, managing, and sustaining the marine resources, including coral reef restoration and economically important marine species rehabilitation, to support the fisheries development at the national and island levels. These also complement the protected areas initiatives of MELAD.

The Government of Kiribati has two national plans that expresses its development priorities; the Kiribati 20 years Vision (KV20) covering the period 2016 to 2036 and the Kiribati Development Plan that runs over successive four years periods. These recognize Kiribati's vulnerability to climate change as a key constraint to achieving the targeted sustainable development outcomes. The KV20 underscores the need to mainstream climate change adaptation and mitigation into various programmes to ensure that the working environment is sensitive to environment protection and management, climate change and sustainable development. Across all government ministries, there are strategic plans developed and aligned with the two national documents which identify specific priority areas and sectoral approaches. To help achieve these priorities, ministries also recognize and adopt other strategies which includes the Kiribati Climate Change Policy, the Kiribati Joint Implementation Plan (KJIP) 2019-2028 and the Kiribati Waste Management and Resource Recovery Strategy (KWMRRS) 2020-2030 among others.

As a Pacific SIDS and an LDC, Kiribati has a marginal influence on GHGs emitted into the atmosphere. Hence, there are no priorities related to mitigation of climate change. However, mitigation is indirectly addressed under the specific key sectors energy, environment, agriculture and livestock. Currently, the Government is working on strengthening the policies, legislations, and institutional arrangements of key relevant sectors to improve efforts to mitigate climate change. Simultaneously, a Climate Change Finance Division has been recently established at the Ministry of Finance and Economic Development (MFED) to coordinate and secure climate change financing from Least Development Countries Fund (LDCF), Green Climate Fund (GCF), and the Adaptation Fund (AF).

ES 2. National greenhouse gas inventory

Under Article 4.1 (a) of the Convention, each Party must develop, periodically update, publish, and make available to the Conference of the Parties (COP), in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the COP. The present Greenhouse Gas (GHG) inventory is being compiled within the framework of the preparation of the First Biennial Update Report (BUR1).

This present inventory provides information on GHG emissions by sources and removals by sinks for all years for the period 2000 to 2019. Improvements over the previous inventory consisted in the review of activity areas for maximum completeness and recalculations with the availability of better national activity data (AD) for all years to enhance consistency and accuracy.

The existing GHGIMS, inclusive of the institutional arrangements for compiling the inventory, is still being developed. The existing institutional arrangements which are under review in line with the Measurement, Reporting and Verification (MRV) system within the framework of the BUR1 are further detailed in the MRV chapter.

This GHG inventory covers the whole territory of the Republic of Kiribati with estimates made at the national scale.

The national GHG inventory includes estimates for the four IPCC sectors, namely, Energy, Industrial Processes and Product Use (IPPU), Agriculture Forestry and Other Land Use (AFOLU) and Waste and includes emissions of the direct GHGs carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) for categories addressed.

Estimates of GHG emissions have been compiled using the IPCC 2006 Guidelines for National GHG Inventories (IPCC, 2007) to ensure that the GHG emission estimates are Transparent, Accurate, Complete, Consistent and Comparable (TACCC) as far as possible and in line with decision 18/CMA.1.

Limited availability of disaggregated AD (e.g., facility level data) and national EFs led to the adoption of the Tier 1 level for all categories.

Global Warming Potentials (GWP) of the IPCC Fifth Assessment Report (AR5) have been used to convert GHGs other than CO_2 to the latter equivalent as prescribed in decision 18/CMA.1.

The KCA was performed using the tool available within the IPCC inventory software (Version 2.69) for both the level and trend assessments. There are 11 key categories for both the level (2019) and trend assessment for the period 2000 to 2019.

Quality Assurance (QA) and Quality Control (QC) procedures were not implemented by Kiribati during the preparation of this inventory due to lack of capacity and the appropriate systems. However, the international consultants did perform a QA/QC as defined in the 2006 IPCC Guidelines (IPCC, 2007) as far as practicable.

The Uncertainty Assessment was also performed by the international consultants based on the ranges provided for activity data and default emission factors in the IPCC 2006 Guidelines.

The inventory is still somewhat incomplete even if there have been major improvements on the previous one.

For consistency purposes on the method and sources of data and maintaining the same completeness for categories and gases covered, emissions were recalculated for the period 2004 to 2008 and the absolute emissions of CH_4 and N_2O were aggregated after their conversion into CO_2 equivalents using the AR5 GWPs for comparability with the present inventory.

A consistent time series for the period 2000 to 2019 was built with a good level of confidence and comparability between years in the trend of the emissions.

The Republic of Kiribati remained a net emitter throughout the timeseries 2000 to 2019. Gross national emissions increased from 77,265 t CO_2 e in 2000 to reach 127,283 t CO_2 e in 2019 (Figure ES1). Removals from the AFOLU sector decreased slightly, by 964 t CO_2, from the year 2000 to 27,767 t CO_2 in 2019 (Figure ES1). Net emissions were estimated at 99,516 t CO_2 e in the year 2019, representing an increase of 105% over the year 2000 (Figure ES1).

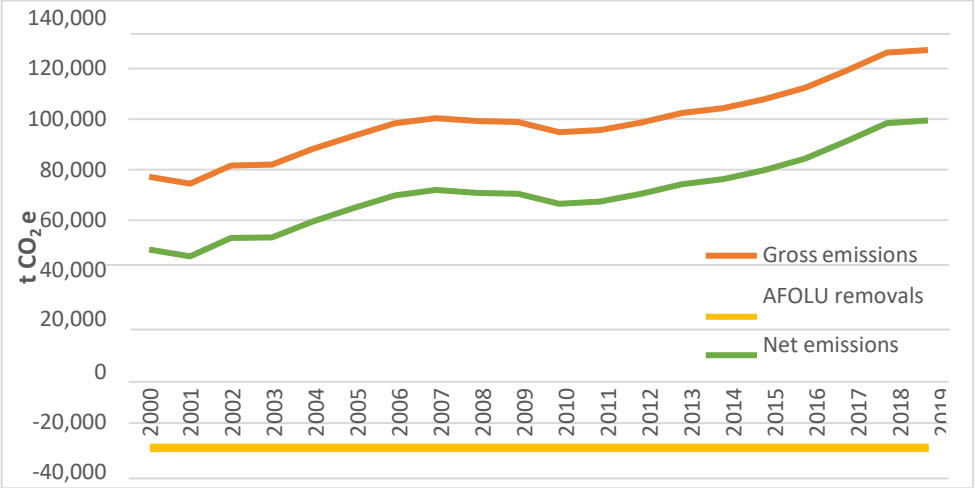


Figure ES 1: Trend of gross emissions, AFOLU removals and net emissions (2000 – 2019)

Consequently, the per capita net emissions increased from 0.57 in the year 2000 to 0.84 t CO_2 e in 2019 representing an increment of 46.9% resulting from the countries normal development.

The share of gross emissions by sector is provided in Figure ES2. Total gross emissions increased by 65% over the 20-years timeseries, mainly driven by significant increases in the Energy and Waste sectors. During the period 2000 to 2019, the emissions from the Energy sector increased by 59%. Emissions from the IPPU sector fell by 39% from the year 2000 when it emitted 123 t CO_2 e to 75 t CO_2 e in 2019 is not very apparent in Figure ES2 because of its marginal contribution. AFOLU emissions increased from 22,666 t CO_2 e in 2000 to reach its maximum in 2010 at 24,651 t CO_2 e to thereafter decrease to 22,824 in t CO_2 e 2019. Emissions from the Waste sector increased by nearly 425% from the 2000 level of 4,877 t CO_2 e to 25,602 t CO_2 e in 2019.

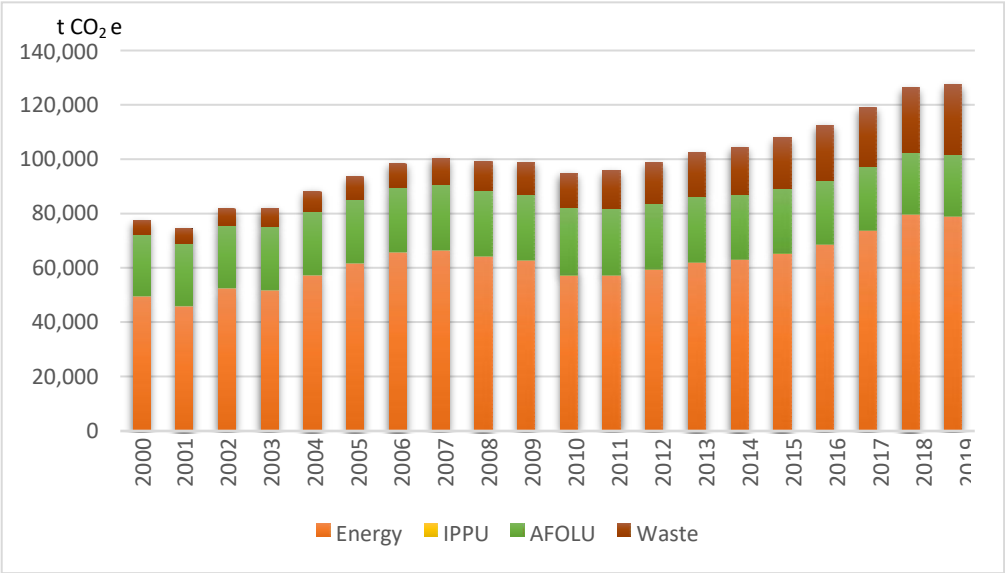


Figure ES 2: Evolution of share of gross emissions by sector (2000 – 2019)

CO_2 remained the main contributor to national gross GHG emissions, followed by CH_4 and N_2O over the full time series. In 2019, the share of GHG emissions was as follows: 57% CO_2, 37% CH_4 and 6% N_2O.

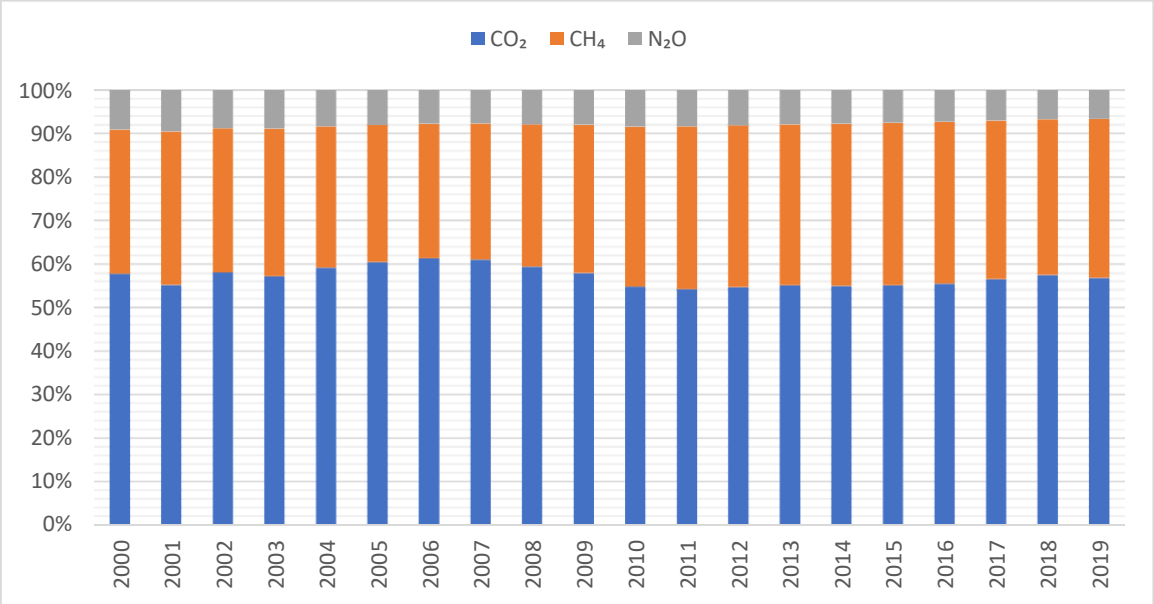


Figure ES 3: Share of gross emissions of each direct GHGs (2000 – 2019)

Numerous challenges were encountered during the compilation of the present inventory, namely, lack of an operational GHG inventory management system, no data collection and sharing network inclusive of appropriate tools for performing same, unavailability of AD for some categories, and limited capacity of stakeholders and national experts.

Upfront to the preparation of a National Inventory Improvement Plan, the key issues to be addressed have been identified and documented.

ES 3. Information on mitigation actions and their effects, including associated methodologies and assumptions

Background

Kiribati ratified the PA on 16 September 2016 and became obligated to report in accordance with the Modalities, Procedures and Guidelines (MPGs) of decision 18/CMA.1 as from 2024 in its Biennial Transparency Report (BTR). In view of this, the country is starting to align its reporting to these MPGs during the preparation of the mitigation chapter of this first Biennial Update Report (BUR1).

The last mitigation assessment was associated with the INDC and dates back to 6 years. Hence, it has been deemed essential to update this exercise within the framework of the preparation of the BUR1 to provide sound information for informing government's decisions and guide future reporting to the UNFCCC while building capacity of national experts to transit to the MPGs of the PA in the future. Additionally, further potential mitigation actions have been identified for the Agriculture, Forestry and Other Land Use (AFOLU) and Waste sectors during the exercise. The latest sectoral policies, plans and roadmaps were analysed and activities presenting a potential for mitigation assessed.

Updated mitigation potential

Table ES 1 summarizes the abatement potential (t CO_2 e) at the national and sectoral levels relative to the national and sectoral BAU scenarios for the year 2030. Implementation of all the mitigation actions retained for all the sectors have a total reduction potential of 88,085 t CO_2 e, representing 64.8% of the BAU scenario. Of these 64.8%, Energy will contribute 51.6% (70,135 t CO_2 e), Waste 8.2% (11,200 t CO_2 e) and AFOLU 5.0% (6,750 t CO_2 e). Thirty eight actions in the Energy Sector from the INDC, KIER and NDC

Roadmap and five additional measures, two on AFOLU and three on Waste, have been assessed and retained.

Table ES 1: National mitigation potential (t CO_2 e) for year 2030 compared to the BAU scenario

Level	Emissions – BAU scenario	Emissions – Mitigation scenario	Emissions avoided	% of national BAU emissions
National	135,960	47,875	88,085	64.8%
Energy	81,500	11,365	70,135	51.6%
IPPU	60	60	-	-
AFOLU	21,300	14,550	6,750	5.0%
Waste	33,100	21,900	11,200	8.2%

The INDC actions account for 2,412 t CO_2 e presently avoided annually from fully implemented actions, 237 t CO_2 e for partly implementated ones and a reduction potential of 25,856 t CO_2 e for those planned in 2030. For the KIER report on the Energy sector, emissions reduction from implemented actions amount to 3,711 t CO_2 e with another 897 for actions from partly implemented ones and 3,922 t CO_2 e for the planned ones. The NDC roadmap projects emissions reduction of 33,100 t CO_2 e. A summary of all actions from all reports and the total mitigation potential are presented in Table ES2.

Kiribati also identified in its NDC one action to increase its sink capacity through the plantation of mangroves and the removals are estimated at 42.5 t CO_2 e in 2030.

Table ES 2: Summary of emissions reduction potential of implemented, ongoing implementation, and planned mitigation actions or group of actions

Source	Implemented	Ongoing implementation	Planned	Total
INDC	2,412	237	25,856	28,505
KIER	3,711	897	3,922	8,439
NDC Roadmap	-	-	33,100	33,100
Total	6,123	1,134	62,878	70,135
Share of national	8.7%	1.6%	89.7%	

ES 4. Constraints and gaps, and related financial, technical and capacity needs, including a description of support needed and received

UNFCCC reporting requirements have evolved significantly and despite the progress made on numerous fronts when preparing the national reports, Kiribati still faces significant challenges which are very difficult to meet as they are very ambitious and require meaningful financial, technical, and human resources.

Enhancement of the reporting requirements, namely the enhanced transparency framework of the PA in accordance with its Article 13, now demands for a permanent framework to facilitate the production of these reports. Kiribati seeks to develop and strengthen existing institutional arrangements for reporting in accordance with the MPGs of Decision 18/CMA.1. Kiribati intends to make use of Capacity Building Initiative for Transparency (CBIT) funds from the GEF to develop and implement its MRV systems to track the implementation of the NDC.

Kiribati has progressed in the compilation of its GHG inventory, especially the one in this BUR1 to be in line with the TACCC principles, resource permitting as far as possible. The country has addressed new categories and improved its timeseries which is now more consistent.

Kiribati has implemented numerous mitigation actions despite the multiple constraints and gaps encountered at the legal, institutional, and procedural levels. There is a need to improve the enabling environment, the technology assessment and transfer for mitigation, notwithstanding capacity building of national experts. Barriers must be removed to speed up implementation of mitigation actions and prepare project proposals for mobilizing funds.

Kiribati is highly vulnerable because it is a SIDS and a LDC at the same time. The pace at which adaptation measures are being implemented is too slow for the country to build its necessary resilience to climate change.

Kiribati requires technical and capacity building support to implement its NDC mitigation and adaptation actions to meet the objectives of the Convention and report on these as per Articles 7 and 9 of the PA. Technical capacity building concerns mainly mitigation and adaptation technologies to be identified in relation with the measures that are most prominent and prioritized for implementation. Several other overarching issues such as information sharing and networking, knowledge sharing, and sensitization must also be addressed for successful implementation of the NDC mitigation and adaptation actions.

As a SIDS and an LDC, Kiribati needs robust institutional structures to take on and implement programs and activities on climate change. Building human and institutional capacity to address climate change will be a fundamental component of the NDC implementation. Capacity building for climate change will thus include further development and strengthening of personal skills, expertise and capacity of relevant institutions and organizations on adaptation, mitigation and reporting. Capacity building targets a wide group of stakeholders, including the government, NGOs, local communities, and the private sector.

Implementation of the Convention as per the country's low-carbon strategy is even more demanding because of the significant amounts of funds required to develop and implement mitigation and adaptation projects. Funding implementation of mitigation actions as estimated in the NDC is around 4.629 M USD and 69.021 M USD for adaptation.

ES 5. Information on domestic measurement reporting and verification

Kiribati does not have a domestic MRV system in place to report to the UNFCCC and has conceptualized one within the framework of its first Biennial Update Report (BUR1) preparation for eventual development and implementation. The MRV system will be an online interactive platform where all stakeholders can feed in and share data and information on the implementation of the UNFCCC for reporting. The system will also serve as a repository of climate change data.

Kiribati will build on the existing Monitoring and Evaluation (M&E) system to optimize use of resources while gaining time for developing readiness to report in accordance with the ETF of the PA. Development of the MRV system will aim at addressing institutional, legal, and procedural agreements; data and information needs; and financial gaps and barriers.

Proposed MRV system

Collection of data and other information for producing the last GHG inventory, information on mitigation actions and support received and needed used for the preparation of the BUR1, indicate that the present systems and arrangements for the MRV of Emissions (GHG inventory) are still weak and need strengthening while the MRV for Mitigation and Support are in their infancies. Since climate change affects directly or indirectly all socio-economic development sectors and is embedded in almost all the Sustainable Development Goals (SDGs), all Government Institutions, Non-Governmental Organizations

(NGOs) and Civil Society Organizations (CSOs) and other community organizations will be invited to contribute in the MRV systems.

The stakeholders identified for participation, as well as their potential role and responsibilities, are presented under each MRV component in this report. The overall responsibility for implementing all MRV activities will rest with MELAD-ECD supported by MFED on the financial aspect and NSO for archiving. Key ministries having the mandate of the respective IPCC sectors will lead the process regarding sectoral data and information collection for the three MRV components. MELAD-ECD will store all data and information collected in the Kiribati Environment Management Information System (KEMIS) for reporting to the Convention, informing decision making and other uses.

MRV emissions (GHG inventory)

Good quality Activity Data (AD) are key elements for compiling TACCC GHG inventories. Data providers are stakeholders who generate, measure, or record the crucial data and information required for the estimation of GHG emissions and removals. Data and information shall thus flow from the data providers using the appropriate tools and templates to be developed. MELAD-ECD will then compute emissions and removals. The inventory calculation steps will be quality controlled, and quality assured by the KNEG and approved for adoption by MELAD-ECD for writing up the national inventory report.

MRV mitigation (NDC tracking)

MRV mitigation will serve to track implementation of NDC actions of the country. The ministry responsible for the IPCC sector will lead the data and other information collection process. Data providers will be imparted with the necessary capacity to use the tools and MPGs to be developed to report annually or at other intervals on progress made in implementing NDC actions. Data and information shall thus flow from the data providers using the appropriate tools and templates to be developed. MELAD as the reporting agency will then arrange the data and information in the appropriate reporting format, provide analysis where needed, and include them in the BTR to also enable the international community to track and assess progress on implementation of NDC actions.

MRV support

There already exist a Climate Finance Division within the Ministry of Finance for tracking the use of funds received from development partners and it will need consolidation to become the MRV support for reporting financing of climate actions. The Ministry of Finance could assume the responsibility for collecting and compiling all information relating to financial support received and provide them to MELAD-ECD for inclusion in the BTR. MELAD-ECD can lead the collection of other information with the collaboration of executing agencies on technology transfer and capacity building. Once more, tailored tools and templates will need to be developed for collecting information on the different elements of support, and concerned stakeholders trained on their use for providing information to the Ministry of Finance and MELAD.

Development, implementation and operationalization of the domestic MRV system

The development, implementation and operationalization of the domestic MRV system will be rolled out in four steps (i) Designing of the MRV system; (ii) Development of tools, templates, guidelines and indicators; (iii) Implementation of the prototype for the Energy sector and (iv) Refinement of the prototype and upscaling it to the four IPCC sectors.

ES 6. Other information relevant to the achievement of the objective of the Convention

Kiribati is among the most environmentally fragile countries in the world. It is also one of the countries most vulnerable to the impacts of climate change. The country's ability to react to risks caused by climate change is hindered by its extremely vulnerable society, its relatively limited economic and isolated geographical situation. Climate change and the ensuing sea level rise are predicted to increasingly affect coastal areas and therefore the living conditions of most people. According to a study (Piguet, 2019) cited by the IPCC, Kiribati is one of the five nations that may become uninhabitable by 2100, creating more than 100,000 stateless climate refugees.

The main concerns faced by Kiribati, largely due to the consequences of climate change, are coastal erosion, coastal inundation, loss of mangroves and coral reefs, severe impacts on freshwater resources, serious impacts on agriculture, and meaningful impacts on public health. The increased incidence of natural disasters such as drought, floods and weather extremes represent additional tremendous risks to the natural resource base such as the ocean, which is vital for the provision of basic needs to the population. Several reports have highlighted the very high vulnerability of Kiribati to climate change.

To cope with climate change, Government has implemented policy measures towards building adaptive capacity and enhancing resilience of the most vulnerable people essentially by reducing exposure and sensitivity to climate impacts. Government has also developed the Kiribati Joint implementation Plan (KJIP) for climate change and disaster risk management in line with the KV20 and the KDP as well as strategic ministerial plans and sectoral policies. Kiribati recognizes the support received from its development partners for partial implementation of this plan for enhancing sustainable development and build the resilience of communities. Kiribati will need further financial, technical and capacity building assistance to further roll out the KJIP and the adaptation activities earmarked in its revised NDC.

1. National circumstances and institutional arrangements

1.1. Introduction

The submission of the BUR1 by the Government of Kiribati is mandatory for the country to fulfil its obligations under Article 4, paragraph 1(a), and Article 12 of the Convention and decision 1/CP.16. The development and submission of the first Biennial Update Report (BUR1) is highly valued by Kiribati as a Small Island Developing State (SIDS), as well as a Least Developed Country (LDC) country. Kiribati is still predominantly rural with a subsistence-based economy (GOK, 2014). There is high confidence that warming from anthropogenic emissions from the pre-industrial period to the present time will persist for centuries to millennia, and will cause further long-term changes in the climate, with associated impacts such as sea level rise. There is also high confidence that sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century (Masson-Delmotte et al., 2018). The Government of Kiribati considers climate change a prominent issue at the national level, as it has huge potentials to adversely impact and undermine the three pillars of sustainable development, the people and their culture, and Kiribati as a nation.

1.2. Institutional arrangements

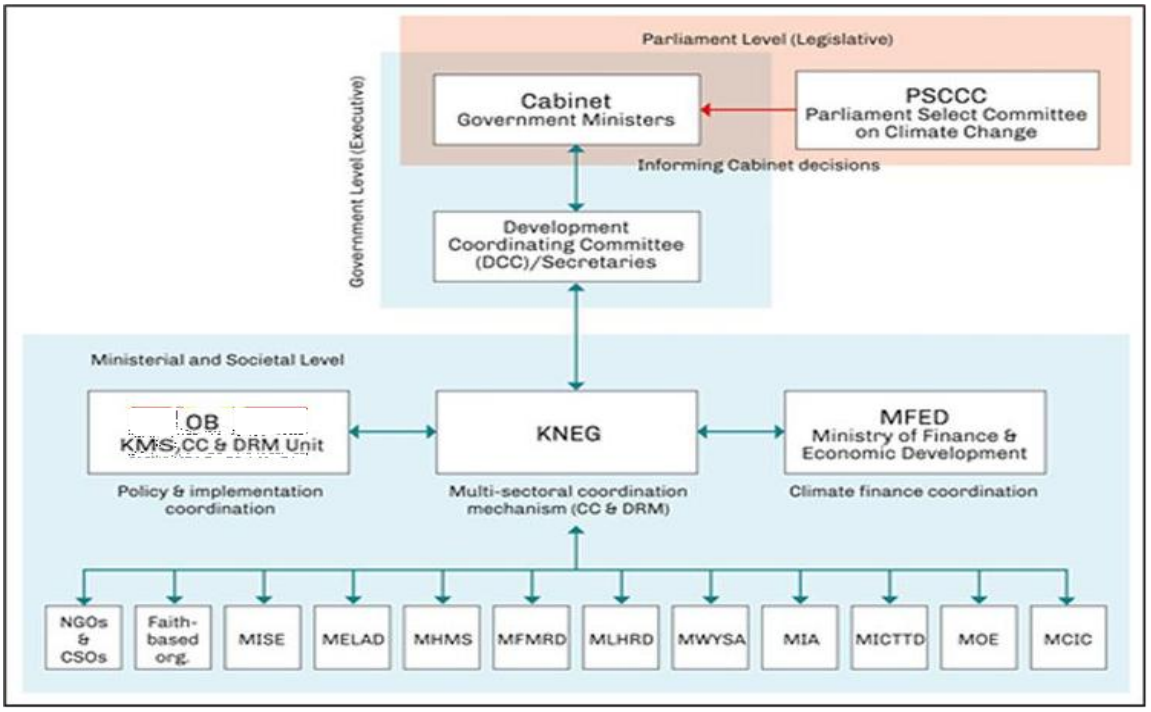
The legal framework regarding climate change in Kiribati falls under the Disaster Risk Management and Climate Change Act 2019 and the Environment Act 2021 which defines the governing structure. The two key principles of the Disaster Risk Management and Climate Change Act 2019 ensure mainstreaming of climate change in all sectoral activities within the sustainable development agenda of the country. These two principles are:

i. Climate change and disaster risks affect all individuals, communities and the environment, and action to address them must be mainstreamed and integrated across all sectors and levels of government and society.
ii. Climate change and disaster risks should be managed within an overall framework of sustainable development and in line with the sustainable development goals.

Te Beretitenti, Office of the President (OB), acting upon advice of the Cabinet, has the overall responsibility for climate change actions to protect people and places in the country from disasters and climate change impacts. The Kiribati National Expert Group (KNEG) on Climate Change and Disaster Risk Management, established under this Act is the principal strategic coordination and technical advisory body for disaster risk management and climate change. KNEG comprises Directors from each ministry plus the Ministry that is responsible for the administration of this Act (Ministry of Environment, Lands and Agricultural Development), Kiribati Meteorological Service (KMS), Kiribati Police Service, Kiribati Red Cross Society (KRCS) and relevant non-government entities representing vulnerable groups and others as specified in the Regulations to this Act.

The Ministry of Environment, Lands and Agricultural Development (MELAD) has an important mandate to provide and update information and data for all Multilateral Environmental Agreements (MEAs) national reporting obligations as well as provide technical advice on climate change, particularly from the Environment perspective. The main roles and responsibilities of Environment and Conservation Division (ECD) of MELAD comprise coordinating and planning climate change actions of government and various organizations, including needs assessments, resource mobilization, logistics and other common services (implementing the UNFCCC and reporting) and strengthening national capacity, including initiating trainings and drills at government and community levels.

More details on the institutional arrangements, including the Measurement, Reporting and Verification systems are provided in the MRV chapter (Chapter 5). A schematic representation of the institutional and governance framework is depicted in Figure 1.1.

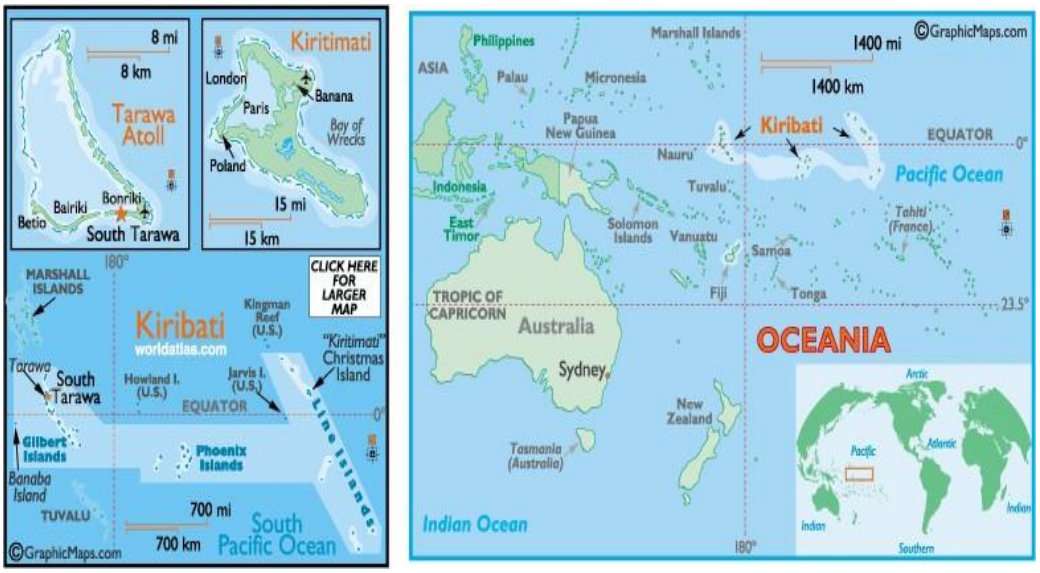


Acronyms: KMS, CC, DRM – Kiribati Meteorological Services, Climate Change, Disaster Reduction Management; MISE – Ministry of Infrastructure and Sustainable Environment; MHMS – Ministry of Health and Medical Services; MFMRD – Ministry of Fisheries and Marine Resources Development; MLHRD – Ministry of Labour and Human Resource Development; MWYSA – Ministry of Women, Youth and Social Affairs; MIA – Ministry of Internal Affairs; MICTTD – Ministry of Information, Communication, Transport and Tourism Development; MOE – Ministry of Education; MCIC – Ministry of Commence, Industry and Cooperatives

Figure 1.1: Institutional and governance structure of Kiribati

1.3. Geographic profile

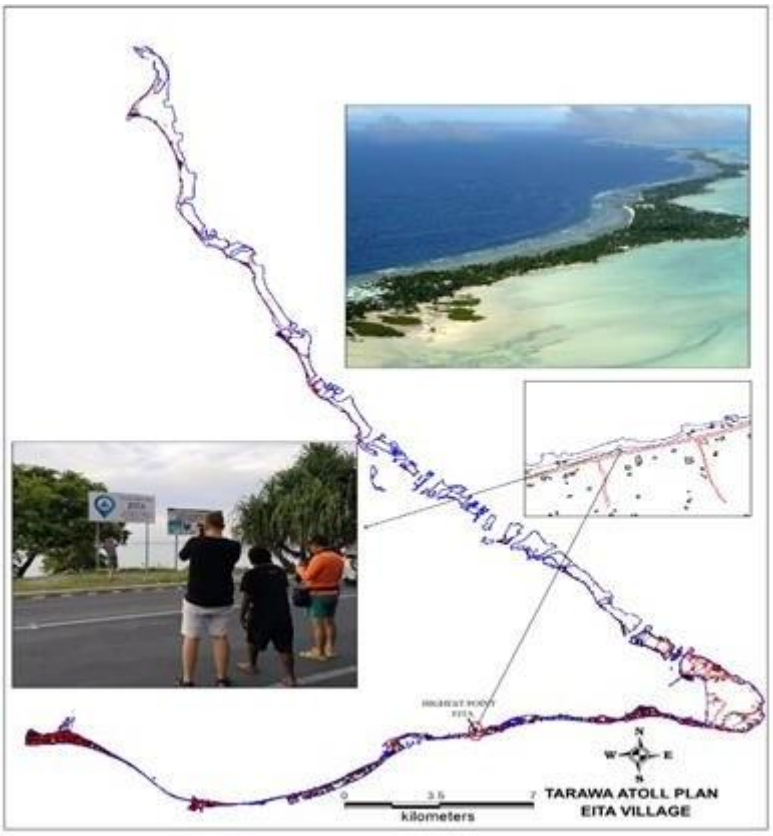
Kiribati is a small island state in the central Pacific, comprised of 32 low-lying atolls and 1 uplifted limestone island scattered over the four hemispheres, on latitude 1° 52' 15.31" North and longitude 157° 21' 45.36" West. The atolls fall under 3 main clusters, namely the Gilbert, Phoenix and Line Islands groups as shown in Figure 1.2.



Source: KiriCAN 2014 "Kiribati and Climate Change"

Figure 1.2: Coordinates and geographical situation of Kiribati

Kiribati main islands are characterised as tiny low lying coral atolls (Figure 1.3) only a few metres above sea level. For example, Eita village, the highest point in the capital Tarawa is about 3 metres above sea level.



Source: MELAD 2020

Figure 1.3: Eita Village – Highest point on Tarawa Atoll

Kiritimati in the Line group is the largest atoll that extends dozens of kilometres over the North Pacific Ocean whereas Banaba is the only limestone island in the Gilbert that has the highest elevation of 81 metres above sea level.

Most of the islands in the Phoenix group commonly known as the Phoenix Island Protected Area (PIPA) comprising 8 islands (Kanton, Enderbury, Mckean, Birnie, Manra, Orona, Rawaki, and Nikumaroro) which are uninhabited except Kanton with an administrative population of less than fifty people. The PIPA, demarcated as a Marine Protected Area (MPA) since 2006 by the Kiribati government and the UN-Convention on Biological Diversity, was a UNESCO world heritage site famous for its productive and diverse marine biodiversity. The total management area of PIPA is 408,250 km^2 enclosed by a 60 nautical mile boundary around each atoll. The islands themselves comprise 11 square miles of low-lying land, in many cases rising no more than 2 metres above sea level.

As far back as 1989, a UN report on the greenhouse effect listed Kiribati as one of the countries at risk from rising sea levels. Ten years later, two of its uninhabited islands, Abanuea and Tebua Tarawa (the latter used by fisherman) disappeared under the waves (https://www.iberdrola.com).

1.4. Climate profile

Kiribati is the only country known to be situated within the four hemispheres. Its islands are scattered to the Northern, Eastern, Southern and Western hemispheres (Figure 1.2). Due to its location, Kiribati experiences hot and humid conditions throughout the year (PCCSP Report, 2011).

Kiribati has two main seasons, namely the Wet and Dry seasons. The Wet season is from November to April and the Dry season is from May up to October, but this varies according to location and movement of the climate drivers known as the InterTropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ). The ITCZ is very active during the wet season (Salinger J, NIWA. 2007). This is due to the amount of solar radiation received (latent heat – evaporation), which is much higher compared with the dry season. Since the sea surface temperature (SST) at the equator varies by only a few degrees, the ITCZ deflection from the Northern Hemisphere to the equator also varies. On the other hand, the SPCZ may influence the weather and climate of the Southern part of the Kiribati Islands.

The monthly average rainfall for Kiribati Islands ranges according to their geographical location, Tarawa: 125-250 mm, and Kiritimati: 40-200 mm. Rainfall data are provided in Figure 1.4. Rainfall recorded in Kiritimati is very low since it is very far from the ITCZ and SPCZ.

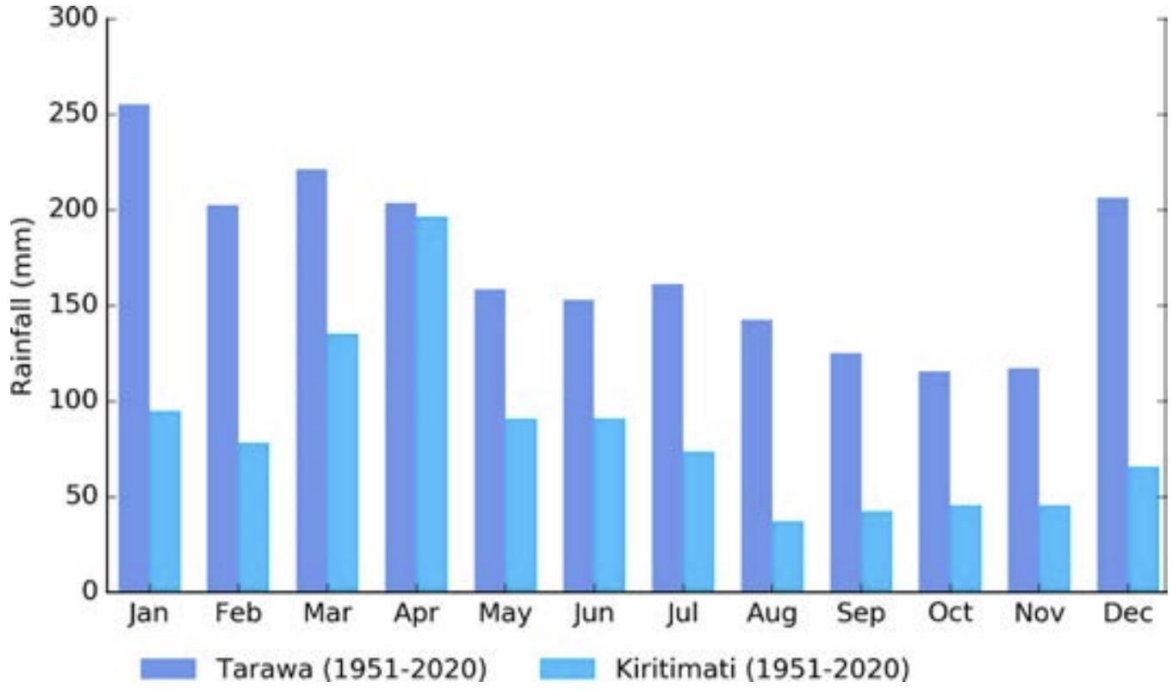


Figure 1.4: Average monthly rainfall for the Tarawa and Kiritimati islands

El Nino Southern Oscillation is the couple of ocean temperature and atmospheric conditions that are used to predict the phase and strength of El Nino and La Nina events in the Pacific islands. During the El Nino phase the ITCZ moves closer and persists much longer at the equator, which then increases the intensity of Wet and Dry seasons. On the other hand, the La Nina phase reverses the El Nino situation. Both El Nino and La Nina have a great impact on the weather patterns as in or during the tropical cyclone season. The SPCZ moves northeast during El Nino and move southwest during La Nina based on SPI (Salinger J, NIWA. 2007). The Madden-Julian Oscillation (MJO) is one of the major fluctuations in the tropical weather on a shorter time scale (weekly to monthly) (Source: Bureau of Meteorology, Australia). The influence of MJO causes changes in weather patterns such as higher precipitation and more intense tropical cyclone activity. Kiribati Meteorological Service (KMS) continually monitors the MJO forecast on a weekly basis during its strengthening phase in the West Pacific region.

The annual rainfall (bar graph) and number of wet days (where rainfall is at least 1 mm; line graph) at Tarawa and Kiritimati are given in Figure 1.5. Straight lines indicate linear trends for annual rainfall (black) and number of wet days (blue). Criteria for statistical robustness were not met for determining a linear

trend for number of wet days at Kiritimati. No of we days is on the increasing trend which is also reflected similarly by annual rainfall.

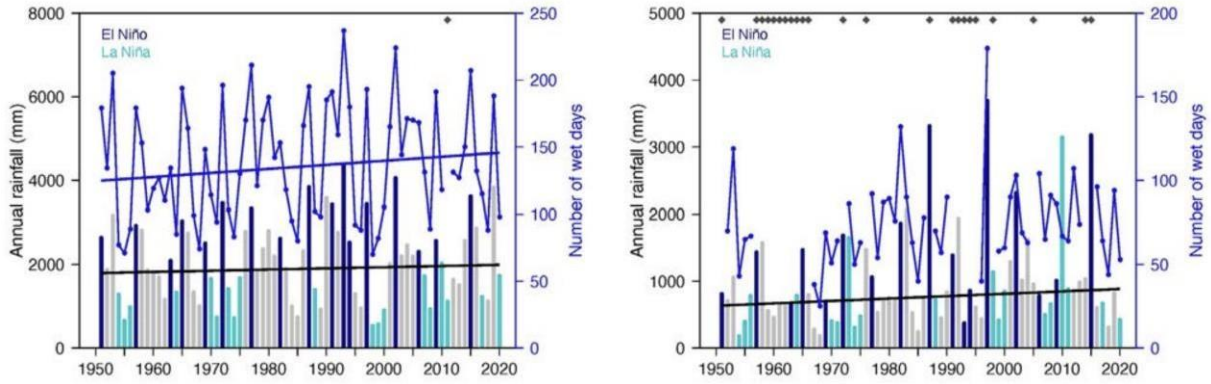


Figure 1.5: Annual Rainfall and wet days for Tarawa (left) and Kiritimati (right)

Annual longest run of consecutive dry days (bar graph) and maximum daily rainfall (line graph) at Tarawa and Kiritimati are illustrated in Figure 1.6). Straight lines indicate linear trends for dry days (black) and maximum daily rainfall (blue). Criteria for statistical robustness were not met for determining linear trends at Kiritimati. Diamonds indicate years with insufficient data for one or both variables. Maximum daily rainfall is increasing very slightly over time while the number of dry days is slowly regressing.

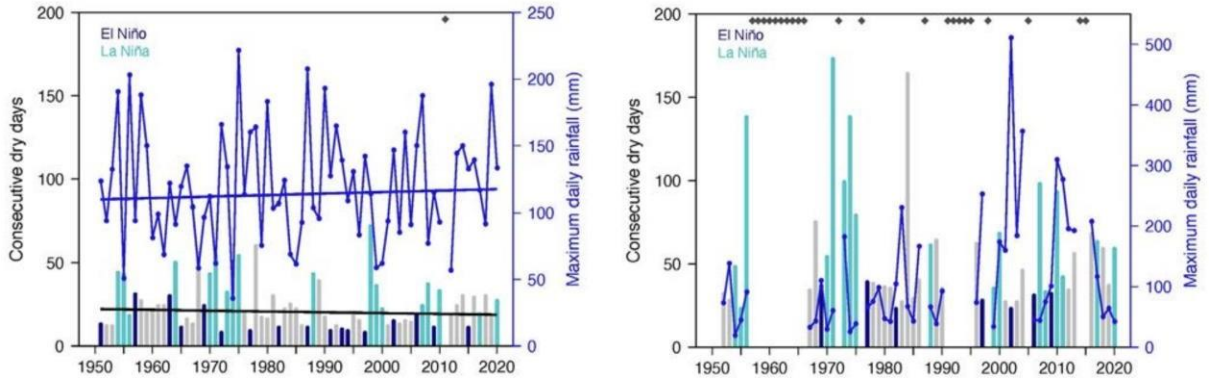


Figure 1.6: Annual Rainfall and dry days for Tarawa (left) and Kiritimati (right)

Throughout the year, Kiribati mean temperature is around 28-29^{o}C. The maximum temperature based on data for the past 3 decades is around 31-32^{o}C, except for Kiritimati where it is slightly lower (29-31^{o}C). The minimum temperature is around 25-26^{o}C in Tarawa and between 24-25^{o}C which is slightly cooler due to its position relative to the ITCZ (Figure 1.7). When comparing the average temperature for periods 1961 to 1990 with those for 1991 to 2020 for Tarawa, it is clearly observed that both maximum and minimum temperatures have increased in the recent decades.

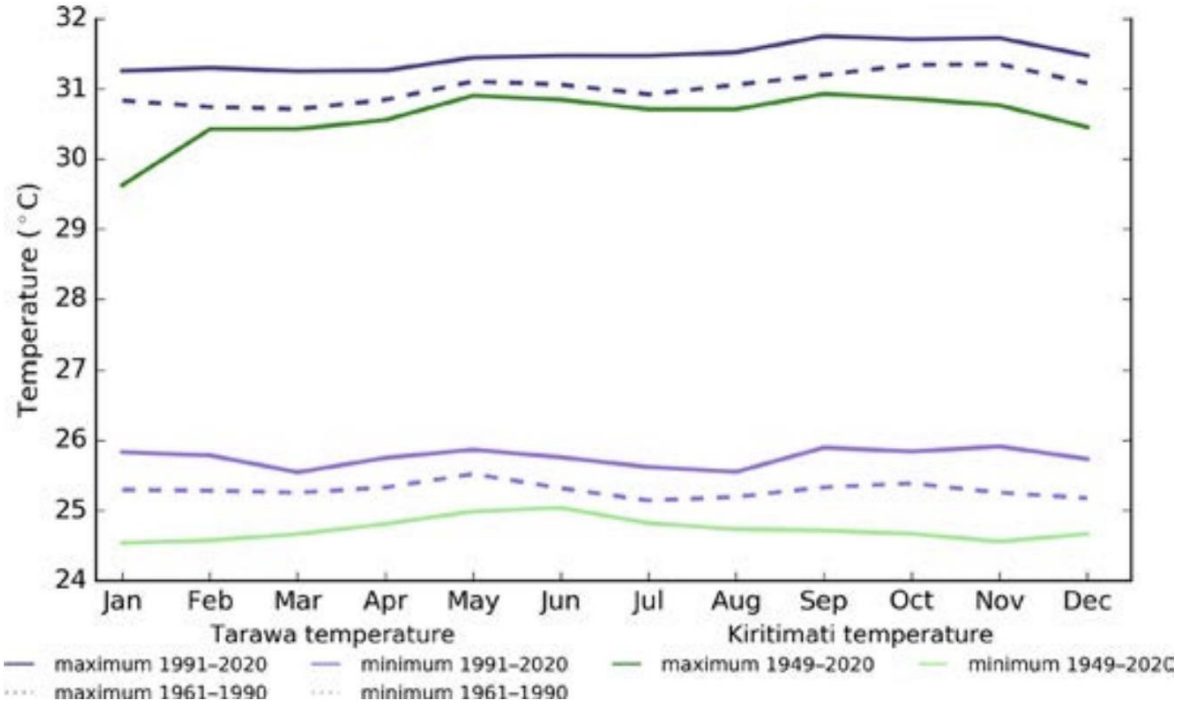


Figure 1.7: Average monthly minimum and maximum temperatures for Tarawa and Kiritimati islands

In Kiribati extreme events are associated with ENSO phenomena. The following are some of the extreme events that have already occurred in Kiribati. Tropical cyclone may not materialise in the Kiribati region due to a weak Coriolis force at the equator. The increase in impact associated with TC during the El Nino phase is severely affecting parts of Kiribati in terms of heavy rain, strong wind, and coastal wave inundation (KMS report, 2015). In 2015/16 during the strongest El Nino, Tropical Storm Bavi and TC Pam was the first twin cyclone ever documented by KMS bringing most devastating impacts to some parts of Kiribati including Arorae, Tamana and Tarawa as well.

Droughts are usually associated with La Nina events and are occasionally severe in Kiribati. For example, only 20 mm of rainfall were received over the 18 months period from July 1988 to December 1989 (IPCC REPORT, 2011).

1.5. Population profile

The population of Kiribati is dominated by a very young and youthful cluster relatively to its neighbouring Pacific Islands. South Tarawa accounts for the most densely populated island due to its status of capital of Kiribati. The two islands South Tarawa and Kiritimati are considered as urban areas, where most of the migration from the rural Outer Islands has occurred. Of the three island groups, the Gilbert group has the most inhabitants. In the 2010 census, South Tarawa had the largest fraction of the population with 49%, making up for nearly half of the people. The 2020 census recorded a total population of 119,438, of which 70,441 (59%) were urban dwellers and 48,997 (41%) rural. In 2020, 58,904 (49%) were males and 60,534 (51%) females. The 2010 census recorded a total population of 103,058 and in the 2015 census the total population was reported at 110,136 showing a gradual increase of around 7,000 people from the previous census held five years before. The increase in demographic rate recorded during the decade 2010 to 2020 is 16%, representing an average annual increase of 1.6%.

The proportion of women stayed stable at 51% of total population from 2010 to 2020. There were slightly more women in urban areas in 2020 where they represented 52% of the population compared to 49% in

rural areas. The urban population in Kiribati increased by 49% from 2010 to 2020 when the country reached a 59% urbanization rate compared to 49% in 2010. This shows that over and above the population increase, there has also been migration from rural to urban areas. The average household size was 5.9 persons/household in 2020 compared to 6.4 in 2010.

With respect to education, 93% of the urban population aged 15 years and above had attended school up to class 3 in 2020 compared to 87% in rural areas. In that same year, 87% of the urban population aged 12 and above could read and write without difficulty compared to 76% in the rural areas.

The unemployment rate did not change from 2010 to 2020 with 11% of the active workforce not having an economic activity. The active workforce involved in different sectors in 2020 is illustrated in Figure 1.5. The Wholesale and retail trade including repair of motor vehicles and Agriculture, Forestry Fishing accounted for 52% of the activity of the workforce. Women were more employed in the Education and Wholesale and retail trade including repair of motor vehicles where they represented 75% and 54% respectively in these sectors (2020 Population and Housing/General Report and Results).

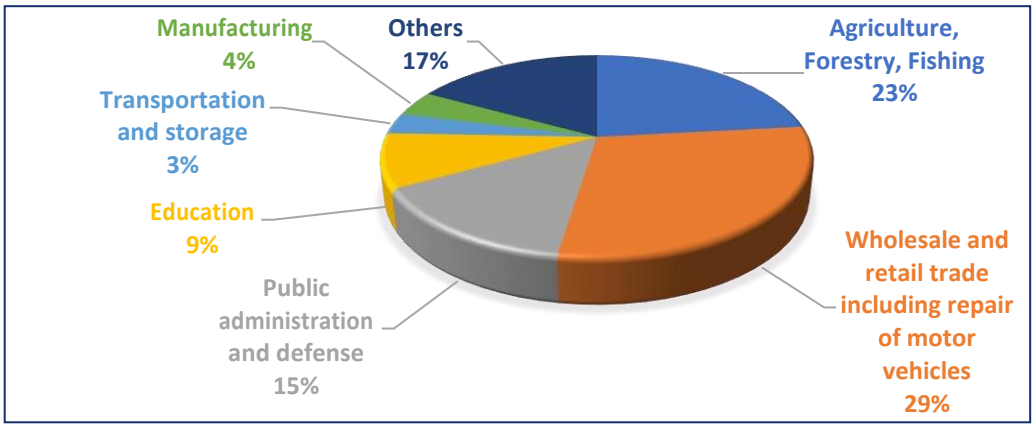
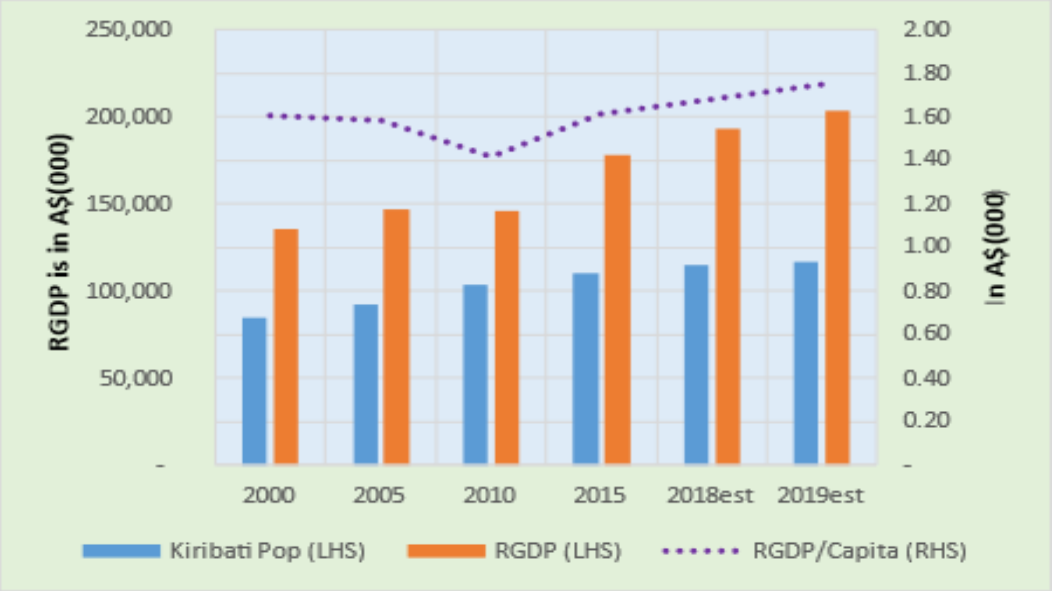


Figure 1.8: Distribution of Kiribati workforce across activities in 2020

1.6. Economic profile

Kiribati has a vulnerable economy and is struggling to establish its place in an increasingly globalizing economy. Like many other small island developing states, the country faces many economic challenges given its remoteness, limited resource base, small market size, and limited institutional capacity. International development assistance contributes significantly to government revenues and is an important source of foreign exchange.

Prior to the COVID-19 outbreak, Kiribati's economy performed well with an average annual real GDP growth rate of 4.75% during the period 2015 to 2019. However, in 2020 a decline of 0.5% in economic growth was recorded. Strict border and containment restrictions and a sharp drop of 16% in fishing revenues were contributors to this decline (IMF, 2021). Real GDP per capita increased from AUD 1,612 in 2015 to AUD 1,749 in 2019 as reflected in Figure 1.6.



Source: NSO, 2020

Figure 1.9: Per capita real GDP growth (2000 – 2019)

1.7. Impact of COVID-19 on the economy

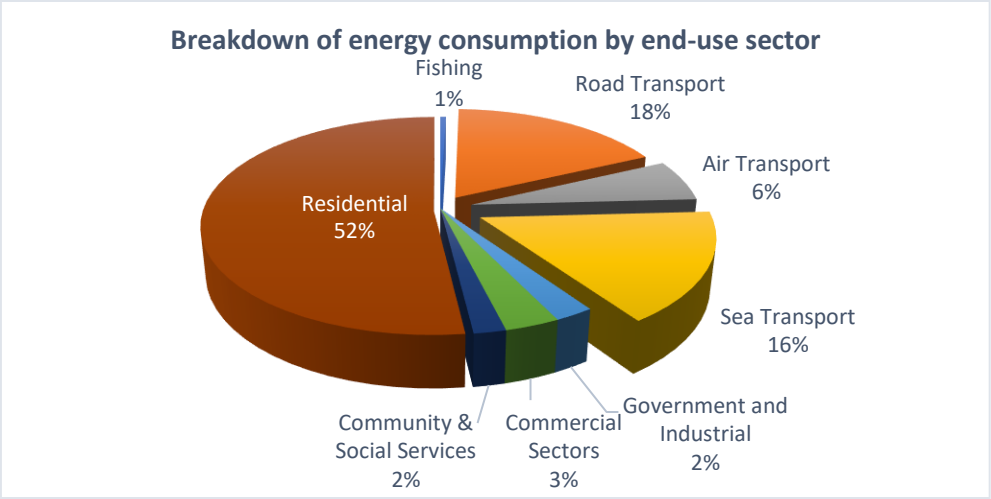
According to the Kiribati Vision (KV20), the nation draws its focus and attention to two key productive sectors which are fisheries and tourism with an expectation that other developments are to follow through sectoral linkages. However, in 2020, in the wake of the COVID-19 pandemic, although not greatly affected compared to other neighbouring countries, Kiribati has commenced shifting its focus and resources towards preparedness plans and prevention measures.

The pandemic and strict containment measures have put strains on economic activity resulting in many development projects being delayed because of the restrictions on the movement of personnel and materials, prolonged delay in cargo shipments affecting local business' operations, shortage of imported goods, and has also contributed to the reduced employment opportunities translating into reduced income and persistence of inequality.

1.8. Energy

South Tarawa accounts for most of the electricity demand in Kiribati (29.6 GWh of generation in 2018). As a result, South Tarawa has the largest and most complex electricity generation system in Kiribati with an installed capacity of 6.6 MW of diesel generation and 1.6 MWp of PV (PED report, 2019). Kiritimati island has the second largest electricity demand with an estimated total demand of 2.2 GWh in 2017. The remainder of Kiribati's power generation systems are composed of small diesel generators, PV-diesel macro grids and solar home systems distributed across the outer islands.

In 2019, the Kiribati (Gilbert Island Group) total final energy consumption was 1523 TJ of which 54% was petroleum product and 46% from renewable sources (1% from solar while 45% from biomass). The residential sector is the largest consumer of energy with a share of 52.0% (Figure 1.7) followed by the road transport sector that used 17.6% while sea transport consumed 16%. As of 2019, electricity made up only 3.9% of households' energy consumption. More than 80% of household's energy consumption comes from biomass in the form of coconut residue and firewood (87.0%) with petroleum products in the form of kerosene (6.2%) and gasoline (2.9%) accounting for the remaining. Liquefied petroleum gas use is limited due to high costs, especially in comparison to subsidized kerosene prices. Gasoline was the major fossil fuel used with 42% share of consumption while diesel followed with 35% on national basis (Personal communication; 2019 Energy Balance from MISE).



Source: MISE Energy Balance Table 2019

Figure 1.10: Breakdown of energy consumption by end-user

Even though Kiribati is blessed with abundant indigenous energy resources from solar, wind, ocean, coconut copra and biomass, it is highly dependent on petroleum imports for electricity generation, transportation, and domestic uses. All petroleum products, such as diesel, gasoline, kerosene, and lubricants are imported to Kiribati. Energy products made up 14% of the total value of imports in 2018 (NSO, 2018). The Government of Kiribati (GOK) uses price controls and tax exemptions for fossil fuels to keep their prices more affordable for low-income households. However, the Government subsidy is only applied to household kerosene and diesel used for electricity generation (SPC, Fuel subsidy report). The high dependency on imported fuel creates vulnerability to oil price volatility and results in high energy costs, which place a burden on local development.

The Energy Policy of 2009 is the major document guiding the development of the sector. In its Integrated Energy Roadmap (KIER 2017-2025), the GOK has set targets to reduce fossil fuel consumption by 45% in South Tarawa and 60% in Kiritimati Island, by scaling-up renewable energy and adopting energy efficiency measures. The GOK's short-term and long-term policy strategies – Kiribati Development Plan (2016-2019) and the Kiribati Vision for 20 years (2016 – 2036) – iterate the Government's goal to increase its citizen's access to high quality and climate resilient infrastructure by increasing the use of renewable energy in all sectors of the economy.

1.9. Transportation

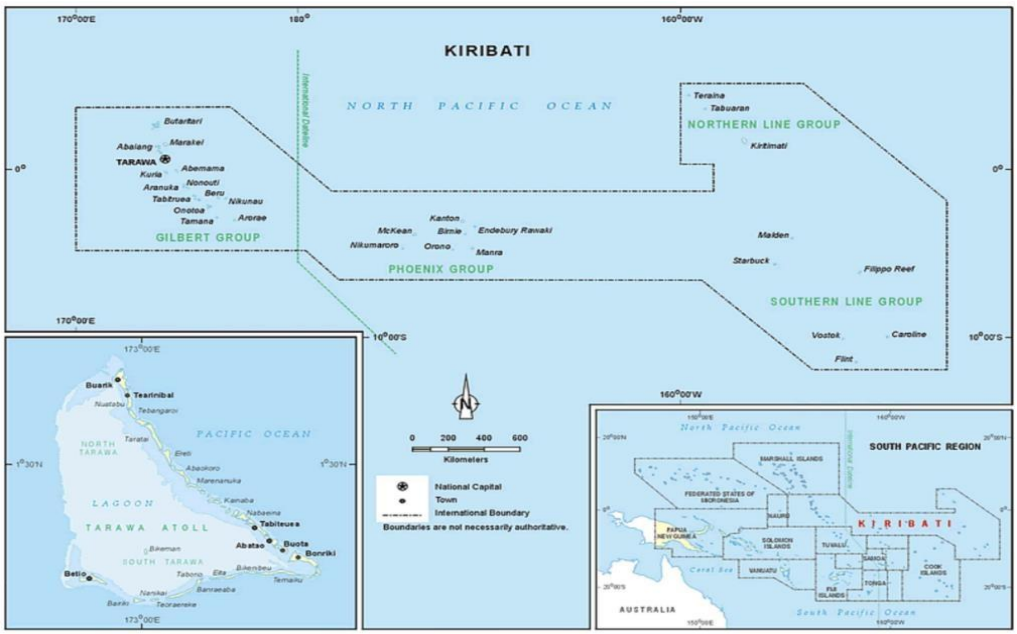
1.9.1. Air transport

Two main international airports in Kiribati provide regular international and domestic services. Bonriki International Airport (BIA) is located on the island of Tarawa, which is part of the Gilbert group of islands, and Cassidy International Airport (CXI) is located on the island of Kiritimati which is part of the Phoenix group of islands. BIA and CXI are considered as hubs. These two airports and a further 17 outer islands airports are operated by the Airport Kiribati Authority (AKA).

1.9.2. Maritime Transport

Kiribati is an oceanic nation and a large proportion of its population is engaged in marine activities. Shipping is critical to the economic and social welfare of the people of Kiribati, and safe navigation is vital to secure this welfare and to protect the environment. Kiribati is a big ocean nation with a total Exclusive Economic Zone (EEZ) of 3,441,810 km^2. Since the Kiribati islands are scattered over the four hemispheres, Kiribati faces an enormous geographical challenge of isolation and distance as shown by the fact that the

distance from the capital, Tarawa, to the Phoenix Islands is 1,500 km and 3,300 km to the Line Islands (Figure 1.8). The islands are connected via sea transportation in addition to aviation.



Source: Kiribati Maritime Transport Policy 2016-20

Figure 1.11: Distribution of Kiribati islands over the ocean

1.9.3. Road transport

Due to its topography, size and restricted resources, the road infrastructure of Kiribati is quite limited. It consists of about 700 km of roadways of which the only tarred main road, which is some 50 km long, is found in the South Tarawa Island. Current records show 9,394 vehicles are registered on South Tarawa, comprising of private, commercial and government vehicles, such as trucks, buses, sedans as well as motorbikes and tricycles. Since KLTA has not been established in the Line and Phoenix groups, consequently the data for vehicles in those two groups is not available, though the estimation is that 89% of the total number of vehicles are in the Gilbert group, while 11% of non-registered vehicles are found on the Line (7%) and Phoenix (4%) groups. Most of the vehicles are second-hand imported ones.

1.10. Manufacturing industry

Kiribati is not an industrialized country due to its remoteness and restricted connectivity, small size, lack of indigenous resources, a very small economy and lack of specialized skills. Major industries include clothing, fish processing, food processing, handicrafts, and tourism. The main industrial products exported are copra, fish and processed fish. The five sectors of the tourism segment are transportation, accommodation, food and beverage, recreation and entertainment, and travel services. In 2019, manufacturing contributed a nominal 3.9% to national GDP with AUD 9.7 million.

1.11. Waste

The type of wastes found in Kiribati is typical to those commonly found in small island developing states. The characteristics and generation of waste over the years reflect the population increase and change in lifestyle. Kiribati imports a significant quantity of products including foods from abroad to meet the local population needs. Consequently, most of the waste problems arrive from overseas as packaging for these essential goods. The materials produced locally are organic and can be managed at the household level with little concern for their impact. According to statistics from the Kiribati Waste Management Resource Recovery Strategy (2020), the average waste composition was 59% organic waste, 10% miscellaneous, 9% metal, 7% glass/ceramic, 7% plastic, 5% paper, and 3% textile/rubber.

Only South Tarawa and Kiritimati Island possess proper waste disposal infrastructures. There are three approved landfills on South Tarawa - Betio landfill, Nanikaai landfill, and Bikenibeu landfill, and Kiritimati Island has one approved dumpsite and one hazardous cell. The dumpsites on Kiritimati Island, both approved and illegal, are not regulated and managed to required standards. On outer islands, there are no proper waste collection systems in place, so waste items are simply buried discriminately or burned at dumpsites or disposed of at sea, threatening the marine environment.

In Kiribati, waste incineration is resorted to mainly to treat medical and quarantine wastes. The hospital incinerators are operated only on South Tarawa, Tabiteuea North and Kiritimati Island, though the Tabitebuea North and Kiritimati incinerators break down frequently.

Kiribati operates a recycling plant through a private business supported under the Special Fund (Waste Material Recovery) Act 2004 and Special Fund (Waste Material Recovery) Regulation 2005. Currently, only specific waste materials including lead-acid batteries, aluminium cans, and PET bottles are accepted under the Act. The government through the Kiribati Waste Management and Resource Recovery Strategy 2020-2030 (KWMRRS) aims to expand the scope of these recycling activities to include other waste materials which have value such as e-waste, scrap metal and used oil. Export of these recyclables from 2005 to 2022 totalled some 376 tons.

Wastewater, including sanitation and industrial wastewater, are addressed by different government ministries. For instance, the Ministry of Infrastructure and Sustainable Energy (MISE) is responsible for sanitation. There is no treatment system for sewage from the households that are collected by the sewerage system operated by the Public Utilities Board (PUB) on South Tarawa and Betio. The sewerage system only collects sewage and discharges it into the ocean at three main sea outfalls. There are other sewerage systems including the hospital system in Nawerewere and Moroni High School that are not connected to the PUB system and have their own outfalls. All these systems do not have treatment plants as well. Those households that are not connected to the PUB system have their own on-site septic system. They are serviced by the PUB vacuum truck to de-sludge their septic tanks when they are full and discharged into the PUB system for disposal into the ocean through the outfalls.

Based on the lube oil import data of 2018, Kiribati imported about 150,000 litres which result in about 75,000 litres of used oil being generated. In 2019, about 50,000 litres of used oil were exported in International Organization for Standardization (ISO) tanks by Kiribati Oil Company limited (KOIL) and PUB for recycling in Fiji.

Another important feature of waste treatment in Kiribati is composting. The main composting facility operates on approximately one hectare of land. Very little soil is available on the islands of Kiribati, and, therefore, composting for fertilizing is a very useful activity to promote. Approximately 60 tonnes of compost are produced annually.

1.12. Agriculture and forestry

The Food and Agriculture Organization (FAO) and the Convention on Biological Diversity (CBD) terms of agriculture, forestry, and livestock are far from the definitions and concepts of these words in Kiribati, given its context as an atoll nation. Yet, the resources that nature has endowed to the islands contribute to what the Government and the people of Kiribati refer to as agriculture, forestry, and livestock. There are many limitations affecting agriculture, forestry, and livestock activities. Undertaking agriculture, forestry, and livestock rearing in Kiribati is either very challenging or very expensive because of the infertile, very alkaline and coarse-textured soil, the limited land area, and limited water. In Kiribati, most of the land areas are restricted to frequently less than 1 km^2 and their characteristic widths are often less

than 1 km (DIJON, 1983) or not more than 2 km (Otiuea, Teariki, & Timeon, 2015). Surface water is scarce or non-existent in many islands due to the small size, low elevation, and high soil and regolith permeability (Thomas, 2003; White & Falkland, 2010), except for Tabuaeran (Washington Island) in the Northern Line Island Group (GOK, 2014).

This is critical because food and nutrition security are among the top Government agenda at the national level. The Government of Kiribati through the Agriculture & Livestock Division (ALD) of MELAD, is the main institution that undertakes major agriculture, forestry (to some extent), and livestock activities, on the capital island of South Tarawa. Being known as fishermen, I-Kiribati also engage in subsistence farming especially long-term fruit trees such as coconut palms, screw-pine, bananas, breadfruit trees, native figs and giant swamp taro. On South Tarawa, the cultivation of cash crops like Chinese cabbages, cucumbers, egg plants, tomatoes, water and rock melons and other cash crops are more common. Compost, soil from tethered pigs and pig/chicken manure are commonly used as soil amendments to improve soil health. Subsistence livestock farming mainly piggery is common throughout the country because of its cultural significance. Poultry farming is also practiced but mainly as free-range farming with small number of battery cage farms particularly on South Tarawa. These are important protein supplements to fish for the people of Kiribati. There is no commercial livestock farming in Kiribati, the only exceptions being small-scale egg producers on South Tarawa and the two piggery farms and one poultry farm operated by ALD. There are ducks seen on some of the islands like South Tarawa and Abemama but in small numbers (Kiribati, National Statistic Office, 2015).

1.13. Water resources

The geography of Kiribati creates significant human development and growth challenges, including access to safe and reliable water, and sanitation. Freshwater resources of Kiribati consist of rainwater, shallow unconfined groundwater generally within less than 2 m of the surface, imported water or desalination (Falkland, 2002). The raised island of Banaba uniquely has freshwater pools in subterranean caves that could serve as an emergency source of water in times of severe drought.

Numerous reports and policy documents have highlighted the major issues and concerns on water and sanitation in the country. Some of the main concerns which exacerbates the vulnerability of the population are:

- Provision of adequate water for human health and community development.
- Provision of equitable access to safe water.
- Protection of water sources.
- Provision of appropriate sanitation.
- Impact of droughts on water supplies.
- Impact of sea level rise on water resources.
- Provision of sustainable water supply and sanitation systems.
- Ensuring groundwater supply systems do not compromise rights or livelihoods.
- Improvement in water governance, capacity building and maintenance of skills.
- Improvement in knowledge and monitoring; and
- Land and water ownership in water source areas and common perceptions

1.14. Fisheries

Kiribati has a land area of 810.5 km^2, a coastline of 1,143 km and an Exclusive Economic Zone (EEZ) of 3.55 million km^2 (http://macbio-pacific.info/kiribati/). Fishing and seaweeds' contribution to national GDP was estimated at AUD 25 million (10%) in 2019 compared to about AUD 16 million in 2015 (NSO.gov.ki – GDP

master table 2021). The estimated exports of fish and fishery products were valued at AUD 180 million, tuna being the major species exported.

Total capture fisheries production was estimated at 238,000 tonnes in 2019 and 213,000 tonnes in 2020 due to reduced activities because of COVID-19 (https://data.worldbank.org/indicator/ER.FSH.AQUA.MT?locations=KI). Subsistence and small-scale commercial fishing are conducted throughout the islands using traditional canoes driven by sail or paddle, plywood canoes powered by outboard motors and larger outboard-powered crafts. In 2016, an estimated 5,000 people were engaged in marine fisheries, either full or part time. There is a great reliance on marine resources for livelihoods, government revenue, and especially nutrition. According to several sources, Kiribati has one of the highest per capita consumption of fish in the world, at a per capita consumption of 77 kg.

Eucheuma seaweeds have been cultured in Kiribati since the early 1980s. Kiribati exports small quantities of dried seaweed, mainly from Tabuaeran and Kiritimati Islands, where it makes a useful addition to household incomes. Kiribati aquaculture production fell to about 2,000 tonnes in 2016 after peaking at some 11,000 tonnes in 2010 (https://data.worldbank.org/indicator/ER.FSH.AQUA.MT?locations=KI).

1.15. Health

In Kiribati, high density housing facilitates transmission of infectious and other diseases outbreaks. Being an atoll, there is acute water security problem, which is exacerbated by increasing waste generation and pollution problems as well as fluctuating weather patterns. All these have significant health consequences for the people of Kiribati, especially those living on South Tarawa.

The National Climate Change and Health Action Plan (NCCHAP) developed for Kiribati by the World Health Organization (WHO) identified five key health domains having the potential to be impacted by climate change. These include water safety and water-borne diseases, food safety and food-borne diseases, vector-borne diseases, disease surveillance, and ciguatera fish poisoning (GOK, 2011).

Urbanization and lifestyle changes have contributed to erosion of the Kiribati culture with negative effects on health. Almost 80 to 90% of the total population rely on imported food grains such as rice, flour, and sugar, as their staple food sources. Non-communicable diseases are now recognized as the leading cause of health problems in Kiribati. In the Pacific region, 75% of deaths are due to NCDs, which is attributed to an increased dependence on imported food that are of poor nutritional quality, the inactive lifestyles of the people and a shift towards a more Westernized diet.

In Kiribati, there is one main headquarter hospital located on South Tarawa, the capital island, which is the referral hospital and a secondary one located in Betio. The other two hospitals are located on Tabiteuea North in the southern part of the Gilberts, and Kiritimati Island in the Line Group. These four hospitals are supported by a network of 22 Health Centres and 82 village clinics. Medical supplies, medical equipment, and qualified medical doctors to adequately service the main and sub-hospital for the general public, including the outer islands medical health centres are limited. Health infrastructures and facilities are also inadequate, resulting in the overseas medical referrals to either Fiji, New Zealand, India and Taiwan for major and complex cases.

1.16. Biodiversity

Climate changes are threating individual species as well as the entire ecosystems, with adverse consequences for human well-being and their society. On the other hand, biodiversity, through the ecosystem services it supports, makes an important contribution to both climate change mitigation and adaptation (Diversity, 2009). Biodiversity conservation, management and sustainable utilisation, are

critical to addressing climate change (2014). Ecosystems like mangroves, seagrass and coral reef, have important roles in the carbon cycle through atmospheric carbon dioxide (CO_2) sequestration and storage (Kapos, Scharlemann, Campbell, Chenery, & Dickson, 2008). These three ecosystems are protected under the Environment Amendment Act 2007 in Kiribati.

Under the MELAD environment portfolio, GOK has invested in the establishment of marine protected areas (MPA) at the national and island levels under the Environment Amendment Act 2007, through the PIPA in the Phoenix Islands Group in 2006, the Southern Line Islands Marine Protected Area (SLIMPA) in the Line Islands Group in 2020, and through the community based protected areas in several islands of the Gilbert Group.

Areas occupied by mangroves have been mapped and changes in the coastal areas due to mangroves are currently taken into consideration by the Lands Management Division (LMD) of MELAD with the support of ECD. In some islands, mangrove replanting and monitoring is already ongoing with the full support of the villages and islands concerned. Similar work for seagrass ecosystems and coral reefs are under way under the responsibility of MELAD ECD. Nineteen species of birds (avifauna), which include the only endemic vertebrate terrestrial bird 'te bokikokiko' (Kiritimati Islands warbler, *Acrocephalus aequinoctialis*), and the bonefish are protected under the Wildlife Conservation Amendment Ordinance 2007 and the Kiritimati Island Bonefish Regulations under the Fisheries Act. The bonefish on South Tarawa is also protected under the Bonefish Regulation under the Fisheries Act.

1.17. Development priorities and objectives

The Government of Kiribati has two national plans that expresses the development priorities of the country. These plans are the Kiribati Vision for 20 years (KV20) covering the period from 2016 – 2036 and the Kiribati Development Plan (KDP) that covers successive four years periods. The KV20 is the long-term development blueprint for the country and the KDP guides the formulation of policies and programs to advance the socio-economic development of Kiribati. The KV20 comprises 4 pillars – Wealth, Peace and Security, Infrastructure for Development, and Governance. In addition to the 4 core pillars the Vision has included the Environment, Climate Change and Sustainable Development under cross-cutting issues. It recognizes Kiribati's vulnerability to climate change as a key constraint to achieving the desired outcomes. The Vision underscores the need to mainstream climate change adaptation and mitigation into various programmes. Mainstreaming climate change into development programming will ensure that the working environment is sensitive to environment conservation, climate change and sustainable development. The environment conservation adaptation and mitigation measures will reduce risks and ensure that the development programmes implemented create sustainable development for all.

Strategic plans are also developed across all government ministries, aligned to the two national documents which identify specific priority areas and sectoral approaches. To help achieve these priorities, ministries recognize and adopt other strategies which include the Kiribati Joint Implementation Plan (KJIP 2019 – 2028) and the Kiribati Waste Management and Resource Recovery Strategy (KWMRRS 2020 – 2030) among others.

1.18. Priorities related to mitigation of climate change

As one of the small Governments of the Pacific SIDS and LDC, Kiribati has a marginal influence on the release of GHGs into the atmosphere with no major industries. Under the KIEP 2021 – 2036 and the Kiribati Joint Implementation Plan (KJIP), the priorities related to mitigation of climate change focus on addressing issues related to the emissions of GHGs and the enhancement of the carbon sinks through the establishment of marine protected areas, community-based protected areas, and the designation of the Ramsar sites, to help mitigate climate change in the Kiribati context.

There are specific priorities related to mitigation of climate change in Kiribati. These priorities are addressed under the specific key sectors energy, environment, agriculture and livestock. This is important considering that the Government of Kiribati does not put emphasis and priority on climate change mitigation. The Government of Kiribati is still working hard in supporting direct and indirect efforts that relate to mitigation of climate change at the national, island, and village levels. Currently, the Government is working on strengthening the policies, legislations, and institutional arrangements of the key relevant sectors like the environment and energy, that would strengthen and improve efforts to mitigate climate change at the national level.

Simultaneously, a Climate Change Finance Division has been recently established at the Ministry of Finance and Economic Development (MFED) to coordinate and secure climate change financing from the Least Developed Country Fund (LDCF), the Green Climate Fund (GCF), and the Adaptation Fund (AF). This will ensure minimal disruption from the impacts of climate change, while tapping maximum benefits at the national, regional and international levels to secure Kiribati's target to achieving sustainable development. The three leading institutions on climate change, namely OB, MELAD, and MFED work collaboratively and also separately in a coordinated manner with other relevant sectors to support sustainable development at the national level.

2. National greenhouse gas inventory

2.1. Introduction

2.1.1. Commitments under the Convention

The United Nations Framework Convention on Climate Change (UNFCCC) is one of the three Multilateral Environmental Conventions that materialized from the resolutions of the UN Conference on Environment and Sustainable Development held in Rio de Janeiro, Brazil, in 1992. It came into force on 21 March 1994. The Republic of Kiribati ratified the UNFCCC on 06 January 1997 as a non-Annex 1 Party. Under Article 4.1 (a) of the Convention, each Party must develop, periodically update, publish, and make available to the Conference of the Parties (COP), in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the COP. Kiribati has to-date submitted two national greenhouse gas inventories (GHG) inventories as components of National Communications. The present GHG inventory is being compiled within the framework of the preparation of the First Biennial Update Report (BUR1).

2.1.2. The inventory process

2.1.2.1. Background

The preparation of the present inventory started in 2020, as a component of the BUR1. The process served to build national capacity on the preparation of GHG inventories. However, Kiribati must still develop and operationalize a robust GHG inventory management system (GHGIMS) for sustainably preparing GHG inventories in line with decision 18/CMA.1 instead of the present ad hoc system. Kiribati is working on institutionalization of the process to address the higher frequency of reporting, the higher standard and quality, and the enhanced transparency requirement of the PA. Furthermore, Kiribati resorted to international consultants to provide capacity building to national experts to prepare good quality GHG inventory reports.

This present inventory provides information on GHG emissions by sources and removals by sinks for all years for the period 2000 – 2019. Improvements over the previous inventory consisted in the review of activity areas for maximum completeness and recalculations with the availability of better national activity data (AD) for all years to enhance consistency and accuracy.

2.1.2.2. Institutional arrangements for inventory preparation

Kiribati has always prepared its GHG inventories using national experts, the objective being to build and strengthen existing capacities. Capacity building has been done through training activities, notably for running the IPCC 2006 software. The existing GHGIMS, inclusive of the institutional arrangements for compiling the inventory, is still being developed. The current institutional arrangements which are under review in line with the Measurement, Reporting and Verification (MRV) system within the framework of the BUR1 are further detailed in the MRV chapter.

2.2. Overview of the inventory

2.2.1. Coverage

This GHG inventory covers the whole territory of the Republic of Kiribati with estimates made at the national scale.

The national GHG inventory includes estimates for the four IPCC sectors, namely, Energy, IPPU, AFOLU and Waste. However, the categories and subcategories have not been fully exhausted because of their limited contribution to the economy and lack of AD for this period. The coverage of activity areas is provided under the completeness section of this report.

The GHG inventory includes emissions of the direct GHGs CO_2, CH_4 and N_2O only.

The latest inventory year is 2019 in order to meet decision 2/CP.17, namely 4 years prior to the submission date of the BUR. In line with the requirement to provide a trend of estimates, the period 2000 to 2019 has been adopted. To ensure consistency, estimates for all previous years 2004 to 2008 have been recalculated whenever required, using the same methodology and data sources to reflect improved AD or EFs as appropriate.

2.2.2. Method

Estimates of GHG emissions provided in this report have been compiled using the 2006 IPCC Guidelines for National GHG Inventories (IPCC, 2007). The purpose of adopting these guidelines is to ensure that the GHG emission estimates are Transparent, Accurate, Complete, Consistent and Comparable (TACCC) as far as possible and in line with decision 18/CMA.1.

Results from the GHG inventory of the NC2, availability of resources, existing capacity and availability of AD dictated the choice of source categories to be included for compilation. A prioritization exercise was conducted, and the highest emitting source categories were privileged, the intent being to improve estimates by moving to Tier 2. Selection of the Tier level was guided by the general decision-tree reproduced in Figure 2.1 and category specific decision trees provided in the Guidelines.

The selection of the Tier level for all sectors was constrained by the limited availability of disaggregated AD (e.g., facility level data) and national EFs. This led to the adoption of the Tier 1 level for all categories. National AD was complemented with those available in international databases and IPCC default EFs were used. Detailed descriptions of the methods adopted for generating missing data and equations used in each sector, including AD and EFs used, are provided under each IPCC sector in this report.

The different steps guiding the preparation of the present inventory were:

- Review of previous inventory to prioritise use of resources.
- Collect, quality control and validate AD.
- Selection of Method – Tier level within each category and sub-category.
- Selection and validation of emission factors (EFs).
- Computation of GHG emissions by the international firm supported by experts from key institutions and ECD.
- Key Category Analysis (KCA).
- Uncertainty Analysis.
- QA / QC of emissions computations and outputs.
- Recalculations.
- Assessment of completeness.
- Trend analysis.
- Identification of gaps, constraints and needs.
- National Inventory Improvement Plan.
- Chapter for the BUR1.

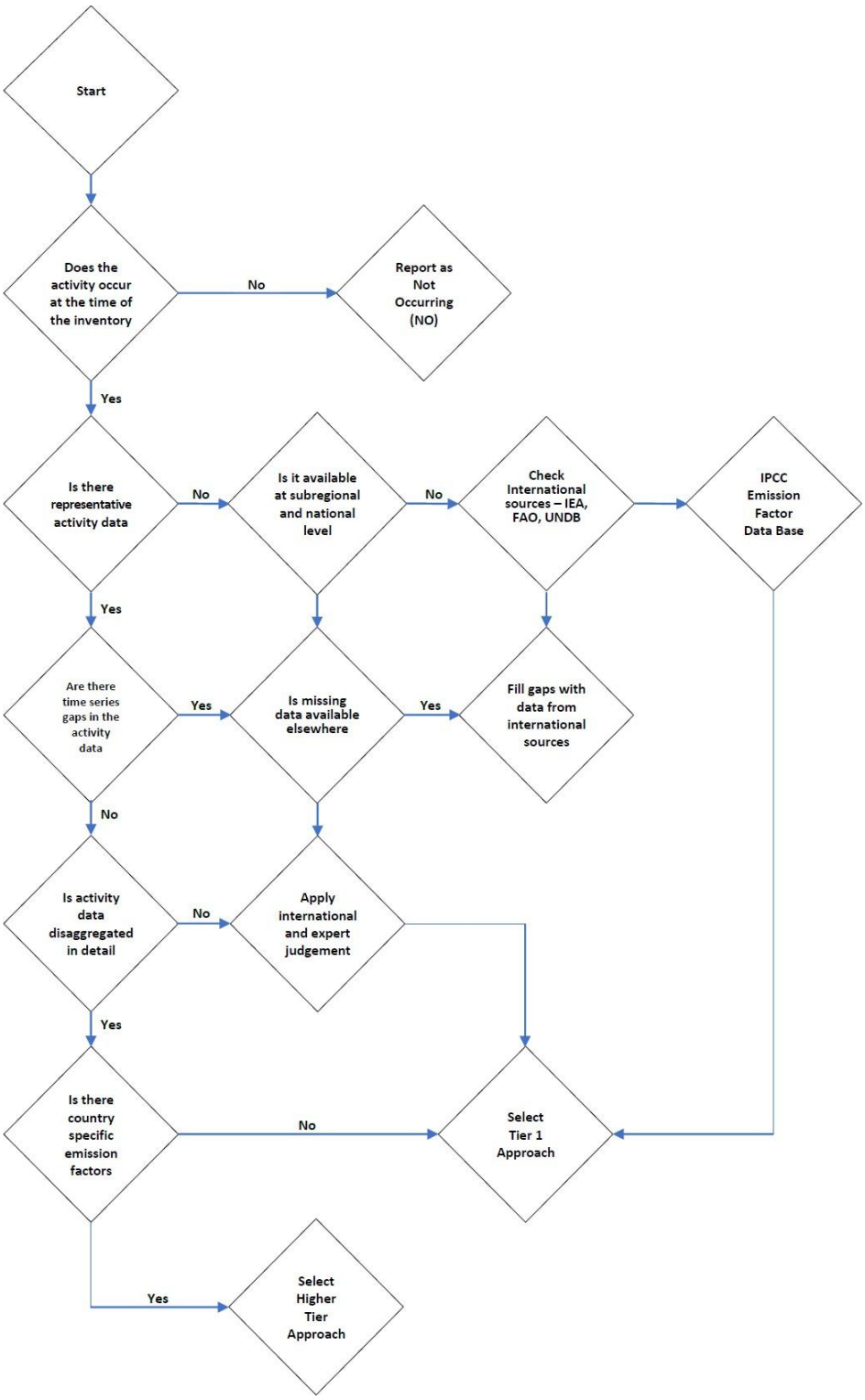


Figure 2.1: Decision tree used to determine Tier Level method

2.2.3. Global Warming Potential

Global Warming Potentials (GWP) of the IPCC Fifth Assessment Report (AR5) have been used to convert GHGs other than CO_2 to the latter equivalent as prescribed in decision 18/CMA.1. These GWPs provide a consistent basis for comparing the relative effect of the emissions of all GHGs uniformized over a period of 100 years by converting the emissions of the other GHGs to that of CO_2. The values adopted for the three direct GHGs CO_2, CH_4 and N_2O are provided in Table 2.1

Table 2.1: Global Warming Potential

Gas	Symbol	GWP
Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous Oxide	N_2O	265

The size of the country and its population results in low emission values. For ease of understanding and to conform with recent COP decisions, emissions in this report have been expressed in tonnes where 1 Gigagram = 1,000 tonne = 1,000,000 kilograms = 1,000,000,000 grams.

2.2.4. Key Category Analysis

KCA gives the characteristics of the emission sources and sinks. According to the 2006 IPCC Guidelines (Vol. 1_4, Ch. 4 – Method Choice), key categories are those which contribute 95% of the total annual emissions, when ranked from the largest to the smallest emitter. A key category is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs in terms of the absolute level of emissions, the trend in emissions, or both (IPCC, 2000). Thus, it is a good practice to identify key categories, as it helps prioritize efforts and improve the overall quality of the national inventory, while also guiding mitigation policies, strategies, and actions.

The KCA was performed using the tool available within the IPCC inventory software (Version 2.69) for both the level and trend assessments. The results for the level assessment for the year 2019 are presented in Table 2.2 and the trend assessment in Table 2.3. Eleven key categories were identified in the quantitative level assessment for the year 2019. The first 6 categories as per Table 2.2 contribute to 82.8% of emissions/removals. The main category, Land converted to Forestland, is responsible for 17.9% of emissions/removals in absolute terms. All sectors, except IPPU, are represented among the categories that contribute to 95% of emissions/removals in the year 2019.

Table 2.2: Key Category Analysis for the year 2019: Approach 1 – level assessment

A	B	C	D	E	F	G
IPCC Category code	**IPCC Category**	**GHG**	**2019 Ex,t ($t\ CO_2\ e$)**	**|Ex,t| ($t\ CO_2\ e$)**	**Lx,t**	**Cumulative Total of Column F**
3.B.1.a	Forest land Remaining Forest land	CO_2	-27,741	27,741	0.179	0.179
1.A.3.b	Road Transportation	CO_2	23,421	23,421	0.151	0.330
1.A.4	Other Sectors – Liquid Fuels	CO_2	21,867	21,867	0.141	0.471
4.D	Wastewater Treatment and Discharge	CH_4	20,503	20,503	0.132	0.603
1.A.1	Energy Industries – Liquid Fuels	CO_2	19,067	19,067	0.123	0.726
3.A.2	Manure Management	CH_4	15,858	15,858	0.102	0.828
1.A.4	Other Sectors – Biomass	CH_4	5,337	5,337	0.034	0.863
1.A.3.a	Civil Aviation	CO_2	4,122	4,122	0.027	0.889
3.A.2	Manure Management	N_2O	3,631	3,631	0.023	0.913
1.A.3.d	Water-borne Navigation – Liquid Fuels	CO_2	3,600	3,600	0.023	0.936
4.A	Solid Waste Disposal	CH_4	3,048	3,048	0.020	0.956

This situation does not change when considering the trend assessment for the period 2000 to 2019 (Table 2.3). The four major contributors in the trend assessment are Forestland remaining Forestland (CO_2), Manure management (CH_4), Energy Industries-Liquid fuels (CO_2) and Wastewater treatment and discharge (CH_4), totalling 75.4% of the 95% contributions of the assessment.

Table 2.3: Key Category Analysis (2000 – 2019): Approach 1 – trend assessment

A	B	C	D	E	F	G	H
IPCC Category code	IPCC Category	GHG	2000 Year Estimate Ex0 (t CO_2 e)	2019 Year Estimate Ext (t CO_2 e)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
3.B.1.a	Forest land Remaining Forest land	CO_2	-28,721	-27,741	0.275	0.308	0.308
3.A.2	Manure Management	CH_4	15,738	15,858	0.155	0.173	0.482
1.A.1	Energy Industries – Liquid Fuels	CO_2	16,098	19,067	0.132	0.147	0.629
4.D	Wastewater Treatment and Discharge	CH_4	4,240	20,503	0.111	0.125	0.754
3.A.2	Manure Management	N_2O	3,603	3,631	0.035	0.040	0.793
1.A.4	Other Sectors – Biomass	CH_4	4,226	5,337	0.031	0.035	0.829
4.A	Solid Waste Disposal	CH_4	-	3,048	0.029	0.032	0.861
1.A.3.b	Road Transportation	CO_2	12,689	23,421	0.025	0.027	0.888
1.A.3.d	Water-borne Navigation – Liquid Fuels	CO_2	2,871	3,600	0.022	0.024	0.912
3.C.4	Direct N2O Emissions from managed soils	N_2O	11,520	21,867	0.018	0.020	0.933
1.A.4	Other Sectors – Liquid Fuels	CO_2	1,830	1,834	0.017	0.019	0.951

The summary of Key Categories based on the quantitative evaluation for the 2019 level assessment and trend for the period 2000 to 2019, is presented in Table 2.4. Ten categories are common to both the level and trend assessments.

Table 2.4: Summary of Key Categories for level (2019) and trend (2000 – 2019) assessments

Number	IPCC category code	IPCC category	GHG	Approach used	Comment
1	1.A.1	Energy Industries – Liquid Fuels	CO_2	L1 T1	Quantitative
2	1.A.3.a	Civil Aviation	CO_2	L1	Quantitative
3	1.A.3.b	Road Transportation	CO_2	L1 T1	Quantitative
4	1.A.3.d	Water-borne Navigation – Liquid Fuels	CO_2	L1 T1	Quantitative
5	1.A.4	Other Sectors – Liquid Fuels	CO_2	L1 T1	Quantitative
6	1.A.4	Other Sectors – Biomass	CH_4	L1 T1	Quantitative
7	3.A.2	Manure Management	CH_4	L1 T1	Quantitative
8	3.A.2	Manure Management	N_2O	L1 T1	Quantitative
9	3.B.1.a	Forest land Remaining Forest land	CO_2	L1 T1	Quantitative
10	3.C.4	Direct N2O Emissions from managed soils	N_2O	T1	Quantitative
11	4.A	Solid Waste Disposal	CH_4	L1 T1	Quantitative
12	4.D	Wastewater Treatment and Discharge	CH_4	L1 T1	Quantitative

Notation keys: L = key category according to level assessment; T = key category according to trend assessment; and Q = key category according to qualitative criteria. The Approach used to identify the key category is included as L1, L2, T1 or T2.

2.2.5. Methodological issues

This section provides an overview of the methodological approach adopted for computing emissions for this inventory. More specific details are provided under the respective IPCC sectors and sub-sectors.

The method adopted to compute emissions involved multiplying AD by the relevant appropriate EF, as shown below:

Emissions (E) = Activity Data (AD) x Emission Factor (EF)

As per Good Practices all methods and tools recommended by IPCC for estimating emissions have been used and followed when compiling this inventory.

Default EFs were assessed for their appropriateness prior to their adoption, namely the situations under which they have been developed and the extent to which they were representative of national circumstances.

There exists no dedicated national framework for data collection and archiving for preparing GHG inventories in the country. Hence, the collection of AD for all sectors was done directly with the stakeholders supported by the project coordinator. Most missing AD were generated using the splicing techniques recommended in the IPCC 2006 Guidelines, based on existing AD and related socio-economic indicators.

2.2.6. Quality Assurance and Quality Control (QA / QC)

QA and QC procedures, as defined in the 2006 IPCC Guidelines (IPCC, 2007) were not implemented by Kiribati during the preparation of this inventory. A QC was performed by the consultants through analysis of the times series consistency, by cross verifying with national data from official reports of the statistics agency and through comparison of national data sets with those from international databases.
QA was done by an independent expert of the international consultancy firm who was not involved in the compilation exercise. The QA exercise comprised the following steps:

- Confirmation of data quality and reliability used for computing emissions based on available information,
- Comparison of AD with those available from national and international websites,
- Review of the AD and EFs adopted within each source category as a first step,
- Verification of the calculation steps in the software to ensure accuracy, and
- Ensuring the report reflects the estimates and results generated by the software.

2.2.7. Uncertainty assessment

Uncertainty estimation is an essential element of a GHG Inventory in addition to the KCA to provide information on the source categories to be prioritized for allocation of resources to improve the quality of the inventory. Inventories prepared in accordance with the 2006 IPCC Guidelines (IPCC, 2007) will typically contain a wide range of uncertainties in the emission estimates associated with AD and EF used. Estimates may be of good quality with low uncertainties when carefully measured and demonstrably complete data sets are used or of lower quality with higher uncertainty estimates such as with N_2O fluxes from soils and waterways. For this inventory median values from the IPCC recommended range were adopted for both AD and EFs. The annual and trend uncertainties for the timeseries for the full inventory are presented in Table 2.5.

Table 2.5: Results of the annual and trend uncertainty (%) analyses for the timeseries 2000 to 2019

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual	26.54	27.27	25.39	25.43	24.05	23.11	22.27	22.03	22.36	22.58
Trend (base year 2000)	-	33.18	33.31	33.40	33.49	33.85	34.25	34.78	35.22	35.75

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual	23.15	23.12	22.71	22.36	22.06	21.90	21.69	21.20	20.67	20.02
Trend (base year 2000)	35.64	36.15	36.70	38.01	37.74	39.56	41.49	43.62	45.61	43.27

Annual uncertainty of the inventory varied between 20.02% and 26.54% while the trend uncertainty increased from 33.18% for period 2000 to 2001 to reach 43.27% for the period 2000 to 2019.

2.2.8. Assessment of completeness

An assessment of completeness provides valuable information on the level of coverage of the inventory and provides for areas of work in the NIIP. An assessment was made for individual activity areas within each source category. Detailed information on the completeness is available in the national and sectoral tables from the software under each IPCC sector. The methodology adopted was according to the 2006 IPCC Guidelines (IPCC 2007) with the following notation keys used:

Notation key	Meaning
NA	Not Applicable
NO	Not Occurring
NE	Not Estimated
IE	Included Elsewhere

2.2.9. Recalculations

The GHG inventories of the First and Second National Communications (NC1 & NC2 respectively) for the year 1994 and period 2004 to 2008 were compiled at Tier 1 level using the IPCC 1996 Guidelines and IPCC 2006 Guidelines for National Greenhouse Gas Inventories (IPCC, 2007). Both these inventories were incomplete, the coverage being Energy, Livestock and Landfills for the NC1 and Energy and Livestock for the NC2.

The present inventory was computed using improved datasets over an extended coverage of categories and the IPCC 2006 Guidelines. For consistency purposes on the method and source of data and maintaining the same completeness for categories and gases covered, emissions were recalculated for the period 2004 to 2008 and the aggregated emissions are presented in Table 2.6. Recalculated absolute emissions of CH_4 and N_2O were aggregated using the AR5 GWPs for comparability with the present inventory. The differences in aggregated national emissions of the NC2 results compared to those of the BUR1 are attributed to errors in the computation of N_2O which were overestimated, the lower coverage of categories and gases, the inclusion of removals from the Land sub-sector and more accuracy for the livestock sub-sector (Table 2.6).

Table 2.6: Comparison of original and recalculated emissions/removals (t CO_2 e) for 2004 to 2008

Year	Aggregated net emissions	
	NC2	BUR1
2004	29,659	59,708
2005	31,230	64,956
2006	229,493	69,945
2007	242,921	72,038
2008	155,873	70,939

2.2.10. Time series consistency

This inventory now covers the period 2000 to 2019 and AD within category were captured from the same sources for all years. Outliers were corrected using the recommended IPCC splicing techniques of the IPCC 2006 Guidelines. The same EFs have been used throughout the time series. This enabled a consistent time series to be built with a good level of confidence and comparability between years in the trend of the emissions.

2.2.11. Gaps, constraints and needs

The main challenges encountered during the compilation of the present inventory and listed below consist essentially of gaps in AD, especially at the plant level, and lack of national EFs for moving to Tier 2 level for key categories.

Main challenges encountered during the compilation of the present inventory

- *Information required for the inventory were obtained from various sources upon request of the MELAD-ECD because of the lack of formal arrangements (MOUs) and channels for an automatic flow and data sharing between MELD and stakeholders.*
- *Kiribati still does not have appropriate templates for data collection to feed into the software.*
- *Most of the AD were not in the required format for feeding in the software to make the emission estimates.*
- *Reliable national biomass (bm) data are not available and had to be derived using statistical modelling or adopted from the FAO database.*
- *Inconsistencies cropped up frequently with data from different sources.*
- *Emissions for a substantial number of categories have not been estimated due to lack of AD, and*
- *Capacity of stakeholders for data collection and computation of emissions are severely lacking. It is recommendable that they strengthen their capacity on these items.*

2.2.12. National Inventory Improvement Plan (NIIP)

The most urgent improvements were identified based on the constraints, gaps and other challenges encountered during the preparation of the present inventory. Those items needing improvement and retained for action during the next inventory cycle are listed below.

- Development and implementation of a national framework for adequate and proper data capture, QC, validation, storage and retrieval to facilitate the compilation of future inventories, typically on an annual basis.
- Development and implementation of a national inventory cycle for inventory compilation.

- Capacity building of stakeholders and strengthening of the existing institutional framework within a robust GHG Management Information System (GHGIMS) to provide improved coordinated action for a smooth implementation of the GHG inventory cycle.
- Development of national EFs to enable adoption of Tier 2 methods for key categories.
- Development and implementation of a QA / QC system including a QA / QC plan to improve inventory quality.
- Access sufficient financial resources to strengthen the present system for inventory compilation and coordination.
- Institutionalize and consolidate the archiving system on GHG inventory data.
- Invest in the collection of the required AD for categories not covered in this exercise to improve completeness of future inventories.
- Conduct new forest inventories to generate national stock and EFs.
- Produce maps for the period 1990 to 2020 to match IPCC representation of land classes to refine land use change data and improve estimates of emissions and sinks in the Land sector.
- Computation of emissions of themissing years 1990 to 1999 to have the complete time series.

2.3. National GHG emissions

2.3.1. Emissions trends for the period 2000 to 2019

The Republic of Kiribati remained a net emitter throughout the timeseries 2000 to 2019. Gross national emissions increased from 77,265 t CO_2 e in 2000 to reach 127,283 t CO_2 e in 2019. Removals from the AFOLU sector decreased slightly, by 964 t CO_2, from the year 2000 to 27,767 t CO_2 in 2019. Net emissions were estimated at 99,516 t CO_2 e in the year 2019, representing an increase of 105% over the year 2000 Table 2.7. The impact of the COVID-19 pandemic on the emissions of 2019 is clearly visible. The increase was slower because of the economic downturn.

Table 2.7: GHG emissions (t CO_2 e) trends (2000 – 2019)

Year	Gross emissions	AFOLU removals	Net emissions	Per capita emission (t)
2000	77,265	-28,731	48,534	0.57
2001	74,507	-28,685	45,822	0.53
2002	81,683	-28,637	53,046	0.60
2003	81,978	-28,590	53,388	0.60
2004	88,249	-28,541	59,708	0.66
2005	93,448	-28,491	64,956	0.70
2006	98,382	-28,438	69,945	0.74
2007	100,421	-28,382	72,038	0.74
2008	99,264	-28,326	70,939	0.72
2009	98,804	-28,266	70,537	0.70
2010	94,797	-28,206	66,591	0.65
2011	95,643	-28,158	67,485	0.65
2012	98,658	-28,109	70,549	0.67
2013	102,384	-28,058	74,326	0.69
2014	104,345	-28,006	76,339	0.70
2015	107,834	-27,954	79,880	0.73
2016	112,400	-27,909	84,491	0.75
2017	119,076	-27,862	91,214	0.80
2018	126,300	-27,815	98,485	0.85
2019	127,283	-27,767	99,516	0.84

Consequently, the per capita net emissions increased from 0.57 in the year 2000 to 0.84 t CO_2 e in 2019 representing an increase of 46.9%.

2.3.2. Emissions trend by IPCC sector

Total gross emissions increased by 65% over the 20-years timeseries, mainly driven by significant increases in the Energy and Waste sectors. The AFOLU sector emissions increased until the year 2010 and then regressed to nearly the same level as 2000 in 2019. In 2019, the Energy sector was the main emitter followed by the Waste sector, while the IPPU sector remained the least emitting sector throughout the whole timeseries.

During the period 2000 to 2019, the emissions from the Energy sector increased by 59%. The sector emitted 78,783 t CO_2 e in 2019 which represented 62% of national emissions as depicted in Table 2.8.

AFOLU emissions increased from 22,666 t CO_2 e in 2000 to reach its maximum in 2010 at 24,651 t CO_2 e. It then decreased to 22,824 t CO_2 e in 2019 (Table 2.8). This sector was the second highest contributor in 2000 when its emissions amounted to 29% of national emissions. This share gradually decreased to 18% in 2019 when the sector became the third highest emitter.

The IPPU sector contributed marginally to total national emissions with its share decreasing from 1.6% in 2000 to 0.06% in 2019. Emissions from the IPPU sector fell by 39% from the year 2000 when it emitted 123 t CO_2 e to 75 t CO_2 e in 2019 (Table 2.8).

Emissions from the Waste sector increased slowly from 6% of national emissions in 2000 to 20% in 2019. Emissions from this sector increased by nearly 425% from the 2000 level of 4,877 t CO_2 e to 25,602 t CO_2 e in 2019.

Table 2.8: National GHG emissions (t CO_2 e) by sector (2000 – 2019)

Year	Gross emissions	Energy	IPPU	AFOLU	Waste
2000	77,265	49,599	123	22,666	4,877
2001	74,507	45,976	158	22,867	5,505
2002	81,683	52,343	139	23,068	6,134
2003	81,978	51,802	130	23,270	6,776
2004	88,249	57,206	128	23,471	7,444
2005	93,448	61,509	121	23,671	8,146
2006	98,382	65,465	114	23,871	8,933
2007	100,421	66,464	108	24,070	9,779
2008	99,264	64,196	103	24,269	10,697
2009	98,804	62,551	96	24,468	11,689
2010	94,797	57,312	87	24,651	12,747
2011	95,643	57,314	80	24,455	13,794
2012	98,658	59,421	79	24,255	14,903
2013	102,384	62,175	70	24,055	16,085
2014	104,345	63,085	60	23,854	17,346
2015	107,834	65,434	61	23,638	18,702
2016	112,400	68,667	62	23,436	20,234
2017	119,076	73,894	62	23,233	21,888
2018	126,300	79,529	71	23,028	23,672
2019	127,283	78,783	75	22,824	25,602

2.3.3. Trend in emissions by direct GHGs

CO_2 remained the main contributor to national GHG emissions, followed by CH_4 and N_2O over the full time series. In 2019, the share of GHG emissions was as follows: 57% CO_2, 37% CH_4 and 6% N_2O. The trends of the CO_2 equivalent emissions and removals by gas is given in Table 2.9 while the annual share of each gas is depicted in Figure 2.2.

Table 2.9: CO_2 equivalent emissions and removals by gas (2000 – 2019)

Year	Gross emissions (t CO_2 e)	Removals (CO_2) (t CO_2 e)	Net emissions (t CO_2 e)	CO_2 (t)	CH_4 (t CO_2 e)	N_2O (t CO_2 e)
2000	77,265	-28,731	48,534	44,656	25,579	7,030
2001	74,507	-28,685	45,822	41,105	26,318	7,084
2002	81,683	-28,637	53,046	47,412	27,079	7,192
2003	81,978	-28,590	53,387	46,868	27,842	7,267
2004	88,249	-28,541	59,708	52,231	28,633	7,386
2005	93,448	-28,491	64,957	56,458	29,487	7,503
2006	98,382	-28,438	69,945	60,344	30,418	7,621
2007	100,420	-28,382	72,038	61,261	31,431	7,728
2008	99,264	-28,326	70,939	58,937	32,507	7,821
2009	98,804	-28,266	70,537	57,228	33,657	7,919
2010	94,797	-28,206	66,590	51,956	34,862	7,978
2011	95,643	-28,158	67,485	51,888	35,766	7,990
2012	98,658	-28,109	70,549	53,913	36,728	8,017
2013	102,385	-28,058	74,326	56,454	37,863	8,067
2014	104,345	-28,006	76,339	57,380	38,866	8,098
2015	107,834	-27,954	79,880	59,423	40,236	8,175
2016	112,400	-27,909	84,491	62,362	41,770	8,268
2017	119,076	-27,862	91,214	67,284	43,427	8,365
2018	126,300	-27,815	98,485	72,623	45,201	8,476
2019	127,283	-27,767	99,516	72,264	46,514	8,505

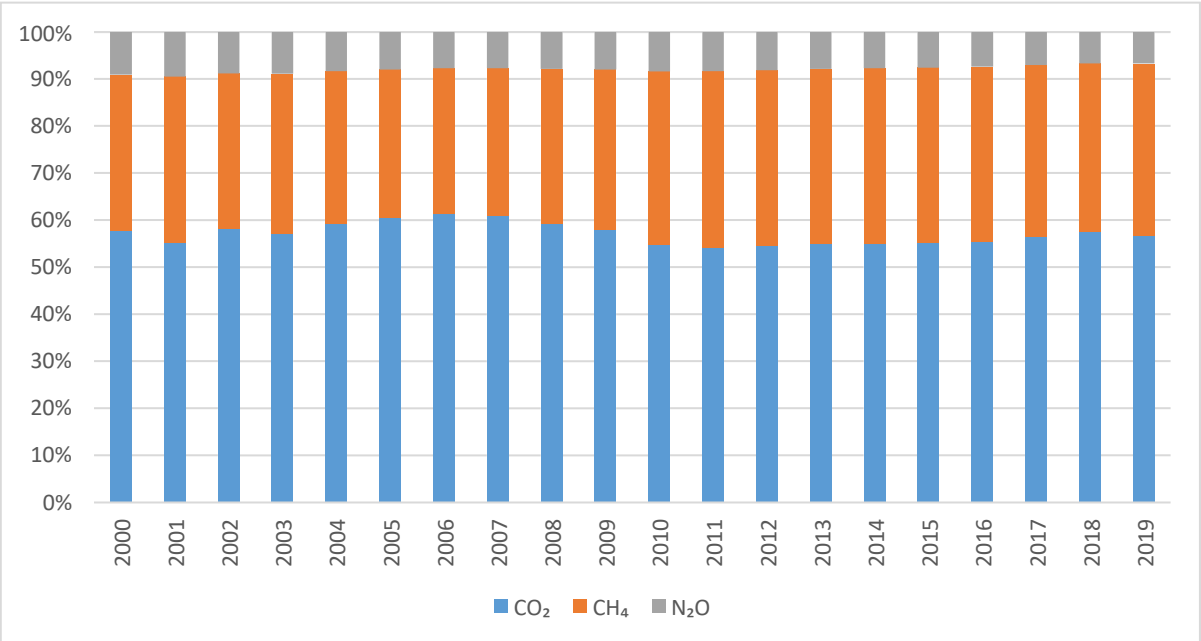


Figure 2.2: Share (%) of aggregated emissions by gas (2000 – 2019)

The software results for the short and long summary are presented in Tables 2.10 and 2.11.

Table 2.10: Short summary – Inventory year 2019

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_X	CO	NMVOCs	SO_2
Total National Emissions and Removals	44,496.871	1,661.212	32.095	NE	NE	NE	NE	NE	NE	NE	NE	NE
1 - Energy	72,075.762	199.082	4.276	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A - Fuel Combustion Activities	72,075.762	199.082	4.276	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes and Product Use	74.785	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.A - Mineral Industry	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NE	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	74.785	NO	NO	NA	NA	NA	NA	NA	NO	NO	NE	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.G - Other Product Manufacture and Use	NO	NO	NE	NO	NE	NE	NO	NE	NA	NA	NA	NA
2.H - Other	NE	NE	NO	NA	NA	NA	NA	NA	NE	NE	NE	NE
3 - Agriculture, Forestry, and Other Land Use	-27,767.228	606.499	22.044	NA	NA	NA	NA	NA	NO	NO	NE	NO
3.A - Livestock	NA	606.499	13.703	NA	NA	NA	NA	NA	NA	NA	NE	NA
3.B - Land	-27,740.841	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	NO	NE	8.341	NA	NA	NA	NA	NA	NO	NO	NA	NA
3.D - Other	-26.387	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	113.551	855.631	5.775	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.A - Solid Waste Disposal	NA	108.8507	NO	NA	NA	NA	NA	NA	NO	NO	NE	NE
4.B - Biological Treatment of Solid Waste	NA	NE	NE	NA	NA	NA	NA	NA	NO	NO	NE	NA
4.C - Incineration and Open Burning of Waste	113.551	14.526	0.164	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NA	732.254	5.611	NA	NA	NA	NA	NA	NO	NO	NE	NO

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
4.E - Other (please specify)	NO	N0	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NE	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOX and NH3	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	3,195.087	0.022	0.089	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	3,195.087	0.022	0.089	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.5.c - Multilateral Operations	NE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Note: The original values in gigagrams in the above table from the software output have been converted to tonnes

Table 2.11 : Long summary – Inventory year 2019

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	44,496.871	1,661.212	32.095	NE	NE	NE	NE	NE	NE	NE	NE	NE
1 - Energy	72,075.762	199.082	4.276	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A - Fuel Combustion Activities	72,075.764	199.082	4.276	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.1 - Energy Industries	19,066.501	0.772	0.154	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.2 - Manufacturing Industries and Construction	IE	IE	IE	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3 - Transport	31,142.385	4.625	1.397	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.4 - Other Sectors	21,866.877	193.685	2.725	NA	NA	NA	NA	NA	NE	NE	NE	NE

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
1.A.5 - Non-Specified	IE	IE	IE	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NO	NO	NO	NA	NA	NA	NA	NA				
1.B.1 - Solid Fuels	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NO	NA
1.B.2 - Oil and Natural Gas	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.B.3 - Other emissions from Energy Production	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes and Product Use	74.785	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.A - Mineral Industry	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.1 - Cement production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.2 - Lime production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.3 - Glass Production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.4 - Other Process Uses of Carbonates	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
2.C.2 - Ferroalloys Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	74.785	NO	NO	NA	NA	NA	NA	NA	NO	NO	NE	NO
2.D.1 - Lubricant Use	74.785	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NA
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NA	NA	NA	NA
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NA	NA	NA	NA
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NA	NA	NA	NA
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NA	NA	NA	NA
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA
2.F.2 - Foam Blowing Agents	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.4 - Aerosols	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA
2.F.5 - Solvents	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NA	NA	NA	NA	NA
2.G - Other Product Manufacture and Use	NO	NO	NE	NO	NE	NE	NO	NE	NA	NA	NA	NA
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NE	NA	NA	NA	NA
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NE	NA	NA	NA	NA
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
2.H - Other	NE	NE	NO	NA	NA	NA	NA	NA	NE	NE	NE	NE
2.H.1 - Pulp and Paper Industry	NE	NE	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-27,767.228	606.499	22.044	NA	NA	NA	NA	NA	NO	NO	NE	NO
3.A - Livestock	NA	606.499	13.703	NA	NA	NA	NA	NA	NA	NA	NE	NA
3.A.1 - Enteric Fermentation	NA	40.130	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.A.2 - Manure Management	NA	566.369	13.703	NA	NA	NA	NA	NA	NA	NA	NE	NA
3.B - Land	-27,740.841	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-27,740.841	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	NO	NO	8.341	NA	NA	NA	NA	NA	NE	NE	NA	NA
3.C.1 - Emissions from biomass burning	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NA	NA
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C.3 - Urea application	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	6.920	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	1.421	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C.7 - Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D - Other	-26.387	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-26.387	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	113.551	855.631	5.775	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.A - Solid Waste Disposal	NA	108.851	NO	NA	NA	NA	NA	NA	NO	NO	NE	NA

	Emissions (t)			Emissions CO_2 Equivalents (t)				Emissions (t)				
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
4.B - Biological Treatment of Solid Waste	NA	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NA
4.C - Incineration and Open Burning of Waste	113.551	14.526	0.164	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NA	732.254	5.611	NA	NA	NA	NA	NA	NO	NO	NE	NA
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NE	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOX and NH3	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	3,195.087	0.022	0.089	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	3,195.087	0.022	0.089	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.5.c - Multilateral Operations	NE	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE

Note: The original values in gigagrams in the above table from the software output have been converted to tonnes

2.4. Energy

2.4.1. Description of the sector

Fuel combustion is the process to generate heat used directly or to produce energy to drive mechanical and electrical systems. During this process the direct GHGs CO_2, CH_4 and N_2O, the GHG precursors CO, NO_X and NMVOCs, water and SO_2 are released. Furthermore, the extraction of hydrocarbons, such as oil and gas, as well as coal also releases the same direct GHGs, their precursors, water and SO_2.

Different activity areas in the Energy sector account for these emissions. The latter are associated with energy production, processing to convert primary fuels to secondary fuels, transportation and storage, and end-product use. Fuel combustion activities are included in these end-product uses and involve both primary and secondary fuels. Upstream of these activities are the extraction, refining, transport, and storage of primary and secondary hydrocarbons. The activities responsible for emissions in Kiribati are:

- Transformation of primary energy into more usable energy forms in power plants for production of heat and electricity generation.
- Use of fuels in stationary and mobile applications, such as
    - Fuel combustion in the transport sector,
    - On-site power generation plants,
    - Industrial use for heat and electricity production to power equipment.

There is no production of fossil fuels in Kiribati. The country is a thus an importer of this commodity for domestic use. The main imported fossil fuels are diesel, motor gasoline, aviation gasoline and dual-purpose kerosene. These fossil fuels are supplemented by renewable energy in the form of fuelwood, crop residues and small amounts of solar. Diesel is utilized for public electricity generation and own-use power generation. Transport fuels include motor gasoline and diesel for road transportation and water-borne navigation and aviation gasoline and jet kerosene for aviation. Fuels consumed in the Commercial / Institutional and Residential sectors include dual purpose kerosene and LPG for cooking and lighting, gasoline, diesel, and biomass fuels (fuelwood and crop residues) for auto-generation of heat and electricity.

Two approaches are recommended for estimating emissions of the Energy sector and both have been adopted. The Reference Approach (RA) is a Top-Down method which estimates net GHG emissions from combustion of primary and secondary fuels supplied to the economy while the Sectoral Approach (SA) is a Bottom-up method for a more accurate estimation of GHG emissions occurring in each source category from fuel combustion.

2.4.2. Methodology

The 2006 IPCC Guidelines for National GHG Inventories (IPCC, 2007) were used to compute emissions for fossil fuel combustion activities. The IPCC Tier 1 Reference and Sectoral approaches were adopted as per the decision trees provided in Figures 2.1 to 2.4 of the Guidelines (Vol. 2 Energy, Ch. 1, page 1.7).

2.4.2.1. The Reference Approach (RA)

The RA, which is a component in the recommended QA / QC procedures, was used to validate the Sectoral approach for the energy sector and involved the following steps:

- Estimation of apparent consumption of fuels by type in the country for the inventory years (2000 – 2019)
- Conversion of fuel amounts to energy units (TJ)

- Computation of total carbon by multiplying apparent consumption by the respective carbon content of each fuel type
- Subtraction of stored carbon (excluded carbon) from fuel carbon
- Conversion of carbon burned to CO_2 emissions.

The RA for estimating CO_2 emissions for combustion processes is expressed as follows:

where:

Apparent Consumption =	production + imports - exports - international bunkers - stock change
Conversion Factor =	factor to convert fuel to energy units (TJ) on net calorific value basis
CC =	carbon content of fuel (tonne C / TJ)
Excluded Carbon =	carbon in feed stocks and non-energy use excluded from fuel combustion emissions (Gg C)
Carbon oxidation factor (COF) =	fraction of carbon oxidized. For this inventory, the factor is 1, assuming complete oxidation
44 / 12 =	molecular weight ratio of CO2 to C

2.4.2.2. The Sectoral Approach (SA)

The equations used for the estimation of GHGs under the Tier 1 level, assuming 100% combustion of carbon, for all categories are:

Stationary combustion

Emissions GHG, fuel = Fuel Combustion fuel * Emission Factor GHG, fuel

where:

Emissions GHG, fuel =	emissions of a given GHG by type of fuel (kg GHG)
Fuel Combustion fuel =	amount of fuel combusted (TJ)
Emission Factor GHG, fuel =	emission factor of a given GHG by type of fuel (kg gas / TJ).

Mobile combustion

$\textbf{Emission} = \sum [\ \textbf{Fuel}_a * \textbf{EF}_a]$

where:

Emissions =	emission in kg
EFa =	emission factor kg / TJ
Fuela =	fuel consumed, (TJ) (as represented by fuel sold)
a =	fuel type (e.g., diesel, Jet Kerosene, Gasoline, Diesel etc.)

2.4.3. Activity data, Emission factors and emissions estimates

2.4.3.1. Reference Approach

Activity data and emission factors

Estimation of apparent consumption of fuels for the RA requires a supply balance of primary and secondary fuels, that is, primary and secondary fuels production, imports, exports, international bunkers, changes in stocks as well as fuels used for non-energy purposes. Only fuels recognised as being used in Kiribati have been adopted for calculating apparent consumption for the RA. Imports data from the energy balances from Kiribati Integrated Energy Roadmap (KIER) report (2017) and the Ministry of Industry and Sustainable Energy (MISE) were used for computing apparent consumption of primary and secondary fuels (Table 2.12).

Activity data for the whole timeseries was not available from a single source. Information obtained from the KIER report was used to estimate AD from the years 2000 to 2009. Except for biomass, information was available from MISE for the years 2010 to 2019. The data was analysed for outliers and gaps were filled using the splicing techniques recommended in the IPCC 2006 Guidelines. The data for 2000 to 2009 was the total amount of fuel used in the economy and the allocation of these fuel types in the different activity areas for the 2000 to 2009 was based on the information of 2010 to 2014.

Emissions estimates

Emissions based on apparent consumption for the RA approach are provided in Table 2.24 where they are compared with those of the SA.

2.4.3.2. Sectoral Approach

Activity data and emission factors

The AD for the energy sector inventory includes data on energy consumption. During the inventory, special attention was paid to data used, from both national and international sources, data preparation for use in the software and documentation. Priority was given to using data sourced directly or estimated from available national sources for the timeseries. Existing gaps were filled either by sourcing for additional data from other official sources or generated by the appropriate splicing techniques recommended in the 2006 IPCC Guidelines. For this inventory, fuel consumption data for all categories and sub-categories were sourced from the energy balances from the KIER report (2017) and from consumption data obtained from MISE.

Energy Industries (1.A.1)

Electricity Generation (1.A.1.a.i)

Emissions in the energy industries category result from fuel combustion in the following:

- Public electricity generation plants,
- Fuel consumption in other energy industries

Emissions from public electricity generating stations in the country result from the combustion of gasoil / diesel in electrical power plants. The AD for activities in this category is provided in Table 2.13.

Table 2.12: Flow of liquid and solid fuels into the economy (2000 – 2019)

Fuel (Ton) / Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Diesel																				
Imports	9,206.4	8,997.2	10,667.3	10,496.5	11,249.5	11,292.6	11,537.0	11,333.9	11,571.8	10,870.8	10,057.2	10,185.9	11,040.9	10,867.4	11,424.4	11,818.3	10,689.4	13,292.4	12,207.0	12,100.8
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	9,587.0	8,933.0	10,025.9	9,629.6	11,235.5	12,466.6	13,345.8	13,559.0	13,049.0	12,433.1	10,253.6	10,094.3	10,410.1	10,763.7	10,634.2	10,841.9	11,353.2	11,871.6	12,837.3	12,407.6
Gasoline																				
Imports	2,838.6	3,065.6	3,223.9	4,031.2	4,384.5	4,153.9	4,300.5	4,038.0	3,962.3	4,059.9	3,771.0	4,731.2	5,145.4	5,340.0	5,021.7	5,238.0	5,361.1	7,284.3	5,656.9	6,136.5
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	2,811.6	2,506.4	2,679.7	3,219.7	3,293.8	3,494.1	3,608.6	3,547.5	3,428.8	3,481.3	3,980.2	4,065.0	4,351.1	4,666.4	5,178.1	5,448.0	5,779.0	6,633.8	7,149.0	7,286.5
Jet Kerosene																				
Imports	659.1	694.9	775.6	1,059.9	877.4	808.9	878.0	995.2	971.5	904.3	1,168.1	1,121.9	1,215.0	1,171.3	1,061.2	1,381.3	1,306.4	1,769.2	1,592.6	1,941.3
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
International Bunkers	404.9	351.7	475.4	410.0	428.0	407.9	476.5	514.8	497.7	519.6	517.6	515.6	538.1	586.5	451.0	566.0	526.6	611.0	812.2	1013.3
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	397.4	345.1	466.5	402.4	420.0	400.3	467.6	505.2	488.4	509.9	515.9	522.9	553.7	592.6	600.6	642.6	868.9	934.4	1,120.9	1,307.3
Other Kerosene																				
Imports	895.4	944.0	1,053.7	1,439.9	1,191.9	1,098.9	1,192.7	1,351.9	1,319.8	1,228.5	1,707.3	1,642.2	1,659.7	1,519.4	1,580.7	1,930.6	1,462.9	1,955.3	1,407.4	1,425.8
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	1,089.9	946.6	1,279.5	1,103.7	1,152.0	1,097.9	1,282.6	1,385.7	1,339.7	1,398.6	1,510.5	1,519.9	1,491.4	1,529.4	1,566.4	1,689.3	1,562.6	1,708.0	1,708.2	1,704.3
LPG																				
Imports	160.3	180.2	472.6	688.9	342.8	316.2	295.8	291.2	247.1	193.3	113.4	156.8	198.0	257.2	154.3	155.1	140.6	126.1	255.8	128.1
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	160.3	180.2	472.6	407.7	342.8	316.2	295.8	291.2	247.1	193.3	113.4	156.8	198.0	257.2	154.3	155.1	140.6	126.1	166.7	166.7
Aviation gasoline																	a			
Imports	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	26.9	12.0	12.0	0.0	0.0	8.2	7.8	7.4	0.0	0.0
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	8.2	7.8	7.4	0.0	0.0
Lubricants																				

Fuel (Ton) / Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Imports	239.4	295.3	264.5	254.8	180.5	180.5	180.5	180.5	180.5	180.5	106.2	105.7	180.4	93.6	156.0	154.6	163.4	172.1	114.4	102.9
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	30.1	26.9	28.7	34.5	35.3	37.4	38.7	38.0	36.7	37.3	42.6	43.4	46.7	58.3	49.9	51.9	58.8	66.9	60.8	62.8
Non-energy use	209.3	268.5	235.7	220.3	145.2	143.1	141.8	142.5	143.8	143.2	63.6	62.3	133.7	35.2	106.1	102.7	104.6	105.2	53.6	40.1
Biomass																				
Production	43,366.8	43,328.0	43,294.5	43,260.5	43,237.7	43,551.7	43,865.8	44,528.1	45,200.7	45,883.8	46,535.0	47,156.9	47,751.8	49,385.4	48,869.3	51,249.0	53,628.6	56,008.3	58,387.9	54,770.0
Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consumption	43,366.8	43,328.0	43,294.5	43,260.5	43,237.7	43,551.7	43,865.8	44,528.1	45,200.7	45,883.8	46,535.0	47,156.9	47,751.8	49,385.4	48,869.3	51,249.0	53,628.6	56,008.3	58,387.9	54,770.0

Transport (1.A.3)

In Kiribati, the transport category comprises civil aviation (domestic and international), road transportation and water-borne navigation (domestic). There are no formal national statistics on the fuel consumption pattern for international navigation sub-category. The AD used in the computation of emissions for the transport sector by subcategory and fuel type are provided in Table 2.13.

Other Sectors (1.A.4) – Commercial / Institutional, Residential and Agriculture / Forestry / Fisheries

Data for fuel consumption in the Commercial, Residential and Agriculture / Forestry / Fisheries sectors, are presented in Table 2.13. Data gaps were filled by using extrapolation methods. In the commercial sector, diesel is consumed for auto-generation of electricity while, in the residential sector, kerosene, LPG and biomass are used for cooking and lighting and gasoline used for auto-generation of electricity.

In the Agriculture / Forestry / Fisheries sectors, ULP (gasoline) is utilized for mobile combustion for the fishing sub-category.

Table 2.13: Activity data (Ton) used for Sectoral Approach of Energy Sector (2000 – 2019)

Categories	Fuel	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Energy generation	Diesel	5052.4	4707.7	5283.6	5074.8	5921.1	6569.9	7033.2	7145.6	6876.8	6552.2	5408.8	5293.6	5503.6	5713.7	5483.0	5233.4	5585.3	5791.4	6455.8	5983.9
International aviation	Jet kerosene	404.9	351.7	475.4	410.0	428.0	407.9	476.5	514.8	497.7	519.6	517.6	515.6	538.1	586.5	451.0	566.0	526.6	611.0	812.2	1013.3
Domestic aviation	Jet kerosene	397.4	345.1	466.5	402.4	420.0	400.3	467.6	505.2	488.4	509.9	515.9	522.9	553.7	592.6	600.6	642.6	868.9	934.4	1120.9	1307.3
	Aviation gasoline	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	8.2	7.8	7.4	0.0	0.0
Road transportation	Gasoline	496.8	442.8	473.4	568.9	582.0	617.3	637.6	626.8	605.8	615.1	643.8	622.7	690.6	846.2	1172.2	1498.3	1729.7	1966.5	2155.8	2326.0
	Diesel	3499.3	3260.5	3659.4	3514.8	4101.0	4550.3	4871.2	4949.0	4762.9	4538.1	3701.7	3630.7	3762.1	3893.5	4024.9	4463.3	4721.1	4756.0	4916.3	5094.2
	Lubricant	4.9	4.3	4.6	5.6	5.7	6.0	6.2	6.1	5.9	6.0	7.1	6.9	7.6	9.3	7.9	16.5	19.1	21.7	15.6	16.4
Domestic waterborne navigation	Gasoline	39.3	35.0	37.4	45.0	46.0	48.8	50.4	49.6	47.9	48.6	64.4	62.0	59.7	65.2	68.6	68.8	83.7	88.5	82.0	84.7
	Diesel	862.8	804.0	902.3	866.7	1011.2	1122.0	1201.1	1220.3	1174.4	1119.0	928.8	955.7	939.5	939.5	923.3	929.7	819.2	996.8	1218.6	1047.2
	Lubricant	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.0	0.9	0.9
Commercial	Diesel	172.6	160.8	180.5	173.3	202.2	224.4	240.2	244.1	234.9	223.8	214.3	214.3	204.8	217.0	203.0	215.4	227.5	327.4	246.6	282.3
	Other kerosene	391.7	340.2	459.8	396.6	414.0	394.6	460.9	498.0	481.5	502.6	550.0	550.8	536.0	548.5	551.9	571.5	551.3	573.3	438.8	493.5
	Gasoline	81.4	72.6	77.6	93.2	95.3	101.1	104.5	102.7	99.3	100.8	111.2	117.0	101.7	129.4	185.3	241.2	438.2	552.6	521.4	666.6
	Other kerosene	698.2	606.4	819.7	707.0	738.0	703.3	821.6	887.7	858.3	896.0	960.4	969.1	955.4	980.9	1014.5	1117.8	1011.4	1134.7	1269.4	1210.8
Residential	LPG	160.3	180.2	472.6	407.7	342.8	316.2	295.8	291.2	247.1	193.3	113.4	156.8	198.0	257.2	154.3	155.1	140.6	126.1	6.3	74.4
	Other solid primary biomass	43366.8	43328.0	43294.5	43260.5	43237.7	43551.7	43865.8	44528.1	45200.7	45883.8	46535.0	47156.9	47751.8	49385.4	48869.3	51249.0	53628.6	56008.3	58387.9	54770.0
Fishing	Gasoline	2194.2	1956.0	2091.2	2512.6	2570.5	2726.8	2816.2	2768.4	2675.8	2716.8	3160.7	3263.2	3499.1	3625.5	3752.0	3639.8	3527.5	4026.3	4389.8	4209.2
	Lubricant	24.8	22.1	23.6	28.4	29.0	30.8	31.8	31.3	30.2	30.7	34.8	35.9	38.5	48.3	41.3	34.6	38.8	44.3	44.3	45.5

Default EFs for Tier 1 level from the 2006 IPCC Guidelines were used in the estimation of GHGs for the energy sector for the direct gases CO_2, CH_4 and N_2O and are given in Table 2.14.

Table 2.14: List of emission factors (kg/TJ) used in the Energy sector by fuel type and category

Fuel	Category	Emission factor			Source of information		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Diesel	Electricity generation	74100	3	0.6	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
	Road transportation	74100	3.9	3.9	Vol. 2, table 3.2.1	Vol. 2, table 3.2.2	Vol. 2, table 3.2.2
	Domestic waterborne navigation	74100	7	2	Vol. 2, table 3.5.2	Vol. 2, table 3.5.3	Vol. 2, table 3.5.3
	Commercial	74100	10	0.6	Vol. 2, table 2.4	Vol. 2, table 2.4	Vol. 2, table 2.4
Gasoline	Road transportation	69300	33	3.2	Vol. 2, table 3.2.1	Vol. 2, table 3.2.2	Vol. 2, table 3.2.2
	Domestic waterborne navigation	69300	7	2	Vol. 2, table 3.5.2	Vol. 2, table 3.5.3	Vol. 2, table 3.5.3
	Residential	69300	10	0.6	Vol. 2, table 2.5	Vol. 2, table 2.5	Vol. 2, table 2.5
	Fishing	69300	10	0.6	Vol. 2, table 2.5	Vol. 2, table 2.5	Vol. 2, table 2.5
Kerosene	International aviation	71500	0.5	2	Vol. 2, table 3.6.4	Vol. 2, table 3.6.5	Vol. 2, table 3.6.5
	Civil aviation	71500	0.5	2	Vol. 2, table 3.6.4	Vol. 2, table 3.6.5	Vol. 2, table 3.6.5
	Commercial	71900	10	0.6	Vol. 2, table 2.4	Vol. 2, table 2.4	Vol. 2, table 2.4
	Residential	71900	10	0.6	Vol. 2, table 2.5	Vol. 2, table 2.5	Vol. 2, table 2.5
Aviation gasoline	Civil aviation	70000	0.5	2	Vol. 2, table 3.6.4	Vol. 2, table 3.6.5	Vol. 2, table 3.6.5
LPG	Residential	63100	5	0.1	Vol. 2, table 2.5	Vol. 2, table 2.5	Vol. 2, table 2.5
Lubricants	Road transportation	73,300	n.a	n.a	Vol. 2, table 2.3	n.a	n.a
	Domestic waterborne navigation	73,300	n.a	n.a	Vol. 2, table 3.5.2	n.a	n.a
	Fishing	73,300	10	0.6	Vol. 2, table 2.5	Vol. 2, table 2.5	Vol. 2, table 2.5
Other primary solid biomass	Residential	100000	300	400	Vol. 2, table 2.5	Vol. 2, table 2.5	Vol. 2, table 2.5

Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2

Emissions estimates by category

Total aggregated emissions from the Energy sector reached 78,783 t CO_2 e in the year 2019 compared to 49,599 t CO_2 e in 2000, representing an increase of 59% (Figure 2.3 and Table 2.15). Fuel Combustion Activities was the only activity contributing to emissions in the Energy sector.

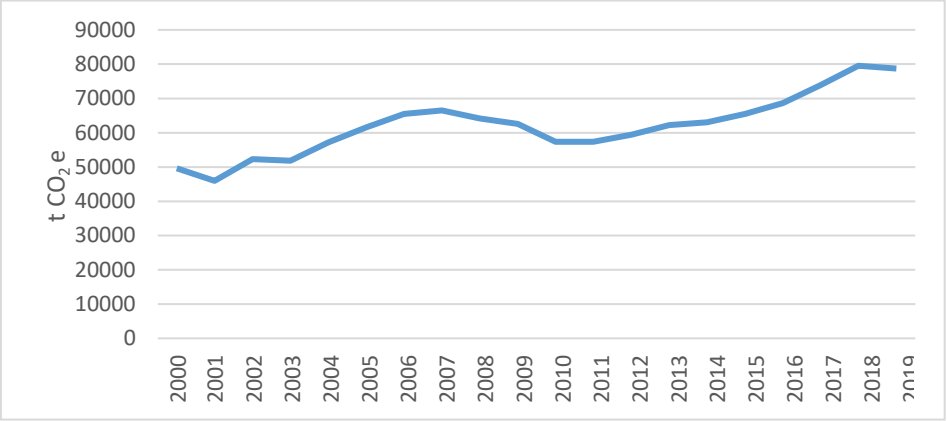


Figure 2.3: Aggregated GHG emissions (t CO_2 e) of the Energy sector (2000 – 2019)

The Transport category was the highest contributor in total emissions out of the three emitting categories with an average of 35% over the whole timeseries. In 2019, it emitted 31,642 t CO_2 e followed by the Other Sectors category with 28,012 t CO_2 e and Energy industries with 19,129 t CO_2 e. The emissions estimates are provided in Table 2.15.

Table 2.15: Aggregated emissions (t CO_2 e) by category in the Energy sector (2000 – 2019)

Year	Total Energy sector	Energy Industries (1.A.1)	Transport (1.A.3)	Other sectors (1.A.4)
2000	49,599	16,151	17,099	16,349
2001	45,976	15,049	15,787	15,140
2002	52,343	16,890	17,884	17,568
2003	51,802	16,223	17,425	18,154
2004	57,206	18,928	19,887	18,390
2005	61,509	21,002	21,756	18,751
2006	65,465	22,483	23,332	19,649
2007	66,464	22,843	23,728	19,893
2008	64,196	21,983	22,853	19,360
2009	62,551	20,946	22,047	19,557
2010	57,312	17,291	18,891	21,130
2011	57,314	16,922	18,696	21,696
2012	59,421	17,594	19,375	22,452
2013	62,175	18,265	20,436	23,473
2014	63,085	17,528	21,834	23,724
2015	65,434	16,730	24,481	24,223
2016	68,667	17,855	26,460	24,352
2017	73,894	18,514	28,120	27,261
2018	79,529	20,638	30,479	28,412
2019	78,783	19,129	31,642	28,012

Emissions by gas

Table 2.16 provides the emissions for the direct gases for the period 2000 to 2019. CO_2 was the main gas in t CO_2 e for all years of the time series. In 2019, CO_2, with 72,076 t, represented 91% of total emissions followed by CH_4 with 7% for a contribution of 5,574 t CO_2 e and N_2O at 2% with 1,133 t CO_2 e. These emissions exclude CO_2 from Biomass burning for energy production which is accounted for as fuelwood removals in the AFOLU sector and reported under Memo Items for informative purposes.

Except for a decrease in consumption between 2008 and 2010, and 2018 to 2019, there was a steady increase in CO_2 emissions from 44,468 t in the year 2000 to 72,076 t in 2019 (Table 2.16). This increase from the year 2000 to 2019 amounted to 62 %.

An increasing pattern is observed for CH_4 emissions which evolved from 154.8 t in 2000 to 199.1 t in 2019 (Table 2.16) representing a 29% increase in emissions. The emissions peaked at 211.5 t in 2018.

Likewise, N_2O emissions increased by 42%, from 797 t CO_2 e in 2000 to 1,133 t CO_2 e in 2019 (Table 2.16).

Table 2.16: Absolute (t) and CO_2 equivalent (t CO_2 e) emissions by gas for the Energy sector (2000 – 2019)

Year	CO_2	CH_4		N_2O		Total (t CO_2 e)
	(t)	(t)	(t CO_2 e)	(t)	(t CO_2 e)	
2000	44,468	154.8	4,333	3.0	797	49,599
2001	40,881	154.3	4,320	2.9	776	45,977
2002	47,205	154.7	4,330	3.0	808	52,343
2003	46,667	154.7	4,332	3.0	802	51,802
2004	52,028	155.0	4,339	3.2	839	57,206
2005	56,260	156.3	4,378	3.3	872	61,509
2006	60,149	157.7	4,416	3.4	899	65,465
2007	61,069	160.1	4,482	3.4	913	66,464
2008	58,746	162.2	4,542	3.4	908	64,196
2009	57,039	164.5	4,607	3.4	904	62,551
2010	51,775	166.7	4,669	3.3	868	57,312
2011	51,711	168.9	4,730	3.3	873	57,314
2012	53,736	171.2	4,794	3.4	891	59,421
2013	56,284	177.3	4,964	3.5	927	62,175
2014	57,218	176.0	4,929	3.5	938	63,085
2015	59,258	184.9	5,176	3.8	999	65,434
2016	62,194	193.5	5,419	4.0	1,054	68,667
2017	67,114	202.6	5,673	4.2	1,107	73,894
2018	72,441	211.5	5,922	4.4	1,166	79,529
2019	72,076	199.1	5,574	4.3	1,133	78,783

Emissions by gas by sub-category

Electricity generation

The estimates of emissions from electricity generation are given in Table 2.17. Emissions followed a varying trend with peaks and lows which is characteristic of energy use in the country. There is an 18% increase from the year 2000 to 2019 when aggregated emissions from this sub-category reached 19,129 t CO_2 e.

CO_2 remained the main GHG emitted for the Energy Industries category with 99.7% and the other two direct gases were responsible for the remaining 0.3% of total aggregated emissions. In absolute terms, CO_2 emissions reached 19,067 t while CH_4 accounted for 0.772 t and N_2O for 0.154 t only in 2019.

Table 2.17: Absolute (t) and aggregated emissions (t CO_2 e) from Electricity Generation (2000 – 2019)

Year	Absolute (t)			Aggregated (t CO_2 e)		
	CO_2	CH_4	N_2O	CH_4	N_2O	Total
2000	16,098	0.652	0.130	18	35	16,151
2001	15,000	0.607	0.121	17	32	15,049
2002	16,835	0.682	0.136	19	36	16,890
2003	16,170	0.655	0.131	18	35	16,223
2004	18,867	0.764	0.153	21	40	18,928
2005	20,934	0.848	0.170	24	45	21,002
2006	22,410	0.907	0.181	25	48	22,483
2007	22,768	0.922	0.184	26	49	22,843
2008	21,912	0.887	0.177	25	47	21,983
2009	20,877	0.845	0.169	24	45	20,946
2010	17,234	0.698	0.140	20	37	17,291

Year	Absolute (t)			Aggregated (t CO_2 e)		
	CO_2	CH_4	N_2O	CH_4	N_2O	Total
2011	16,867	0.683	0.137	19	36	16,922
2012	17,536	0.710	0.142	20	38	17,594
2013	18,206	0.737	0.147	21	39	18,265
2014	17,470	0.707	0.141	20	37	17,528
2015	16,675	0.675	0.135	19	36	16,730
2016	17,796	0.721	0.144	20	38	17,855
2017	18,453	0.747	0.149	21	40	18,514
2018	20,570	0.833	0.167	23	44	20,638
2019	19,067	0.772	0.154	22	41	19,129

Transport (1.A.3)

The aggregated emissions for the sub-categories of the Transport category for the period 2000 to 2019 are provided in Table 2.18. Emissions in the transport sub-categories varied between years over the time series due to variations in the intensity of activities. Emissions from the Transport category increased by 85% from 2000 to 2019. Civil Aviation emissions increased by 220%, followed by Road Transportation and Water-borne Navigation with an increase of 85% and 24% respectively.

Table 2.18: Aggregated emissions (t CO_2 e) of direct GHGs from the Transport sub-sector (2000 – 2019)

Year	1.A.3 Transport	1.A.3.a Civil Aviation	1.A.3.b Road Transport	1.A.3.d Navigation
2000	17,099	1,300	12,900	2,900
2001	15,787	1,134	11,956	2,697
2002	17,884	1,519	13,344	3,021
2003	17,425	1,316	13,179	2,930
2004	19,887	1,372	15,117	3,398
2005	21,756	1,309	16,684	3,763
2006	23,332	1,523	17,786	4,023
2007	23,728	1,643	18,004	4,082
2008	22,853	1,589	17,335	3,929
2009	22,047	1,657	16,637	3,753
2010	18,891	1,677	14,024	3,190
2011	18,696	1,699	13,728	3,270
2012	19,375	1,797	14,369	3,210
2013	20,436	1,920	15,289	3,227
2014	21,834	1,912	16,736	3,185
2015	24,481	2,067	19,207	3,207
2016	26,460	2,785	20,777	2,898
2017	28,120	2,992	21,643	3,485
2018	30,479	3,561	22,740	4,178
2019	31,642	4,153	23,854	3,635

Table 2.19 provides absolute and aggregated emissions of the direct gases by category within the transport sub-sector for the year 2019. In absolute terms the transport sub-sector emitted 31,142 t of CO_2, 4.625 t of CH_4 and 1.397 t of N_2O.

When considering their respective GWPs, CO_2 with 31,142 t CO_2 e made up for 98% of the total emissions of the direct GHGs. CH_4 and N_2O represented 2% with emissions of 129.5 and 370.2 t CO_2 e respectively. Road transportation contributed the major share of emissions in this sub-sector with 23,854 t CO_2 e

(75.4%), followed by Domestic Aviation with 4,153 t CO_2 e (13.1%) and Water-borne Navigation with 3,635 t CO_2 e (11.5%).

Table 2.19: Absolute and CO_2 equivalent emissions (t CO_2 e) for the Transport categories for 2019

Category	CO_2 (t)	CH_4 (t)	N_2O (t)	CH_4 (t CO_2 e)	N_2O (t CO_2 e)	Total (t CO_2 e)
1.A.3 Transport	31,142	4.625	1.397	129.5	370.2	31,642
1.A.3.a - Civil Aviation	4,122	0.029	0.115	0.8	30.6	4,153
1.A.3.a.ii - Domestic Aviation	4,122	0.029	0.115	0.8	30.6	4,153
1.A.3.b - Road Transportation	23,421	4.255	1.184	119.1	313.8	23,854
1.A.3.d - Water-borne Navigation	3,600	0.341	0.098	9.6	25.9	3,635
1.A.3.d.ii - Domestic Water-borne Navigation	3,600	0.341	0.098	9.6	25.9	3,635

Other Sectors (1.A.4)

Aggregated emissions for the Other Sectors sub-categories are provided in Table 2.20. An increase in emissions from the year 2000 to 2019 is observed for all sub-categories but not uniformly over the years of the time series. As such, emissions witnessed an increase or a decrease from one year to the next because of varying intensity in activity. Total aggregated emissions for Other Sectors increased by 71% from 16,349 t CO_2 e in 2000 to 28,012 t CO_2 e in 2019. In 2019, the highest contribution came from activities in the Agriculture / Forestry / Fishing sector with 47% of emissions. The Residential sub-category activities contributed 44% and Commercial / Institutional activities the remaining 9%. Increases in the sub-categories were 92% for Agriculture / Forestry / Fishing, 61% for Residential and 38% for Commercial / Institutional over the timeseries. The sub-category, Fishing (mobile combustion) was the only emitting activity of the Agriculture / Forestry / Fishing sub-category.

Table 2.20: GHG emissions (t CO_2 e) for direct gases in Other Sectors (2000 – 2019)

Year	1.A.4 – Other Sectors	1.A.4.a – Commercial / Institutional	1.A.4.b – Residential	1.A.4.c – Agriculture / Forestry / Fishing / Fish Farms	1.A.4.c.iii – Fishing (mobile combustion)
2000	16,349	1,794	7,702	6,852	6,852
2001	15,140	1,593	7,439	6,108	6,108
2002	17,568	2,035	9,002	6,530	6,530
2003	18,154	1,812	8,495	7,846	7,846
2004	18,390	1,960	8,404	8,027	8,027
2005	18,751	1,969	8,266	8,515	8,515
2006	19,649	2,230	8,625	8,794	8,794
2007	19,893	2,360	8,888	8,645	8,645
2008	19,360	2,278	8,726	8,356	8,356
2009	19,557	2,310	8,764	8,484	8,484
2010	21,130	2,430	8,833	9,867	9,867
2011	21,696	2,432	9,076	10,187	10,187
2012	22,452	2,355	9,174	10,924	10,924
2013	23,473	2,434	9,697	11,343	11,343
2014	23,724	2,400	9,611	11,713	11,713
2015	24,223	2,501	10,375	11,347	11,347
2016	24,352	2,476	10,864	11,012	11,012
2017	27,261	2,866	11,826	12,569	12,569
2018	28,412	2,181	12,539	13,693	13,693
2019	28,012	2,468	12,405	13,139	13,139

The aggregated and absolute emissions by gas is given in Table 2.21. In 2019, CO_2 contributed most emissions from this activity area, with 21,867 t (78%), CH_4 coming next with 5,423 t CO_2 e (19%) and N_2O with 722 t CO_2 e (3%). In absolute terms also, the highest contribution came from CO_2 with 21,867 t. Agriculture/Forestry/Fishing/Fish Farms contributed 60% of CO_2 while the Residential activities emitted 99% of the CH_4 and 95% of the N_2O in this category.

Table 2.21: Absolute (t), aggregated and CO_2 e emissions (t CO_2 e) for direct gases – Other Sectors (2019)

Category	CO_2 (t)	CH_4 (t)	N_2O (t)	CH_4 (t CO_2 e)	N_2O (t CO_2 e)	Total (t CO_2 e)
1.A.4 - Other Sectors	21,867	193.69	2.72	5,423.2	722.1	28,012
1.A.4.a - Commercial / Institutional	2,454	0.34	0.02	9.5	5.4	2,468
1.A.4.b - Residential	6,357	191.46	2.59	5,361.0	686.8	12,405
1.A.4.c - Agriculture / Forestry / Fishing / Fish Farms	13,056	1.88	0.11	52.7	29.9	13,139
1.A.4.c.iii - Fishing (mobile combustion)	13,056	1.88	0.11	52.7	29.9	13,139

Memo items

Emissions from fuels used for international aviation and international marine bunkers (IMB) are excluded from the national total and reported as memo items for information purposes. For this inventory, AD for international Aviation was available and emissions have been estimated and reported. Aggregated emissions from International Aviation increased by 150% from 1,287 t CO_2 e in 2000 to 3,219 t CO_2 e in 2019 (Table 2.22) with variation between the years.

To avoid double counting, CO_2 emissions from biomass combustion for energy production are also reported under Memo Items and not included in the Energy sector emissions. Only CH_4 and N_2O emissions resulting from combustion of the biomass is reported under Energy. This activity emitted 50,305 t CO_2 in 2000, increasing to 63,533 t CO_2 in 2019 which represents an increase of 26%.

Table 2.22: Total emissions (t CO_2 e) and emissions by activity area for international bunkering and burning of biomass (2000 – 2019)

Year	Total emissions	International aviation	CO_2 from biomass burning for energy production
2000	51,592	1,287	50,305
2001	51,378	1,117	50,260
2002	51,732	1,510	50,222
2003	51,485	1,303	50,182
2004	51,516	1,360	50,156
2005	51,816	1,296	50,520
2006	52,398	1,514	50,884
2007	53,288	1,636	51,653
2008	54,020	1,581	52,438
2009	54,876	1,651	53,225
2010	55,625	1,644	53,981
2011	56,340	1,638	54,702
2012	57,102	1,710	55,392
2013	59,150	1,863	57,287
2014	58,121	1,433	56,688

Year	Total emissions	International aviation	CO_2 from biomass burning for energy production
2015	61,247	1,798	59,449
2016	63,882	1,673	62,209
2017	66,911	1,941	64,970
2018	70,310	2,580	67,730
2019	66,753	3,219	63,533

The absolute and aggregated direct GHGs emitted in 2019 are presented in Table 2.23. Total aggregated emissions were 3,219 t CO_2 e with CO_2 contributing 99.2%, CH_4, 0.1% and N_2O, 0.7% in the year 2019.

Table 2.23: Absolute (t) and CO_2 equivalent (t CO_2 e) emissions from International Aviation Bunkers in 2019

Category	CO_2 (t)	CH_4 (t CO_2 e)	N_2O (t CO_2 e)	Total (t CO_2 e)	CH_4 (t)	N_2O (t)
International Bunkers – 1.A.3.a.i - Aviation	3,195	0.6	23.7	3,219	0.022	0.089

Comparison of the IPCC Tier 1 Reference and Sectoral Approaches

It is good practice to compare emissions from these two approaches as significant differences may indicate possible inconsistencies with AD, large statistical differences between energy supply and energy consumption, significant mass imbalances and the approximate net calorific value and carbon content values adopted, unrecorded consumption of fuels, high distribution losses and missing information on stock changes. A relatively small gap (5% or less) is typically expected between the two approaches.

Table 2.24 provides a comparison of the data adopted for computing emissions by the reference and sectoral approaches. When the mass of all fuels is considered, there is an annual variation in total energy consumption between the RA and SA approaches which ranged from -11.6% to 17.3%. This indicates that the data collection system needs to be improved for reducing the large differences observed in some years. These differences are reflected in the emissions also which varied between -11.8% to 16.8% for the timeseries.

Table 2.24: Fuel consumption and emissions under the Reference and Sectoral Approaches (2000 – 2019)

Year	Reference Approach (RA)	Sectoral Approach (SA)	RA/SA difference	Reference Approach (RA)	Sectoral Approach (SA)	RA/SA difference
	(TJ)		(%)	Emissions (t)		(%)
2000	580.1	611.4	-5.1%	42,170	44,470	-5.2%
2001	588.5	562.0	4.7%	42,700	40,880	4.5%
2002	683.8	650.5	5.1%	49,570	47,200	5.0%
2003	755.4	644.0	17.3%	54,500	46,670	16.8%
2004	763.7	716.2	6.6%	55,280	52,030	6.2%
2005	684.6	773.6	-11.5%	49,630	56,260	-11.8%
2006	764.8	826.6	-7.5%	55,410	60,150	-7.9%
2007	754.5	839.0	-10.1%	54,680	61,070	-10.5%
2008	757.9	806.9	-6.1%	54,970	58,750	-6.4%
2009	722.6	783.8	-7.8%	52,390	57,040	-8.2%
2010	687.8	713.7	-3.6%	49,870	51,770	-3.7%
2011	756.4	713.5	6.0%	54,690	51,710	5.8%
2012	817.5	741.9	10.2%	59,090	53,740	10.0%
2013	811.2	777.7	4.3%	58,570	56,280	4.1%

Year	Reference Approach (RA)	Sectoral Approach (SA)	RA/SA difference	Reference Approach (RA)	Sectoral Approach (SA)	RA/SA difference
	(TJ)		(%)	Emissions (t)		(%)
2014	819.6	791.1	3.6%	59,310	57,210	3.7%
2015	871.1	819.7	6.3%	63,020	59,260	6.3%
2016	805.4	860.3	-6.4%	58,190	62,190	-6.4%
2017	1040.6	929.4	12.0%	75,110	67,110	11.9%
2018	886.5	1003.3	-11.6%	64,090	72,442	-11.5%
2019	904.6	999.0	-9.5%	65,370	72,070	-9.3%

Emissions estimates for the Energy sector from the IPCC inventory software for the inventory year 2019 are presented in Table 2.25.

Table 2.25: Energy Sectoral Table - Inventory Year 2019

	Emissions (t)						
Categories	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
1 - Energy	72,075.762	199.082	4.276	NE	NE	NE	NE
1.A - Fuel Combustion Activities	72,075.762	199.082	4.276	NE	NE	NE	NE
1.A.1 - Energy Industries	19,066.501	0.772	0.154	NE	NE	NE	NE
1.A.1.a - Main Activity Electricity and Heat Production	19,066.501	0.772	0.154	NE	NE	NE	NE
1.A.1.a.i - Electricity Generation	19,066.501	0.772	0.154	NE	NE	NE	NE
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	NO	NO	NO	NO	NO	NO	NO
1.A.1.a.iii - Heat Plants	NO	NO	NO	NO	NO	NO	NO
1.A.1.b - Petroleum Refining	NO	NO	NO	NO	NO	NO	NO
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	NO	NO	NO	NO	NO	NO	NO
1.A.1.c.i - Manufacture of Solid Fuels	NO	NO	NO	NO	NO	NO	NO
1.A.1.c.ii - Other Energy Industries	NO	NO	NO	NO	NO	NO	NO
1.A.2 - Manufacturing Industries and Construction	IE	IE	IE	NE	NE	NE	NE
1.A.2.a - Iron and Steel	NO	NO	NO	NO	NO	NO	NO
1.A.2.b - Non-Ferrous Metals	NO	NO	NO	NO	NO	NO	NO
1.A.2.c - Chemicals	NO	NO	NO	NO	NO	NO	NO
1.A.2.d - Pulp, Paper and Print	NO	NO	NO	NO	NO	NO	NO
1.A.2.e - Food Processing, Beverages and Tobacco	IE	IE	IE	NE	NE	NE	NE
1.A.2.f - Non-Metallic Minerals	NO	NO	NO	NO	NO	NO	NO
1.A.2.g - Transport Equipment	NO	NO	NO	NO	NO	NO	NO
1.A.2.h - Machinery	NO	NO	NO	NO	NO	NO	NO
1.A.2.i - Mining (excluding fuels) and Quarrying	NO	NO	NO	NO	NO	NO	NO
1.A.2.j - Wood and wood products	NO	NO	NO	NO	NO	NO	NO
1.A.2.k - Construction	IE	IE	IE	NE	NE	NE	NE
1.A.2.l - Textile and Leather	NO	NO	NO	NO	NO	NO	NO
1.A.2.m - Non-specified Industry	IE	IE	IE	NE	NE	NE	NE
1.A.3 - Transport	31,142.385	4.625	1.397	NE	NE	NE	NE
1.A.3.a - Civil Aviation	4,122.113	0.029	0.115	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)							
1.A.3.a.ii - Domestic Aviation	4,122.113	0.029	0.115	NE	NE	NE	NE
1.A.3.b - Road Transportation	23,420.771	4.255	1.184	NE	NE	NE	NE
1.A.3.b.i - Cars	IE	IE	IE	NE	NE	NE	NE

	Emissions (t)						
Categories	**CO_2**	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOCs**	**SO_2**
1.A.3.b.i.1 - Passenger cars with 3-way catalysts	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.ii - Light-duty trucks	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.iii - Heavy-duty trucks and buses	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.iv - Motorcycles	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.v - Evaporative emissions from vehicles	IE	IE	IE	NE	NE	NE	NE
1.A.3.b.vi - Urea-based catalysts	IE	IE	IE	NE	NE	NE	NE
1.A.3.c - Railways	NO	NO	NO	NO	NO	NO	NO
1.A.3.d - Water-borne Navigation	3,599.500	0.341	0.098	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)							
1.A.3.d.ii - Domestic Water-borne Navigation	3,599.500	0.341	0.098	NE	NE	NE	NE
1.A.3.e - Other Transportation	NO	NO	NO	NO	NO	NO	NO
1.A.3.e.i - Pipeline Transport	NO	NO	NO	NO	NO	NO	NO
1.A.3.e.ii - Off-road	NO	NO	NO	NO	NO	NO	NO
1.A.4 - Other Sectors	21,866.877	193.685	2.725	NE	NE	NE	NE
1.A.4.a - Commercial/Institutional	2,453.633	0.338	0.020	NE	NE	NE	NE
1.A.4.b - Residential	6,357.069	191.465	2.592	NE	NE	NE	NE
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	13,056.176	1.883	0.113	NE	NE	NE	NE
1.A.4.c.i - Stationary	NE	NE	NE	NE	NE	NE	NE
1.A.4.c.ii - Off-road Vehicles and Other Machinery	NE	NE	NE	NE	NE	NE	NE
1.A.4.c.iii - Fishing (mobile combustion)	13,056.176	1.883	0.113	NE	NE	NE	NE
1.A.5 - Non-Specified	IE	IE	IE	NE	NE	NE	NE
1.A.5.a - Stationary	IE	IE	IE	NE	NE	NE	NE
1.A.5.b - Mobile	IE	IE	IE	NE	NE	NE	NE
1.A.5.b.i - Mobile (aviation component)	IE	IE	IE	NE	NE	NE	NE
1.A.5.b.ii - Mobile (water-borne component)	IE	IE	IE	NE	NE	NE	NE
1.A.5.b.iii - Mobile (Other)	IE	IE	IE	NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)							
1.B - Fugitive emissions from fuels	NO	NO	NO	NO	NO	NO	NO
1.B.1 - Solid Fuels	NO	NO	NA	NA	NA	NO	NA
1.B.1.a - Coal mining and handling	NO	NO	NA	NA	NA	NO	NA
1.B.1.a.i - Underground mines	NO	NO	NA	NA	NA	NO	NA
1.B.1.a.i.1 - Mining	NO	NO	NA	NA	NA	NO	NA
1.B.1.a.i.2 - Post-mining seam gas emissions	NO	NO	NA	NA	NA	NO	NA
1.B.1.a.i.3 - Abandoned underground mines	NO	NO	NA	NA	NA	NA	NA
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	NO	NO	NA	NA	NA	NA	NA
1.B.1.a.ii - Surface mines	NO	NO	NA	NA	NA	NA	NA
1.B.1.a.ii.1 - Mining	NO	NO	NA	NA	NA	NA	NA
1.B.1.a.ii.2 - Post-mining seam gas emissions	NO	NO	NA	NA	NA	NA	NA

	Emissions (t)						
Categories	**CO_2**	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOCs**	**SO_2**
1.B.1.b - Uncontrolled combustion and burning coal dumps	NO	NA	NA	NO	NO	NO	NO
1.B.1.c - Solid fuel transformation	NO	NO	NO	NE	NE	NE	NE
1.B.2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
1.B.2.a - Oil	NO	NO	NO	NO	NO	NO	NO
1.B.2.b - Natural Gas	NO	NO	NO	NO	NO	NO	NO
1.B.3 - Other emissions from Energy Production	NO	NO	NO	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA

	Emissions (t)						
Categories	**CO_2**	**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOCs**	**SO2**
Memo Items (3)							
International Bunkers	3,195.087	0.022	0.089	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)	3,195.087	0.022	0.089	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)	IE	IE	IE	NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)	NO	NO	NO	NO	NO	NO	NO
Information Items							
CO2 from Biomass Combustion for Energy Production	63,533.200						

Note: The original values in gigagrams in the above table from the software output have been converted to tonnes

2.5. Industrial Processes and Product Use (IPPU)

2.5.1. Description of sector

Kiribati is not an industrialized country and emissions occur from a very restricted number of categories. GHGs are also emitted during non-energy use of hydrocarbons such as lubricants and solvents while HFCs and PFCs are lost from installed equipment. Other gases also emitted in different IPPU sub-categories, include sulphur hexafluoride (SF_6) and NMVOCs.

Because of unavailability of appropriate datasets, the only category and activity area covered in this inventory is:

- Non-Energy Products from Fuels and Solvent Use – Use of Lubricants

2.5.2. Methods

The method provided in the 2006 IPCC Guidelines for National GHG Inventories, Vol. 3 (IPCC, 2007) was used for computing emissions.

The formula used for computing emissions is

$$\text{Emissions} = \sum Aj * EFi$$

where:

A =	Activity is Production Process Input or output (tonnes / year)
j =	Industrial Activity
EF =	Emission factor (t / kt) and
i =	GHG or precursor

2.5.3. Activity Data, Emission factors and Emissions Estimates

2.5.3.1. Lubricant Use

Activity data

The total amount of lubricants estimated in the Energy sector was discounted for the part used in 2-stroke engines and the remaining used as AD for this activity. Data on lubricants used for estimating emissions are given in Table 2.26.

Table 2.26: Use of lubricants (TJ) (2000 – 2019)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Amount of lubricants	8.4	10.8	9.5	8.9	8.8	8.2	7.8	7.4	7.0	6.6

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Amount of lubricants	5.9	5.4	5.4	4.8	4.1	4.1	4.2	4.2	4.8	5.1

Emission factors

All EFs used for computing emissions in the IPPU sector were the IPCC defaults adopted from the 2006 IPCC Guidelines and are given in Table 2.27 for the category estimated.

Table 2.27: EFs and their sources for the IPPU sector

Category	EF adopted	2006 IPPC Guidelines
Lubricant Use	Carbon content: 20.0 t C / TJ of lubricant – ODU factor: 0.2	Vol. 3_3, Ch. 5 Non-Energy from Fuels and Solvent Use Ch. 5.2.2.2, Page 5.9

Trends of emissions - IPPU Sector

Since only lubricants use is considered in the IPPU sector, CO_2 was the only GHG emitted. A 39% decrease in total CO_2 emissions (Table 2.28), from 123 t in 2000 to 75 t in 2019 is observed across the timeseries.

Table 2.28: Emissions of CO_2 (t) by sub-category for the IPPU sector (2000 – 2019)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Emissions (t CO_2)	123	158	139	130	128	121	114	108	103	96

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Emissions (t CO_2)	87	80	79	70	60	61	62	62	71	75

Results of the estimates from the IPCC inventory software for the inventory year 2019 are presented in Table 2.29.

Table 2.29: Sectoral IPPU table – Inventory Year 2019

Categories	Emissions (t)			Emissions CO_2 Equivalents(t)					(t)			
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (1)	Other halogenated gases without CO_2 equivalent conversion factors (2)	NO_x	CO	NMV OCs	SO_2
2 - Industrial Processes and Product Use	74.785	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.A - Mineral Industry	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.1 - Cement production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.2 - Lime production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.3 - Glass Production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.4 - Other Process Uses of Carbonates	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.4.a - Ceramics	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.4.b - Other Uses of Soda Ash	NO	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Categories	Emissions (t)			Emissions CO_2 Equivalents(t)					(t)			
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (1)	Other halogenated gases without CO_2 equivalent conversion factors (2)	NO_x	CO	NMVOCs	SO_2
2.A.4.c - Non Metallurgical Magnesia Production	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.A.4.d - Other (please specify) (3)	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify) (3)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use (6)	NE	NO	NO	NA	NA	NA	NA	NA	NO	NO	NE	NO
2.D.1 - Lubricant Use	74.785	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.D.3 - Solvent Use (7)	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NA
2.D.4 - Other (please specify) (3), (8)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.1.a - Refrigeration and Stationary Air Conditioning	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.1.b - Mobile Air Conditioning	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA
2.F.2 - Foam Blowing Agents	NE	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA
2.F.3 - Fire Protection	NE	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.4 - Aerosols	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA
2.F.5 - Solvents	NA	NA	NA	NE	NE	NA	NA	NA	NA	NA	NA	NA

Categories	Emissions (t)			Emissions CO_2 Equivalents(t)					(t)			
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (1)	Other halogenated gases without CO_2 equivalent conversion factors (2)	NO_x	CO	NMVOCs	SO_2
2.F.6 - Other Applications (please specify) (3)	NA	NA	NA	NO	NO	NA	NA	NA	NA	NA	NA	NA
2.G - Other Product Manufacture and Use	NO	NO	NE	NO	NE	NE	NO	NE	NA	NA	NA	NA
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NE	NA	NA	NA	NA
2.G.1.a - Manufacture of Electrical Equipment	NA	NA	NA	NA	NO	NO	NA	NO	NA	NA	NA	NA
2.G.1.b - Use of Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NE	NA	NA	NA	NA
2.G.1.c - Disposal of Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NE	NA	NA	NA	NA
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NO	NO	NA	NO	NA	NA	NA	NA
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.3.a - Medical Applications	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.3.b - Propellant for pressure and aerosol products	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.3.c - Other (Please specify) (3)	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.4 - Other (Please specify) (3)	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H - Other	NE	NE	NE	NA	NA	NA	NA	NA	NO	NO	NE	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NE	NE	NA	NA	NA	NA	NA	NA	NO	NO	NE	NO
2.H.3 - Other (please specify) (3)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: The original values in gigagrams in the above table from the software output have been converted to tonnes

2.6. Agriculture, Forestry and Other Land Use (AFOLU)

2.6.1. Description

The AFOLU sector comprises four subcategories:

- Livestock (3.A)
- Land (3.B)
- Aggregate sources and non-CO_2 emissions from land (3.C)
- Other (3.D)

For this inventory, three subsectors (except 3D) have been covered. Emissions from enteric fermentation and manure management have been estimated for the two livestock populations. For the land (3.B) category, the area of the various land classes has been kept constant over the timeseries due to lack of AD and only the sink capacity of Forestland and fuelwood removal have been considered. This is an improvement on past inventories when only livestock was included. Non-CO_2 aggregated sources consisted of direct and indirect N_2O emissions from manure and managed soils. Under Other (3.D), AD for harvested wood products (HWP) were not available but the wood component in waste sent to landfill in the Waste sector module was automatically transferred in the software and this resulted in an emission being estimated for that category.

2.6.2. Methods

Tier 1 was adopted for the estimation of emissions and removals in the AFOLU sector as there was no country-specific data to enable computation at the Tier 2 level. AD here refer to the intensity or level of activity that led to emissions / removals of GHGs while EF represents the rate at which a particular GHG is emitted or removed because of use of, change of and level of intensity / frequency of use / number of activities under certain defined conditions. Therefore, the product of AD and EF gives the total GHG emission for a particular activity. The equation is:

$$E = AD * EF$$

where:

E =	Emission
AD =	Activity Data
EF =	Emission factor

The method used for estimating emissions for the sub-categories of the AFOLU sector were obtained from the IPCC 2006 Guidelines Vol. 4 as follows; Livestock – Ch. 2; Land – Ch. 2, 3 and 4; Aggregate sources and non-CO_2 emissions on land – Ch. 2 and 11.

2.6.3. Activity Data, Emission factors and emission estimates

2.6.3.1. Activity data and emission factors

The data needed for this inventory were sourced from different relevant national and international institutions (Table 2.30) as appropriate.

Table 2.30: Activity Data description and sources for the AFOLU sector

Category	Sub-category	Data Type	Data Source
Livestock	Enteric Fermentation	Animal population (Swine, and poultry)	MELAD, NSO, BUR 1 draft national circumstances chapter, Expert judgement, IPCC GL
	Manure Management		
Land	Forestland	Forest and other land classes area	W, World Bank, FAO FRA reports
		Climate zone and soil classification	IPCC GL
		Biomass estimate for 5 IPCC pools (above-ground biomass, below-ground biomass, deadwood, herb, litter and soil	IPCC GL
		Harvested Wood Products	-
		Wood / Fuel wood removal	FAOSTATS
Aggregate and non-CO2 emissions on land	Biomass burning	Considered not occurring	-
	Direct N2O emission from managed soil	Synthetic fertilizer consumption. Use was banned since 2003. No AD available	-
	Indirect N2O emission from managed soil	Crop land area	MELAD, BUR 1 draft national circumstances chapter, Expert judgement
	Indirect emissions from manure management	Animal population (Dairy cow, Cattle, goats, sheep, swine and poultry)	MELAD, BUR 1 draft national circumstances chapter, Expert judgement

Source: FAOSTAT – http://faostat.fao.org (Accessed July 2021)

Outliers and gaps identified in the inventory were filled using the appropriate IPCC splicing technique. The specific technique applied was selected based on the nature and type of the missing or inconsistent data gap. Some of the techniques used were averages, trending, interpolation, and extrapolation.

Livestock (3A)

Emissions from enteric fermentation and management of manure for the livestock sector are estimated from the domestic population of swine and poultry. The EFs corresponding to the Oceania region for developing countries were adopted. AD used for computing the emissions for both enteric fermentation and manure management are provided in Table 2.31. The total swine population was subdivided in a 90:10 proportion for swine market and swine breeding respectively based on IPCC Guidelines.

Based on expert judgement, the manure management systems assigned to livestock are:

- Swine: 100% dry lot
- Poultry: 90% in Poultry manure with litter and 10% Pasture, Range, Paddock

Table 2.31: Livestock population (2000 – 2019)

Year	Swine market	Swine breeding	Poultry
2000	35,825	3,980	41,690
2001	36,594	4,066	42,530
2002	37,368	4,152	43,380
2003	38,133	4,237	44,210

Year	Swine market	Swine breeding	Poultry
2004	38,907	4,323	45,050
2005	39,573	4,397	45,480
2006	39,834	4,426	45,240
2007	40,050	4,450	44,920
2008	40,212	4,468	44,510
2009	40,320	4,480	44,010
2010	35,397	3,933	34,725
2011	36,081	4,009	37,740
2012	36,774	4,086	38,460
2013	37,458	4,162	39,170
2014	38,133	4,237	39,870
2015	38,412	4,268	31,280
2016	37,269	4,141	31,640
2017	36,927	4,103	30,110
2018	36,540	4,060	28,500
2019	36,117	4,013	26,800

Source: Draft national circumstances, BUR1

Land (3B)

Human activities drive changes in land use from one class to another with possible emissions or sequestration of CO_2. The land use change is the result of conversion of land categories amongst the various IPCC land classes, namely (a) Forestland (FL), (b) Cropland, (c) Grassland, (d) Wetlands, (e) Settlements and (f) Other land. This sub-sector was not covered in previous inventories and availability of AD and EFs is still a major challenge for Kiribati. For this inventory, the area determined for the various land classes occurring in Kiribati were kept constant across the timeseries. Thus, emissions stemming from changes in land use have not been computed.

Data for Forestland, Wetland, perennial Cropland were obtained from the different sources listed in Table 2.30. The area of Forestland was divided into two sub-types, namely wooded land and mangroves. The area of mangrove is quite old, dating back to nearly two decades. Cropland was sub-divided in annual cropland and perennial cropland with the latter covering the coconut plantations which are extensive in Kiribati. The remaining three land types were assigned as being 1,000 ha each of annual Cropland, Settlements and the remainder Other Land. Grassland is considered as not occurring in Kiribati. The land cover data are presented in Table 2.32.

The IPCC default soil type Sandy mineral and Tropical wet climate were adopted since these were considered as being most appropriate to represent the country. The islands forming the Republic of Kiribati are atolls and most of the soils are of coral sand origin with phosphate deposits originating from birds' droppings on some of the islands. Human intervention and deposits of litter contribute to increase the organic matter content but there is difficulty to classify such soil.

The wooded land part of Kiribati is covered with a mixture of both hard and soft wood species. Some of this vegetation does not qualify for the definition of Forest land but the presence of woody species and their growth must be captured under the specific conditions of Kiribati as an atoll. Stock factors for the specific conditions of Kiribati are not available in the guidelines. Under these circumstances the lowest stock factor available in the Guidelines has been adopted to be conservative and avoid overestimation. The mangroves in Kiribati are of the fringing type in the absence of rivers and estuaries.

The situation of annual Cropland in Kiribati is also very special as the area is intermingled with Settlement due to the lack of well-defined areas on the atolls. The same applies for breadfruit and coconut trees present in backyards. Default stock factors were adopted for perennial coconut crop.

Settlements include houses, buildings, roads and other infrastructure such as the ports and airports.

Other land are the areas covered by rock outcrops and exposed coral sand areas primarily.

Further improvement of data quality is required to improve the estimates of the Land sector by moving to the Tier 2 level through the inclusion of land use changes between the IPCC land classes over the full time series as well as deriving national stock and EFs specific to the country. Land cover by the six IPCC classes and their management practices are given in Table 2.32.

Table 2.32: Land cover (ha) by the different land classes (2000 – 2019) and their management practices

Land cover	Area	Land use (FLU)	Management (FMG)	Input (FI)
Forestland – Wooded land	11,892	1.0	1.0	1.0
Forestland – Mangrove	258	1.0	1.0	1.0
Cropland Annual	1,000	0.48	1.22	1.0
Cropland perennial	64,800	1.0	1.0	1.0
Wetland	4	Not applicable		
Settlements	1,000	1.0	1.0	1.0
Other land	2,096	1.0	1.0	1.0

Wood removals for the period 2000 to 2019

National statistics are not available on the amount of fuelwood and merchantable wood removed. Wood, coconut husks and leaves, and copra waste are used for cooking according to census reports while poles are sometimes used for construction purposes. Fuelwood quantities available from FAOSTATS were adopted (Table 2.33). These were estimated to be removed as tree parts as per expert judgement.

Table 2.33: Wood removal (m^3) from Forestland (2005 – 2019)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fuel wood removals	2,402	2,449	2,497	2,545	2,595	2,646	2,701	2,758	2,816	2,876

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Fuel wood removals	2,937	2,986	3,036	3,087	3,140	3,193	3,239	3,286	3,334	3,383

Source: FAOSTATS

Carbon stock factors in different land representations

Stock factors from IPCC Guidelines assigned to the three sub-classes Wooded land and Mangrove are given in Table 2.34. Default factors for tropical wet region, tropical rainforest and other broadleaf were considered as most appropriate and adopted.

Table 2.34: Stock factors of Forestland sub-classes

	Forestland (Wooded land)	Forestland (Mangrove)
Age class (years)	Above 20	Above 20
Growing stock level (m3/ha)	10-20	61-80
Above ground biomass (tdm/ha)	30.0	60.0
Above ground biomass growth (tdm / ha / yr)	1.0	5.0
Ratio above to below ground	0.37	0.37

Aggregate sources and non-CO_2 emissions on land (3C)

Three out of the eight IPCC categories in the Aggregate sources and non-CO_2 emissions on land sub-sector occur in Kiribati. The categories are:

- 3.C.4 - Direct N_2O emissions from managed soils
- 3.C.5 - Indirect N_2O emissions from managed soils
- 3.C.6 - Indirect N_2O emissions from manure management

Emissions for 3.C.4 and 3.C.6 were estimated while those from 3.C.5 were not computed due to the absence of readily available data. AD used for estimating emissions for these activities were obtained from the same sources as for the livestock sub-sector. Inorganic fertilizers have been banned from use since 2003 and AD for the period 2000 to 2003 were not available.

Other (3D) - Harvested Wood Products (3.D.1)

No estimates were made for HWP due to lack of data even from the FAOSTATS. However, during the processing of Solid Waste Disposal (4A) under the Waste sector, wood sent to landfill is estimated by the software for HWP. Thus, a sink value was estimated by the software for HWP.

2.6.3.2. Emissions estimates

Table 2.35 shows the emissions and removals by category of the AFOLU sector. Overall, the sector removed 4,944 t CO_2 e in 2019. Total emissions for that year amounted to 22,824 t CO_2 e while total removals stood at 27,767 t CO_2 e. The Land Sector (3B) accounted for 99.9% of removals across the time series. Total removals decreased by 18% from the year 2000 to 2019. The highest emitter of the AFOLU sector is Livestock (3A) with 90% of total emissions in the year 2019 and the remainder occurred in the Aggregate sources and non-CO_2 emissions on land (3C) subsector.

Table 2.35: Emissions and removals (t CO_2 e) by source category (2000 – 2019)

Year	Livestock (3A)	Removals from Land (3B)	Aggregate sources and non-CO2 emissions on land (3C)	Other – HWP (3D)	Total emissions	Net removals
2000	20,456	-28,721	2,210	-10	22,666	-6,065
2001	20,637	-28,674	2,230	-10	22,867	-5,818
2002	20,818	-28,626	2,250	-11	23,068	-5,569
2003	21,000	-28,578	2,270	-12	23,270	-5,321
2004	21,181	-28,528	2,290	-13	23,471	-5,070
2005	21,362	-28,477	2,309	-14	23,671	-4,820
2006	21,542	-28,423	2,328	-15	23,871	-4,567
2007	21,723	-28,366	2,347	-17	24,070	-4,313

Year	Livestock (3A)	Removals from Land	Aggregate sources and non-CO2 emissions on land (3C)	Other – HWP (3D)	Total emissions	Net removals
2008	21,903	-28,308	2,366	-18	24,269	-4,056
2009	22,084	-28,248	2,384	-19	24,468	-3,799
2010	22,258	-28,187	2,393	-20	24,651	-3,555
2011	22,078	-28,138	2,377	-20	24,455	-3,703
2012	21,896	-28,088	2,358	-21	24,255	-3,854
2013	21,715	-28,037	2,340	-22	24,055	-4,004
2014	21,533	-27,984	2,322	-22	23,854	-4,152
2015	21,345	-27,931	2,293	-23	23,638	-4,316
2016	21,163	-27,885	2,274	-24	23,436	-4,472
2017	20,980	-27,838	2,253	-25	23,233	-4,630
2018	20,796	-27,790	2,231	-26	23,028	-4,787
2019	20,613	-27,741	2,210	-26	22,824	-4,944

The trend of absolute and CO_2 equivalent emissions by gas, and aggregated emissions for the AFOLU sector is presented in Table 2.36. Emissions ranged between 16,853 to 18,337 t CO_2 e for CH_4 and between 22,666 to 24,651 t CO_2 e for N_2O. In 2019, CH_4 and N_2O contributed 16,982 t CO_2 e and 5,842 t CO_2 e respectively when taking their GWP into consideration. CH_4 remained the main gas emitted over the entire period 2000 to 2019 followed by N_2O.

Table 2.36: Absolute and CO_2 equivalent emissions (t) by gas, and total emissions for the AFOLU sector (2000 – 2019)

Year	CH_4 (t)	N_2O (t)	CH_4 (t CO_2 e)	N_2O (t CO_2 e)	Total (t CO_2 e)
2000	601.9	21.9	16,853	5,813	22,666
2001	607.2	22.1	17,002	5,865	22,867
2002	612.5	22.3	17,151	5,917	23,068
2003	617.9	22.5	17,301	5,969	23,270
2004	623.2	22.7	17,450	6,021	23,471
2005	628.5	22.9	17,599	6,072	23,671
2006	633.8	23.1	17,748	6,123	23,871
2007	639.2	23.3	17,896	6,173	24,070
2008	644.5	23.5	18,045	6,224	24,269
2009	649.8	23.7	18,194	6,274	24,468
2010	654.9	23.8	18,337	6,314	24,651
2011	649.6	23.6	18,189	6,266	24,455
2012	644.3	23.5	18,039	6,216	24,255
2013	638.9	23.3	17,889	6,165	24,055
2014	633.6	23.1	17,740	6,115	23,854
2015	628.0	22.8	17,585	6,053	23,638
2016	622.7	22.6	17,435	6,002	23,436
2017	617.3	22.4	17,284	5,949	23,233
2018	611.9	22.2	17,133	5,895	23,028
2019	606.5	22.0	16,982	5,842	22,824

Livestock

Total aggregated emissions from livestock varied between 20,456 of the year 2000 and 22,258 t CO_2 e in 2010 with emissions for 2019 standing at 20,613. Manure management was the major contributor to total emissions throughout the timeseries with 95% of total emissions on average. In absolute terms, emissions were 606 t of CH_4 and 14 t of N_2O in 2019 (Table 2.37).

Emissions in the enteric fermentation category originated from swine only. In 2019, total emissions of CH_4 from enteric fermentation were 1,124 t CO_2 e representing a slight increase from year 2000 emissions which stood at 1,115 t CO_2 e. The emissions varied during the timeseries and reached a maximum of 1,213 t CO_2 e in 2010 (Table 2.37).

Table 2.37: Absolute (t) and CO_2 equivalent emissions (t CO_2 e) from livestock (2000 to 2019)

Year	CO_2 equivalent emissions (t)			Absolute (t)	
	Enteric fermentation	Manure management	Aggregated total	CH_4	N_2O
2000	1,115	19,342	20,456	602	14
2001	1,124	19,513	20,637	607	14
2002	1,134	19,684	20,818	613	14
2003	1,144	19,856	21,000	618	14
2004	1,154	20,027	21,181	623	14
2005	1,164	20,198	21,362	629	14
2006	1,174	20,369	21,542	634	14
2007	1,184	20,539	21,723	639	14
2008	1,193	20,710	21,903	644	15
2009	1,203	20,880	22,084	650	15
2010	1,213	21,045	22,258	655	15
2011	1,203	20,875	22,078	650	15
2012	1,193	20,703	21,896	644	15
2013	1,183	20,531	21,715	639	14
2014	1,173	20,359	21,533	634	14
2015	1,163	20,182	21,345	628	14
2016	1,153	20,009	21,163	623	14
2017	1,144	19,836	20,980	617	14
2018	1,134	19,663	20,796	612	14
2019	1,124	19,490	20,613	606	14

Manure Management (3.A.2)

Absolute, CO_2 equivalent, and total aggregated emissions are presented in Table 2.38. Total aggregated emissions increased marginally from 19,342 t CO_2 e in 2000 to 19,490 t CO_2 e in 2019 (Table 2.38). In 2019, CH_4 contributed about 81% of the total aggregated emissions from manure management and N_2O the remaining 19%. CH_4 and N_2O emissions varied over the time period 2000 to 2019, reaching a maximum of 612 t and 15 t respectively in absolute terms in 2010.

Table 2.38: Trend of absolute, CO_2 equivalent and aggregated CH_4 and N_2O emissions (2000 – 2019) from manure management

Year	Absolute (t)		CO_2 equivalent (t)		Total (t CO_2 e)
	CH_4	N_2O	CH_4	N_2O	
2000	562	14	15,738	3,603	19,342
2001	567	14	15,878	3,635	19,513
2002	572	14	16,017	3,667	19,684
2003	577	14	16,157	3,699	19,856
2004	582	14	16,296	3,731	20,027
2005	587	14	16,435	3,763	20,198
2006	592	14	16,574	3,795	20,369
2007	597	14	16,713	3,826	20,539
2008	602	15	16,852	3,858	20,710
2009	607	15	16,990	3,890	20,880
2010	612	15	17,124	3,921	21,045
2011	607	15	16,986	3,889	20,875
2012	602	15	16,846	3,857	20,703
2013	597	14	16,706	3,825	20,531
2014	592	14	16,566	3,793	20,359
2015	586	14	16,421	3,760	20,182
2016	581	14	16,281	3,728	20,009
2017	576	14	16,140	3,696	19,836
2018	571	14	15,999	3,664	19,663
2019	566	14	15,858	3,631	19,490

Emissions from Land (3B)

The estimated CO_2 removals from land decreased from 28,271 t in 2000 to reach 27,740 t in 2019 (Figure 2.4). This is mainly due to an increase in fuelwood removal. The Land sub-sector remained a net sink throughout the time series.

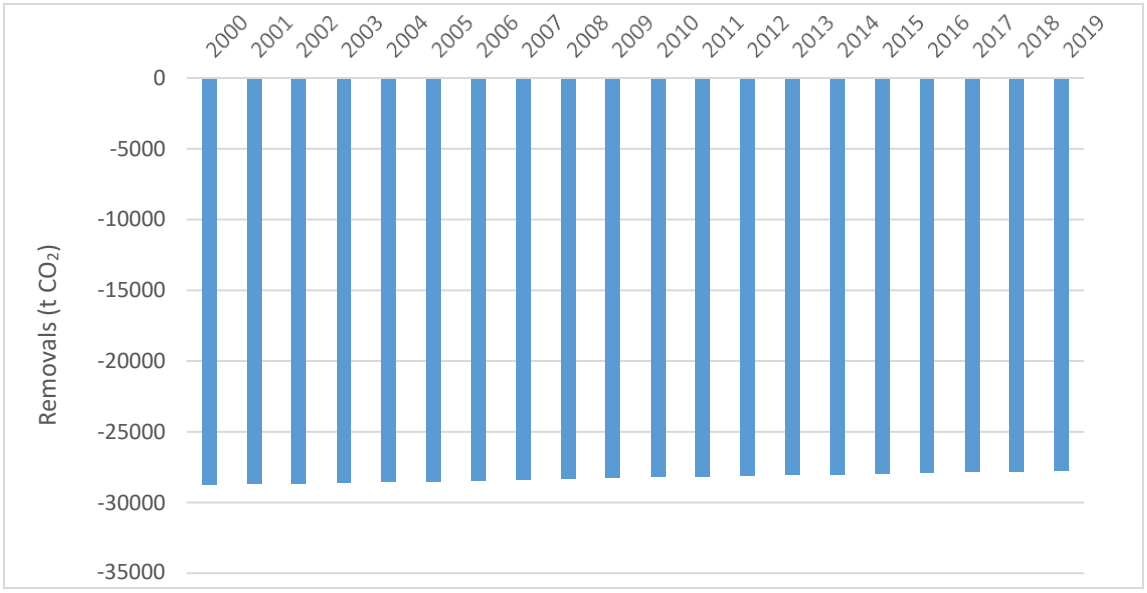


Figure 2.4: Trend of emissions in Forestland

Non-CO_2 emissions from Land (3C)

In 2019, the total aggregated non-CO_2 emissions from Land increased from 2,210 t CO_2 e (Table 2.39) in 2000 to 2,393 in 2010 to regress to the same value again in 2019.

Table 2.39: Emissions of N_2O (t CO_2 e) from sub-sector 3C (2000 to 2019)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
N_2O emissions (t CO_2 e)	2,210	2,230	2,250	2,270	2,290	2,309	2,328	2,347	2,366	2,384

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N_2O emissions (t CO_2 e)	2,393	2,377	2,358	2,340	2,322	2,293	2,274	2,253	2,231	2,210

Direct N_2O emissions from managed soils was the major contributor to total emissions with an average share of 83% throughout the timeseries (Figure 2.5). Direct emissions increased from 1,830 t CO_2 e in the year 2000 to peak at 1,984 t CO_2 e in 2010 and then drop gradually to 1,834 t CO_2 e in 2019, while Indirect emissions increased from 376 t CO_2 e in 2000 to a maximum of 409 t CO_2 e in 2009 and 2010 to regress drop gradually to 376 t CO_2 e in 2019.

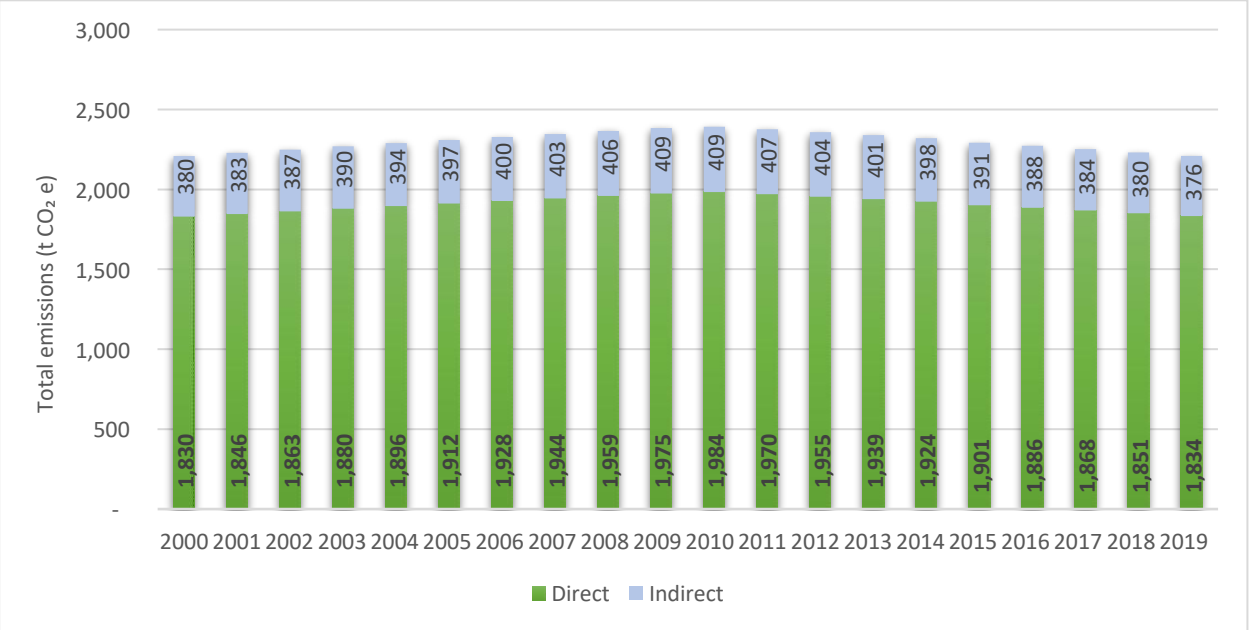


Figure 2.5: Trends of direct and indirect emissions of N_2O from soil management

Harvested Wood Products

HWPs represented a sink of CO_2 which fluctuated during the period 2010 and 2019. The evolution of removals through HWPs is given in Figure 2.6. There was an overall tendency for removals to increase between 2000 and 2019, from 10 t CO_2 to 22 t CO_2.

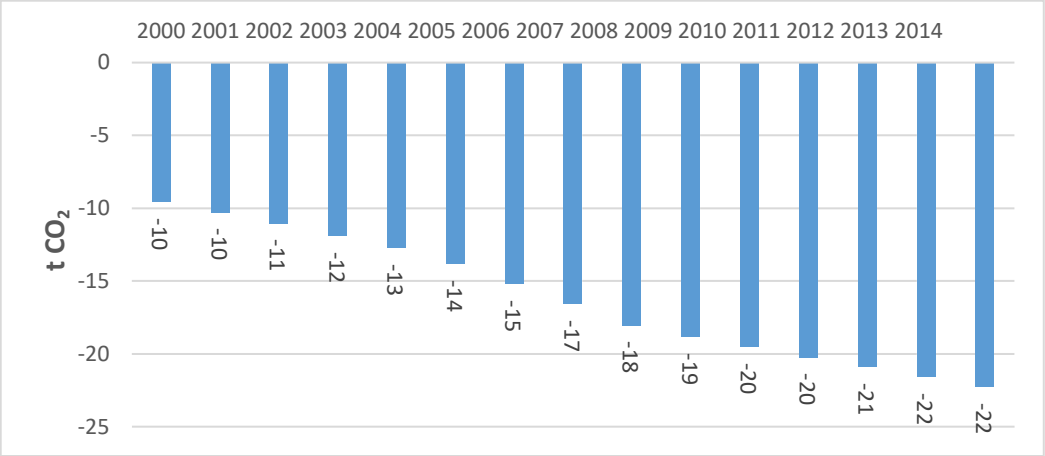


Figure 2.6 CO_2 removed and stored in HWP

Results of the estimates from the IPCC inventory software for the inventory year 2019 are presented in Table 2.40.

Table 2.40: AFOLU sector results – Inventory year 2019

Categories	Emissions (t)					
	Net CO_2 emissions / removals	Emissions				
		CH_4	N_2O	NO_X	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	-27,767.228	606.499	22.044	NE	NE	NE
3.A - Livestock	NA	606.499	13.703	NA	NA	NE
3.A.1 - Enteric Fermentation	NA	40.130	NA	NA	NA	NA
3.A.1.a - Cattle	NA	NO	NA	NA	NA	NA
3.A.1.a.i - Dairy Cows	NA	NO	NA	NA	NA	NA
3.A.1.a.ii - Other Cattle	NA	NO	NA	NA	NA	NA
3.A.1.b - Buffalo	NA	NO	NA	NA	NA	NA
3.A.1.c - Sheep	NA	NO	NA	NA	NA	NA
3.A.1.d - Goats	NA	NO	NA	NA	NA	NA
3.A.1.e - Camels	NA	NO	NA	NA	NA	NA
3.A.1.f - Horses	NA	NO	NA	NA	NA	NA
3.A.1.g - Mules and Asses	NA	NO	NA	NA	NA	NA
3.A.1.h - Swine	NA	40.130	NA	NA	NA	NA
3.A.1.j - Other (please specify)	NO	NO	NO	NO	NO	NO
3.A.2 - Manure Management (1)	NA	566.369	13.703	NA	NA	NE
3.A.2.a - Cattle	NA	NO	NO	NA	NA	NE
3.A.2.a.i - Dairy cows	NA	NO	NO	NA	NA	NE
3.A.2.a.ii - Other cattle	NA	NO	NO	NA	NA	NE
3.A.2.b - Buffalo	NA	NO	NO	NA	NA	NO
3.A.2.c - Sheep	NA	NO	NO	NA	NA	NE
3.A.2.d - Goats	NA	NO	NO	NA	NA	NE
3.A.2.e - Camels	NA	NO	NO	NA	NA	NE
3.A.2.f - Horses	NA	NO	NO	NA	NA	NE
3.A.2.g - Mules and Asses	NA	NO	NO	NA	NA	NE
3.A.2.h - Swine	NA	565.833	13.693	NA	NA	NE
3.A.2.i - Poultry	NA	0.536	0.010	NA	NA	NE
3.A.2.j - Other (please specify)	NO	NO	NO	NO	NO	NO
3.B - Land	-27,740.841	NE	NE	NE	NE	NE
3.B.1 - Forest land	-27,740.841	NE	NE	NE	NE	NE
3.B.1.a - Forest land Remaining Forest land	-27,740.841	NE	NE	NE	NE	NE
3.B.1.b - Land Converted to Forest land	NE	NE	NE	NE	NE	NE
3.B.1.b.i - Cropland converted to Forest Land	NE	NE	NE	NE	NE	NE
3.B.1.b.ii - Grassland converted to Forest Land	NO	NO	NO	NO	NO	NO

Categories	Emissions (t)					
	Net CO_2 emissions / removals	Emissions				
		CH_4	N_2O	NO_X	CO	NMVOCs
3.B.1.b.iii - Wetlands converted to Forest Land	NE	NE	NE	NE	NE	NE
3.B.1.b.iv - Settlements converted to Forest Land	NE	NE	NE	NE	NE	NE
3.B.1.b.v - Other Land converted to Forest Land	NE	NE	NE	NE	NE	NE
3.B.2 - Cropland	NE	NE	NE	NE	NE	NE
3.B.2.a - Cropland Remaining Cropland	NE	NE	NE	NE	NE	NE
3.B.2.b - Land Converted to Cropland	NE	NE	NE	NE	NE	NE
3.B.2.b.i - Forest Land converted to Cropland	NE	NE	NE	NE	NE	NE
3.B.2.b.ii - Grassland converted to Cropland	NO	NO	NO	NO	NO	NO
3.B.2.b.iii - Wetlands converted to Cropland	NE	NE	NE	NE	NE	NE
3.B.2.b.iv - Settlements converted to Cropland	NE	NE	NE	NE	NE	NE
3.B.2.b.v - Other Land converted to Cropland	NE	NE	NE	NE	NE	NE
3.B.3 - Grassland	NO	NO	NO	NO	NO	NO
3.B.3.a - Grassland Remaining Grassland	NO	NO	NO	NO	NO	NO
3.B.3.b - Land Converted to Grassland	NO	NO	NO	NO	NO	NO
3.B.3.b.i - Forest Land converted to Grassland	NO	NO	NO	NO	NO	NO
3.B.3.b.ii - Cropland converted to Grassland	NO	NO	NO	NO	NO	NO
3.B.3.b.iii - Wetlands converted to Grassland	NO	NO	NO	NO	NO	NO
3.B.3.b.iv - Settlements converted to Grassland	NO	NO	NO	NO	NO	NO
3.B.3.b.v - Other Land converted to Grassland	NO	NO	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NE	NE	NE	NE	NE
3.B.4.a - Wetlands Remaining Wetlands	NE	NE	NE	NE	NE	NE
3.B.4.a.i - Peatlands remaining peatlands	NA	NA	NA	NA	NA	NA
3.B.4.a.ii - Flooded land remaining flooded land	NE	NE	NE	NE	NE	NE
3.B.4.b - Land Converted to Wetlands	NE	NE	NE	NE	NE	NE
3.B.4.b.i - Land converted for peat extraction	NA	NA	NA	NA	NA	NA
3.B.4.b.ii - Land converted to flooded land	NE	NE	NE	NE	NE	NE
3.B.4.b.iii - Land converted to other wetlands	NA	NA	NA	NA	NA	NA
3.B.5 - Settlements	NE	NA	NA	NA	NA	NA
3.B.5.a - Settlements Remaining Settlements	NE	NA	NA	NA	NA	NA
3.B.5.b - Land Converted to Settlements	NE	NA	NA	NA	NA	NA
3.B.5.b.i - Forest Land converted to Settlements	NE	NA	NA	NA	NA	NA
3.B.5.b.ii - Cropland converted to Settlements	NE	NA	NA	NA	NA	NA
3.B.5.b.iii - Grassland converted to Settlements	NO	NA	NA	NA	NA	NA
3.B.5.b.iv - Wetlands converted to Settlements	NE	NA	NA	NA	NA	NA
3.B.5.b.v - Other Land converted to Settlements	NE	NA	NA	NA	NA	NA
3.B.6 - Other Land	NE	NA	NA	NA	NA	NA
3.B.6.a - Other land Remaining Other land	NE	NA	NA	NA	NA	NA
3.B.6.b - Land Converted to Other land	NE	NA	NA	NA	NA	NA
3.B.6.b.i - Forest Land converted to Other Land	NE	NA	NA	NA	NA	NA
3.B.6.b.ii - Cropland converted to Other Land	NE	NA	NA	NA	NA	NA
3.B.6.b.iii - Grassland converted to Other Land	NO	NA	NA	NA	NA	NA
3.B.6.b.iv - Wetlands converted to Other Land	NE	NA	NA	NA	NA	NA
3.B.6.b.v - Settlements converted to Other Land	NE	NA	NA	NA	NA	NA
3.C - Aggregate sources and non-CO2 emissions sources on land (2)	NE	NO	8.341	NO	NO	NA
3.C.1 - Emissions from biomass burning	NA	NO	NO	NO	NO	NA
3.C.1.a - Biomass burning in forest lands	NA	NO	NO	NO	NO	NA
3.C.1.b - Biomass burning in croplands	NA	NO	NO	NO	NO	NA
3.C.1.c - Biomass burning in grasslands	NA	NO	NO	NO	NO	NA
3.C.1.d - Biomass burning in all other land	NA	NO	NO	NO	NO	NA
3.C.2 - Liming	NO	NA	NA	NA	NA	NA
3.C.3 - Urea application	NO	NA	NA	NA	NA	NA

Categories	Emissions (t)					
	Net CO_2 emissions / removals	Emissions				
		CH_4	N_2O	NO_X	CO	NMVOCs
3.C.4 - Direct N2O Emissions from managed soils (3)	NA	NA	6.920	NA	NA	NA
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	NE	NA	NA	NA
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	1.421	NA	NA	NA
3.C.7 - Rice cultivation	NA	NO	NA	NA	NA	NA
3.C.8 - Other (please specify)	NE	NO	NO	NA	NA	NA
3.D - Other	-26.387	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-26.387	NA	NA	NA	NA	NA
3.D.2 - Other (please specify)	NO	NO	NO	NO	NO	NO

2.7. Waste sector

2.7.1. Description

Anthropogenic activities lead to the generation of both solid and liquid wastes. These wastes consist of different materials, including plastics, wood, paper, food remains and garden waste among others.

Wastes are further sub-divided into domestic and industrial wastes as listed below:

- Solid waste: Municipal (Domestic) and industrial solid wastes
- Wastewater: Domestic and industrial wastewater.

Currently in Kiribati, solid waste is often disposed of in an unsustainable manner. Kiribati currently has very limited landfills that are engineered. Solid waste, collected by the city councils, are mostly disposed of at unmanaged dump sites. Most of the rural population carry out composting of domestic organic waste. Hospitals incinerate hazardous clinical waste. Liquid waste is disposed of into closed systems, septic tanks, and latrines.

GHG emissions from the Waste sector result largely from disposal of solid wastes through landfilling, dumping, incineration, open burning and treatment of domestic and industrial liquid wastes. The emissions, from solid waste are CH_4 from disposal sites and predominantly CO_2 from open burning of waste. Wastewater can also be a source of CH_4, when treated or disposed of anaerobically, as well as of N_2O emissions. Key factors that affect emissions are population growth, rural-urban drift, and improper management of waste, both at its source of generation and its final fate.

The 2006 IPCC Guidelines divide the Waste sector into the following source categories: Solid Waste Disposal (4A), Biological Treatment of solid waste (4B), Incineration and Open Burning (4C) and Wastewater Treatment and Discharge (4D). Each source category is further divided into sub-categories that consider different waste attributes, management practices and approaches.

Analysis of waste disposal practices led to the identification of 5 categories for computing emissions of the Waste sector in Kiribati. These are:

- 4.A. - Waste Disposal Sites
- 4.C.1 - Waste Incineration
- 4.C.2 - Open Burning of Waste
- 4.D.1 - Domestic Wastewater Treatment and Discharge; and
- 4.D.2 - Industrial Wastewater Treatment and Discharge.

2.7.2. Methods

2.7.2.1. Solid waste

The decision tree of the 2006 IPCC Guidelines was used to choose the most appropriate method for computing emissions of this sector. There are limited data on specificity and management of waste, such as annual information on the amount and composition of waste generated, the details pertaining to waste management practices in both the rural and urban areas of the country, the waste generation rate in the industry and other relevant data. This resulted in the adoption of Tier 1 methodology.

Under this Tier 1 methodology waste emissions were computed using the formula:

$$E = AD * EF$$

where:

E = emissions (tonnes)
AD is the activity data (population and waste generation rate)
EF is emission factor (tonnes per tonne waste)

The decision tree of the 2006 IPCC Guidelines (Vol. 5, Ch. 5, Page 5.9) guided the choice of method for estimating emissions from Incineration and Open Burning and the Tier 1 approach was adopted. The emissions estimates were done by entering the amount of waste incinerated and open burnt directly in the software.

2.7.2.2. Wastewater

The decision tree of the 2006 IPCC Guidelines (Vol. 5, Ch. 6, Page 6.10) guided the estimation of GHG emissions from this subcategory. Domestic wastewater in the software is allocated based on the fraction of total population using each wastewater management system identified in the country.

2.7.3. Activity Data, Emission factors and emissions estimates

2.7.3.1. Activity data and emissions factors

Solid Waste Disposal (4.A) - Waste Disposal Sites

The amount of waste generated in Kiribati was derived from the urban and rural population data times per capita waste generation rates as follows:

- Waste generation studies for urban regions in years 2000, 2010 and 2017 (KWMRRS 2020 to 2030) were used to generate a consistent timeseries of per capita waste generation rate for urban region.
- The waste generation rate for rural regions was estimated at 50% that of the urban region. (Expert judgement).
- Waste characterization data done at the same time as the generation rate was averaged and a single waste characterization was adopted for the timeseries 2000 to 2019.
- An adjustment was made for food waste fed to swine by allocating 25% of food waste in urban and 50% in rural region of the food waste fraction (Expert judgement). Waste characterization was adjusted accordingly, and the final information used was 18% food waste, 37% garden waste, 5% paper, 1% wood, 2% textile, 3% nappies and the remaining 33% as plastics and other inert materials.
- Census information of 2005, 2010 and 2015 were used to estimate the fate of solid municipal waste in the different waste streams. The nomenclature from the census was assigned to match the terminology of the IPCC Guidelines. Information from the census confirms that waste collection occurs only in the urban region.
- The estimated waste generated in the urban and rural regions was added to bring it to the whole country for making the sectoral estimates in the software.

Information provided in Table 2.41 was adopted for generating AD for computing emissions from solid waste.

Table 2.41: Municipal Solid Waste (MSW) activity data used for estimating emissions (2000 – 2019)

Year	Total population	Waste per capita (kg/cap/yr)	Fraction of waste sent to SWDS	% MSW to each SWDS			Amount of waste open burnt (t)
				Managed – Semi aerobic	Unmanaged shallow SWDS	Unmanaged SWDS	
2000	84,504	58.904	0.484	34%	48%	18%	845
2001	86,110	62.073	0.484	34%	48%	18%	907
2002	87,716	65.411	0.484	34%	48%	18%	974
2003	89,321	68.929	0.484	34%	48%	18%	1,045
2004	90,927	72.635	0.485	34%	48%	18%	1,121
2005	92,533	76.540	0.485	34%	48%	18%	1,202
2006	94,638	81.271	0.488	35%	47%	18%	1,301
2007	96,743	86.260	0.491	35%	47%	18%	1,407
2008	98,848	91.523	0.494	35%	47%	18%	1,521
2009	100,953	97.074	0.497	36%	47%	18%	1,643
2010	103,058	99.006	0.499	36%	47%	17%	1,707
2011	104,474	100.695	0.501	36%	47%	17%	1,757
2012	105,889	102.401	0.502	36%	46%	17%	1,808
2013	107,305	104.126	0.503	36%	46%	17%	1,861
2014	108,720	105.870	0.505	37%	46%	17%	1,915
2015	110,136	107.633	0.506	37%	46%	17%	1,969
2016	112,097	109.343	0.507	37%	46%	17%	2,034
2017	114,058	110.895	0.508	37%	46%	17%	2,097
2018	116,018	112.637	0.509	37%	46%	17%	2,165
2019	117,979	114.398	0.510	37%	46%	17%	2,234

Estimation of emissions were based on the following:

- A tropical wet climate in the Oceania – Other Oceania region was chosen for the Republic of Kiribati. Default values for CH_4 generation rate for constant (k) and degradable organic content for each waste constituent available in the software were used.
- The Waste by composition approach based on population was chosen with the starting year as 2000.
- The delay time is set at 6 months and oxidation factor (OX) as 0.
- No industrial waste is produced in the country.

Incineration and Open Burning of Waste (4.C.)

Data from national statistics on clinical waste (150 kg burnt each day) has been used to compute emissions resulting from incineration. AD for Open Burning generated from available information are already given in Table 2.41. Additional information used and EFs are:

The other elements for calculating emissions for waste incineration, IPCC default values, were: Dry matter content is constant at 70%, fraction of carbon in dry matter is 60%, fossil carbon in total carbon is 40% and oxidation factor 1.0. The EF for CH_4 is 60 kg CH_4/Gg wet waste and that of N_2O is 56 kg N_2O/Gg wet waste.

The other elements for calculating emissions for Open burning, IPCC default values, were: Dry matter content is constant at 48%, fraction of carbon in dry matter is 35%, fossil carbon in total carbon is 10%

and oxidation factor 0.58. The EF for CH_4 is 6,500 kg CH_4/Gg wet waste and that of N_2O is 150 kg N_2O/Gg dry waste.

Wastewater Handling (4D) – Domestic Wastewater Treatment and Discharge (4.D.1)

The level of adoption of wastewater management systems by population are applied to generate the organically degradable material in wastewater. Census data from KSO for years 2005, 2010 and 2015 were used to estimate the fraction of population using the different systems. The nomenclature used in the census were harmonized with those in the IPCC Guidelines and 3 systems were retained. The AD generated and used in the computation of emissions for domestic wastewater are presented in Table 2.42. The remaining fraction of population have been assigned as using open air defecation which in Kiribati is referred to as beach, bush, or sea. The protein intake from FAOSTATS, available for years 2014 to 2018, were averaged (27.2 kg/person/year) and used for all years across the timeseries.

The reticulate system in South Tarawa is connected to a sea outfall. In the absence of information with regards to the water table, the highest emitting option for latrines (warm weather and high-water table) has been used.

Table 2.42: Activity data used for domestic wastewater (2000 – 2019)

	Fraction (%) of population using WW system		
Year	Sea and lake discharge	Septic tank	Latrine
2000	0.103	0.061	0.137
2001	0.099	0.066	0.146
2002	0.096	0.071	0.156
2003	0.092	0.077	0.167
2004	0.089	0.083	0.178
2005	0.085	0.090	0.190
2006	0.082	0.097	0.203
2007	0.079	0.105	0.216
2008	0.076	0.114	0.231
2009	0.073	0.123	0.247
2010	0.070	0.133	0.263
2011	0.068	0.144	0.281
2012	0.065	0.155	0.300
2013	0.063	0.168	0.321
2014	0.060	0.182	0.342
2015	0.058	0.197	0.366
2016	0.056	0.213	0.390
2017	0.054	0.230	0.417
2018	0.052	0.249	0.445
2019	0.050	0.269	0.475

The EFs adopted (IPCC 2006 Guidelines Vol. 5, Ch. 6), based on the maximum CH_4 production capacity and CH_4 correction factor for each treatment type, are presented in Table 2.43.

Table 2.43: Emission factor for domestic wastewater calculations

Type of treatment / discharge	Maximum CH_4 producing capacity-BO [kg CH_4 / kg BOD]	CH_4 correction factor for each treatment system – MCFj	Emission Factor [kg CH_4 / kg BOD]
Sea and lake discharge	0.6	0.1	0.06
Latrine, dry climate	0.6	0.7	0.42
Septic tank	0.6	0.5	0.30

2.7.3.2. Emissions estimates

Aggregated emissions by source category

The annual emissions by category from the Waste sector for the period 2000 to 2019 are provided in Table 2.44. The Waste sector emitted 25,602 t CO_2 e in 2019. This represents a 425% increase on the year 2000 when 4,877 t CO_2 e were emitted. Wastewater remained the highest contributor throughout the timeseries. Emissions increased from 239 to 3,048 t CO_2 e (1173%) for solid waste and from 235 to 564 t CO_2 e (140%) for Incineration and open burning.

Table 2.44: Aggregated emissions (t CO_2 e) of the Waste sector (2000 – 2019)

Year	SWDS	Incineration and open burning	Wastewater	Total
2000	-	235	4,642	4,877
2001	239	249	5,016	5,505
2002	445	265	5,424	6,134
2003	627	282	5,867	6,776
2004	794	300	6,350	7,444
2005	951	319	6,876	8,146
2006	1,103	343	7,488	8,933
2007	1,256	368	8,155	9,779
2008	1,420	395	8,882	10,697
2009	1,590	424	9,675	11,689
2010	1,769	439	10,539	12,747
2011	1,938	451	11,405	13,794
2012	2,095	463	12,345	14,903
2013	2,244	475	13,365	16,085
2014	2,386	488	14,471	17,346
2015	2,522	501	15,679	18,702
2016	2,654	516	17,064	20,234
2017	2,785	531	18,571	21,888
2018	2,916	547	20,209	23,672
2019	3,048	564	21,990	25,602

In 2019, Wastewater treatment and discharge was the major contributor with 86% (21,990 t CO_2 e) of the total emissions of the Waste sector. Solid Waste Disposal Sites (SWDS) emissions followed with 3,048 t CO_2 e representing 12% and Incineration and Open Burning contributed the remaining 2% (564 t CO_2 e) (Figure 2.7).

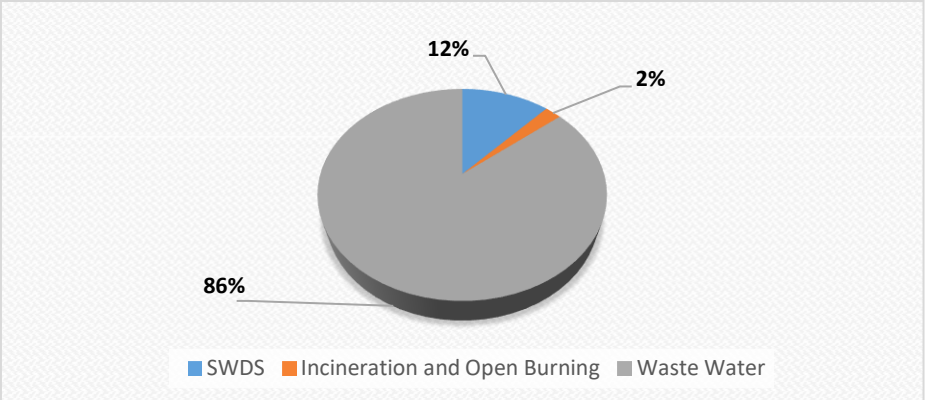


Figure 2.7: Contribution (%) by source category in emissions of the Waste sector in 2019

Emissions by gas

Emissions by gas for the Waste sector are given in Table 2.45. CH_4 was the highest contributor of total emissions from the sector when expressed in t CO_2 e. Its 90% share of 2000 rose to 94 % in 2019. N_2O was the next contributor with 1,530 t CO_2 e in 2019 representing 6% of total emissions while CO_2 emissions were marginal with a share of 0.4% (114 t) in the same year. The increase in emissions from the year 2000 to 2019 was 445% for CH_4, 265% for N_2O and 78% for CO_2.

Table 2.45: Absolute, CO_2 equivalent and total aggregated emissions by gas (2000 – 2019)

Year	Absolute (t)			CO_2 Equivalent (t)		Total aggregated
	CO_2	CH_4	N_2O	CH_4	N_2O	(t CO_2 e)
2000	64	156.91	1.58	4,393	420	4,877
2001	66	178.44	1.67	4,996	443	5,505
2002	69	199.90	1.77	5,597	468	6,134
2003	71	221.77	1.87	6,210	496	6,776
2004	74	244.44	1.98	6,844	526	7,444
2005	77	268.24	2.11	7,511	559	8,146
2006	80	294.79	2.26	8,254	599	8,933
2007	84	323.32	2.42	9,053	642	9,779
2008	88	354.26	2.60	9,919	689	10,697
2009	92	387.71	2.80	10,856	741	11,689
2010	95	423.44	3.00	11,856	796	12,747
2011	96	458.82	3.21	12,847	851	13,794
2012	98	496.23	3.44	13,895	910	14,903
2013	100	536.06	3.68	15,010	975	16,085
2014	102	578.50	3.95	16,198	1,046	17,346
2015	104	624.12	4.24	17,475	1,123	18,702
2016	106	675.58	4.57	18,916	1,212	20,234
2017	109	731.06	4.94	20,470	1,309	21,888
2018	111	790.94	5.34	22,146	1,415	23,672
2019	114	855.63	5.78	23,958	1,530	25,602

Emissions from Solid Waste Disposal Systems

The direct GHG CH_4 is emitted from SWDS and the emissions from 2001 to 2019 are presented in absolute and aggregated values in Table 2.46. CH_4 emissions increased from 9 t or 239 t CO_2 e in 2001 to reach 109 t or 3,048 t CO_2 e in 2019.

Table 2.46: Emissions of CH_4 from solid waste disposal systems (2000 – 2019)

Year	CH_4 (t)	CH_4 (t CO_2 e)
2000	-	-
2001	9	239
2002	16	445
2003	22	627
2004	28	794
2005	34	951
2006	39	1103
2007	45	1256
2008	51	1420
2009	57	1590
2010	63	1769
2011	69	1938
2012	75	2095
2013	80	2244
2014	85	2386
2015	90	2522
2016	95	2654
2017	99	2785
2018	104	2916
2019	109	3048

Incineration and Open Burning of waste

All three direct GHGs are emitted during incineration and open burning of waste. Emissions from Incineration and Open Burning, in absolute and aggregated amounts are given in Table 2.47. Total emissions increased by 140% from 235 t CO_2 e in 2000 to 564 t CO_2 e in 2019. CH_4 remained the major contributor across the time series and its share was 72% (407 t CO_2 e) in 2019 while CO_2 emissions accounted for 20% and N_2O the remaining 8% in the same year. CH_4 and N_2O increased by 164% and 157% respectively from the year 2000 to 2019.

Table 2.47: Absolute, CO_2 equivalent and total aggregated emissions by gas from Incineration and Open Burning (2000 – 2019)

Year	Absolute (t)			CO_2 Equivalent (t)		Total
	CO_2	CH_4	N_2O	CH_4	N_2O	(t CO_2 e)
2000	64	5	0.06	154	17	235
2001	66	6	0.07	165	18	249
2002	69	6	0.07	177	19	265
2003	71	7	0.08	190	21	282
2004	74	7	0.08	204	22	300
2005	77	8	0.09	219	24	319
2006	80	8	0.10	237	26	343
2007	84	9	0.10	256	28	368
2008	88	10	0.11	277	30	395
2009	92	11	0.12	299	32	424
2010	95	11	0.13	311	33	439
2011	96	11	0.13	320	34	451

Year	Absolute (t)			CO_2 Equivalent (t)		Total
	CO_2	CH_4	N_2O	CH_4	N_2O	(t CO_2 e)
2012	98	12	0.13	329	35	463
2013	100	12	0.14	339	36	475
2014	102	12	0.14	349	37	488
2015	104	13	0.14	359	38	501
2016	106	13	0.15	370	40	516
2017	109	14	0.15	382	41	531
2018	111	14	0.16	394	42	547
2019	114	15	0.16	407	43	564

Emissions from Wastewater

The annual absolute (t) and aggregated (t CO_2 e) emissions of direct GHGs from Wastewater increased significantly from 2000 to 2019 as presented in Table 2.48. The total aggregated emissions reached 21,990 t CO_2 e in 2019 which represents an increase of 374% from the year 2000. Wastewater in Kiribati generated more emissions as CH_4 (93%) than N_2O (7%) when compared in CO_2 equivalents in 2019.

Table 2.48: Absolute, CO_2 equivalent and total aggregated emissions from the Wastewater category (2000 – 2019)

Year	Absolute (t)		CO_2 Equivalent (t)		Total aggregated
	CH_4	N_2O	CH_4	N_2O	(t CO_2 e)
2000	151	2	4,240	403	4,642
2001	164	2	4,592	425	5,016
2002	178	2	4,975	449	5,424
2003	193	2	5,392	475	5,867
2004	209	2	5,847	504	6,350
2005	226	2	6,341	535	6,876
2006	247	2	6,915	573	7,488
2007	269	2	7,541	614	8,155
2008	294	2	8,223	659	8,882
2009	320	3	8,966	709	9,675
2010	349	3	9,776	763	10,539
2011	378	3	10,589	816	11,405
2012	410	3	11,470	875	12,345
2013	444	4	12,426	939	13,365
2014	481	4	13,463	1,008	14,471
2015	521	4	14,595	1,084	15,679
2016	568	4	15,892	1,172	17,064
2017	618	5	17,303	1,268	18,571
2018	673	5	18,836	1,373	20,209
2019	732	6	20,503	1,487	21,990

Results of the estimates from the IPCC inventory software for the inventory year 2019 are presented in in Table 2.49.

Table 2.49: Waste sector sectoral table - Inventory Year 2019

Categories	Emissions (t)						
	CO_2	CH_4	N_2O	NO_X	CO	NMVOCs	SO_2
4 - Waste	113.551	855.631	5.775	NE	NE	NE	NE
4.A - Solid Waste Disposal	NA	108.851	NA	NO	NO	NE	NA
4.A.1 - Managed Waste Disposal Sites	NA	IE	NA	NO	NO	NO	NA
4.A.2 - Unmanaged Waste Disposal Sites	NA	IE	NA	NO	NO	NE	NA
4.A.3 - Uncategorised Waste Disposal Sites	NA	IE	NA	NO	NO	NE	NA
4.B - Biological Treatment of Solid Waste		NE	NE	NE	NE	NE	NA
4.C - Incineration and Open Burning of Waste	113.551	14.526	0.164	NE	NE	NE	NE
4.C.1 - Waste Incineration	33.726	0.003	0.003	NE	NE	NE	NE
4.C.2 - Open Burning of Waste	79.825	14.523	0.161	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NA	732.254	5.661	NE	NE	NE	NA
4.D.1 - Domestic Wastewater Treatment and Discharge	NA	732.254	5.661	NE	NE	NE	NA
4.D.2 - Industrial Wastewater Treatment and Discharge	NA	NO	NE	NE	NE	NE	NA
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO

Note: The original values in gigagrams in the above table from the software output have been converted to tonnes

3. Information on mitigation actions and their effects, including associated methodologies and assumptions

3.1. Background

Decision 2/CP.17 in its Annex III provides the guidelines to BUR reporting on mitigation by Non-Annex I Parties. Paragraph 2 (c) of Annex III requires countries to provide information on mitigation actions and their effects, including associated methodologies and assumptions. Kiribati has been implementing mitigation actions since the 1990s but did not keep track of or collect information on them for reporting purposes. As the UNFCCC process evolved further with the Paris Agreement (PA) and its Enhanced Transparency Framework (ETF), Kiribati also pursued efforts to promote mitigation towards meeting the ultimate objective of the Convention to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Implementation of significant actions started in 2014 and continues to-date. Kiribati ratified the PA on 16 September 2016 and is obligated to report, in accordance with the Modalities, Procedures and Guidelines (MPGs) of decision 18/CMA.1, as from 2024 in its Biennial Transparency Report (BTR). In view of this, the country is starting to align its reporting to these MPGs during the preparation of the mitigation chapter of this first Biennial Update Report (BUR1).

Kiribati has completed two national mitigation assessments, which were presented in the two submitted national communications, and has prepared a partial one which served to develop its Intended Nationally Determined Contributions (INDC). Since the partial assessment associated with the INDC dates back to 6 years, it has been deemed essential to update this exercise within the framework of the preparation of the BUR1 to have the most updated information to inform government's decisions and future reporting to the UNFCCC, while building capacity of national experts to transit to the MPGs of the PA in the future. In addition to the updating of the previous assessment, further potential mitigation actions have been identified for the Agriculture, Forestry and Other Land Use (AFOLU) and Waste sectors during the exercise. The latest sectoral policies, plans and roadmaps were analysed and activities presenting a potential for mitigation assessed.

3.2. Update of mitigation assessment

3.2.1. Methods

The steps listed below were adopted for updating the mitigation assessment and preparing the chapter on mitigation actions and its effects in the BUR1.

- Updating the Greenhouse Gas (GHG) inventory for the period 2000 to 2019 to align it to Transparent, Accurate, Complete, Consistent and Comparable (TACCC) principles.
- Creation of a baseline for projecting the Business As Usual (BAU) scenario.
- Generation of socio-economic profiles for use when projecting the BAU emissions.
- Making projections under the BAU scenario for the year 2030.
- Identify mitigation measures and actions in line with national policies and plans.
- Calculate emissions reductions as far as possible for the mitigation actions.
- Prepare the chapter for the BUR1.

The baseline emission estimates obtained for each category for the period 2000 to 2013 were computed to the 2030 time horizon using projected activity data based on socio-economic scenarios generated for

this purpose. Projections were made on a category basis to maximize accuracy as drivers determining the future are not the same for all activities. For example, the evolution in road transportation is not similar to providing access to electricity and its generation. The IPCC 2006 Guidelines have been used for estimating the potential emissions reductions of the newly identified measures. Hence, the emissions estimated for the BAU scenario of the Energy sector for 2030 is not just an extrapolation of baseline emissions but were calculated from combustion of fuels estimated to be used in 2030 for each category of the sector. Two reports, the Kiribati Integrated Energy Roadmap (KIER) and the NDC Roadmap, have been produced to guide the implementation of mitigation actions of the Energy sector, notwithstanding the inclusion of additionnal measures, and served for making the projections. Measures identified and evaluated for the Waste sector are in line with the Kiribati Waste Management Resource Recovery Strategy (KWMRRS 2020 – 2030) except for the domestic wastewater option which is new and considered for the first time. Mangrove plantation was maintained in the assessment, but with more ambition.

3.2.2. Mitigation potential

Table 3.1 summarizes the abatement potential (t CO_2 e) at the national and sectoral levels relative to the national and sectoral BAU scenarios for the year 2030. Implementation of all the mitigation actions retained for all the sectors have a total reduction potential of 88,085 t CO_2 e, representing 64.8% of the BAU scenario. Of these 64.8%, Energy will contribute 51.6% (70,135 t CO_2 e), Waste 8.2% (11,200 t CO_2 e) and AFOLU 5.0% (6,750 t CO_2 e).

Table 3.1: National mitigation potential (t CO_2 e) for year 2030 compared to the BAU scenario

Level	Emissions -BAU scenario	Emissions – Mitigation scenario	Emissions avoided	% of national BAU emissions
National	135,960	47,875	88,085	64.8%
Energy	81,500	11,365	70,135	51.6%
IPPU	60	60	-	-
AFOLU	21,300	14,550	6,750	5.0%
Waste	33,100	21,900	11,200	8.2%

The different mitigation measures which have been evaluated for the Energy, AFOLU and Waste sectors are provided in Table 3.2. The actions in the Energy Sector regroups those from the INDC, KIER and NDC Roadmap are presented under different themes to enable a better understanding of their focus. Five additional measures assessed and included in this chapter are also provided along with their mitigation potential in Table 3.2. Two measures relate to the AFOLU sector for a cumulated reduction potential of 6,750 t CO_2 e. The other three actions are in the Waste sector for a total emissions reduction of 11,200 t CO_2 e.

Table 3.2: Description of actions/group of actions by theme

Theme	List of actions
Energy sector	
Renewable Energy (RE) –Photovoltaic (PV) systems and biofuel for electricity generation	1. 1.3 MW PV in South Tarawa 2. Solar PV mini grid system for Southern Kiribati Hospital 3. Outer island clinic solar system rehabilitation 4. Mereang Taabwai Secondary Schools solar PV mini grid 5. Junior Secondary School system with PV in Outer Islands 6. Solar Home system for households (3900) in the Outer islands 7. Outer islands council solar PV mini grid system in Gilbert and Line Groups 8. PV systems in Outer Island Fish Centres 9. Desalination plants for vulnerable rural community: 19 systems for 12 community systems in 9 islands

Theme	List of actions
	10. Outer island police station solar system rehabilitation: 23 solar systems 11. Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institutions 12. Use of coconut fuel as biofuel for electricity generation 13. Deployment of additional 1,500 and 1,000 kWp PV in the power system of South Tarawa 14. Deployment of 200 kWp PV, 275 kW wind and 264 kW / 560 kWh battery storage in Zone 1 15. Deployment of 150 kWp PV, and 165 kW / 350 kWh battery storage in Zone 2 16. Solar Home system for additional households (6,000) in the Outer islands 17. Ice plants 18. School mini-grid small 19. Short term deployment of PV reverse osmosis (RO) desalination systems 20. Long term deployment of PV RO desalination systems
Energy Efficiency – Supply side	1. Contract for annual maintenance for 3-5 years, competitively bid 2. Rehabilitate distribution and transmission lines, including equipment and tools and repair of the electrical workshop at Betio 3. Meter audits to identify meter faults and preclude illegal power connections
Energy Efficiency (EE) – Demand Side Management (DSM)	1. CFL promotion – to replace incandescent lights with CFL 2. Replacement of 4 feet LTL tube lights with LEDs 3. Replacement of 2 feet LTL tube lights with LEDs 4. Replacing 4 ft. LTLs with LEDs in 40% of commercial buildings 5. Replacing 2 ft LTLs with 2 ft. LED 6. Replacing inefficient air conditioners in 40% of commercial buildings 7. Replacing inefficient refrigerators in commercial buildings 8. Replacement of tube lights to LEDs in government ministry buildings 9. Replace an average of 10 inverter type alternating current units per ministry 10. Ceiling Fans Regulations Switch and replacement of inefficient ACs to fans
EE – Capacity Building and Planning	1. Utility Led Program to Manage Peak Demand and Savings in South Tarawa 2. Capacity Building for Integrated Energy Planning and Energy Statistics in Kiribati 3. Promotion of Sustainable Procurement 4. Capacity Building in Energy Efficiency in Industry
EE – DSM legislation	1. Adopt and implement the use of energy efficient labels and standards for freezers, refrigerators through an amendment to the Consumer Act 2. Strengthening and Expanding the Standards and Labelling Programme for Appliances
EE – DSM improved infrastructure	1. Repairing water pipes leakages and installation of prepayment meters and tariff rates 2. Current sanitation project to repair leakages and improve sewerage infrastructure 3. Efficient lagoon and sea public transportation developed for nearby islands to South Tarawa
EE – DSM building improvement	1. Building renovations and retrofits and proper insulation in all government buildings 2. Supporting the Retrofitting of Major Hotels and Commercial Buildings (Openings)
Maritime transport	1. Outboard motor transition 2. Low carbon mini-container ship 3. Small Low Carbon Cargo/Passenger Freighter 4. Zero Impact Cruise Liner 5. Biofuel Blends in Land and Maritime Transport
Land transport	1. Use of coconut oil as biofuel for road transport 2. Efficient use of fuel for transport for government sector 3. Bicycle/E-Bike Financing Initiative 4. Multi-modal Transit Initiative 5. Improve energy efficiency of imported used vehicles

Theme	List of actions
Air transport	1. Aviation Operational Training Programme
Residential	1. Pilot study of 100 starter kits to implement in South Tarawa 2. Increase access to improved bioenergy cook stoves
AFOLU	1. Planting of Mangroves
Livestock and Land	1. Change in manure management and composting 2. Reduce fuelwood removal
Waste	1. 25% reduction in amount of solid waste sent to landfills 2. 75% reduction in amount of waste open burned 3. Replace 75% of all wet latrines and septic tanks with dry composting latrine system

Analysis of the INDC actions reveals that 2,412 t CO_2 e are presently avoided annually from implemented actions and 237 t CO_2 e for those under implementation while the remaining ones has a planned reduction potential of 25,856 t CO_2 e in 2030. Similarly, the actions from the KIER report which targets energy actions primarily, emissions reduction of implemented actions amount to 3,711 t CO_2 e with another 897 t CO_2 e for actions partly implemented and 3,922 t CO_2 e for the planned ones. The NDC roadmap projects emissions reduction of 33,100 t CO_2 e. There are no duplication of actions when these are classified under each report separately. A summary of all actions from all reports and the total mitigation potential are presented in Table 3.3. These actions which cover only the Energy sector emissions reduction potential, inclusive of post-INDC measures, are expected to result in a national mitigation potential of 70,135 t CO_2 e which tallies with the mitigation assessment exercise for the year 2030 reported earlier and given in Table 3.3.

In addition to the measures of the Energy sector which deal with emissions reduction, Kiribati also identified in its INDC one action to increase its sink capacity through the removal of CO_2 from the atmosphere by mangroves. The removals provided in the INDC have been reviewed in light of recent studies in this assessment and is now estimated at 42.5 t CO_2 e in 2030.

Table 3.3: Summary of emissions reduction potential of implemented, ongoing implementation, and planned mitigation actions or group of actions

Source	Implemented	Ongoing implementation	Planned	Total
INDC	2,412	237	25,856	28,505
KIER	3,711	897	3,922	8,530
NDC Roadmap	-	-	33,100	33,100
Total	6,123	1,134	62,878	70,135
Share of national	8.7%	1.6%	89.7%	

3.3. List of mitigation actions and their effects

Details on individual mitigation actions and their effects are given in Table 3.4 to Table 3.66 as per BUR reporting requirements. Unfortunately, it has not been possible to present quantified emissions reductions for all of them as the information were not available in some cases. Wherever possible and based on information available in the reports complemented with those collected, emissions avoided

have been calculated and included. The actions are listed in the same order as in the National documents analysed.

3.3.1. Measures from INDC

Table 3.4: 1.3 MW PV in South Tarawa

Name of action	1.3 MW PV in South Tarawa
Main objective	Increase share RE
Description	Installation of 1.3 MW PV system in south Tarawa
Gases	CO_2, CH_4, N_2O
Type	Energy – Electricity generation
Progress of implementation	Implemented
Implementing entity	MISE
Progress indicators	1.45 MW PV installed and operational since 2015. 3,941 MWh electricity generated and sent to grid in 2017
Steps taken / envisaged	Not applicable
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Improved energy security, better air quality, displacement of fossil fuel,
Annual GHG reduction (tons)	1,910
International market mechanism	Not applicable

Table 3.5: Solar PV mini grid system for Southern Kiribati Hospital

Name of action	Solar PV mini grid system for Southern Kiribati Hospital
Main objective	Increase share RE
Description	PV mini grid for Southern Kiribati Hospital
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Planned
Implementing entity	MISE
Progress indicators	Progress in project implementation
Steps taken / envisaged	To be covered under POIDIER project
Methodologies / Assumptions	Not Available (NA)
Estimated outcome	Amount of electricity generated and used
Co benefits	Better air quality and health
Annual GHG reduction (tons)	386.4 (Source: INDC of Kiribati)
International market mechanism	To be explored

Table 3.6: Outer islands clinic solar system rehabilitation

Name of action	Outer islands clinic solar system rehabilitation
Main objective	Increase share RE
Description	Rehabilitation of the solar system of Outer islands health clinics
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Planned
Implementing entity	POIDIER & EPU – MISE
Progress indicators	Number of health clinics with PV systems rehabilitated

Name of action	Outer islands clinic solar system rehabilitation
Steps taken / envisaged	Earmarked for funding under the POIDIER project
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Improved livelihood, better health services, better air quality
Annual GHG reduction (tons)	84.6
International market mechanism	To be explored

Table 3.7: Mereang Taabwai Secondary Schools solar PV mini-grid

Name of action	Mereang Taabwai Secondary Schools solar PV mini-grid
Main objective	Increase share RE
Description	PV mini grid for Mereang Taabwai Secondary Schools
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Ongoing
Implementing entity	Not Available
Progress indicators	Progress in project implementation
Steps taken / envisaged	Project to resume when asbestos found in the school buildings are removed
Methodologies / Assumptions	Not Available (NA)
Estimated outcome	Amount of electricity generated and used
Co benefits	Improved livelihood, access to education, better air quality and health
Annual GHG reduction (tons)	29.2 (Source: INDC of Kiribati)
International market mechanism	Not applicable

Table 3.8: Junior Secondary School system with PV in Outer Islands

Name of action	Junior Secondary School system with PV in Outer Islands
Main objective	Increase share RE
Description	Junior secondary schools (36) serviced with PV systems in outer islands
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Planned
Implementing entity	POIDIER & MISE
Progress indicators	Number of schools provided with PV systems
Steps taken / envisaged	Earmarked for funding under POIDIER project
Methodologies / Assumptions	IPCC 2016 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Improved livelihood, access to education, better air quality and health
Annual GHG reduction (tons)	21.5
International market mechanism	To be explored

Table 3.9: Solar Home system for households (3900) in the Outer islands

Name of action	Solar Home system for households (3900) in the Outer islands
Main objective	Increase share RE
Description	Solar Home systems for households (3900) in the Outer islands (Households)
Gases	CO_2, CH_4, N_2O
Type	Energy - Residential

Name of action	Solar Home system for households (3900) in the Outer islands
Progress of implementation	Ongoing
Implementing entity	EPU – MISE
Progress indicators	Number of households using a PV system
Steps taken / envisaged	Task force established to coordinate the planning and distribution of the donation of the PV systems to outer islands
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Number of generators replaced, and amount of electricity generated and used.
Co benefits	Improved quality of living, better air quality, fuel savings
Annual GHG reduction (tons)	199
International market mechanism	Not applicable

Table 3.10: Outer island council solar PV mini grid system in Gilbert and Line Groups

Name of action	Outer island council solar PV mini grid system in Gilbert and Line Groups
Main objective	Increase share RE
Description	PV mini grid system in Gilbert and Line Groups in Outer Island councils
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Completed
Implementing entity	EPU – MISE
Progress indicators	Percentage of off-grid electricity generated from RE source
Steps taken / envisaged	The existing old system for the ice plant were transferred to island council
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Better air quality, improved health, fuel savings
Annual GHG reduction (tons)	145.8
International market mechanism	Not applicable

Table 3.11: PV systems in Outer Island Fish Centres

Name of action	PV systems in Outer Island Fish Centres
Main objective	Increase share RE
Description	PV systems in Outer Island Fish Centres
Gases	CO_2, CH_4, N_2O
Type	Energy - Commercial
Progress of implementation	Completed
Implementing entity	MISE – EPU
Progress indicators	Number of Fish Centres operating with PV systems
Steps taken / envisaged	Financing by Kiribati – Italy Renewable Energy Program (KIIREP)
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	10 Fish Centres operational with PV systems at end of 2017 – Phase 1
Co benefits	Better air quality, better livelihood, improved health, fuel savings
GHG reduction (tons)	109.4
International market mechanism	Not applicable

Table 3.12: Desalination plants for vulnerable rural community: 19 systems for 12 community systems in 9 islands

Name of action	Desalination plants for vulnerable rural community: 19 systems for 12 community systems in 9 islands
Main objective	Increase share RE
Description	Desalination plants for rural community. 19 plants for 12 communities on 9 islands
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	On going
Implementing entity	WSEU and EPU
Progress indicators	Number of desalination plants operating with PV systems
Steps taken / envisaged	Installation completed on 1 island and ongoing on 4 others
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Better air quality, better livelihood, improved health, fuel savings
Annual GHG reduction (tons)	37.9 (TBE for one island)
International market mechanism	Not applicable

Table 3.13: Outer island police station solar system rehabilitation: 23 solar systems

Name of action	Outer island police station solar system rehabilitation: 23 solar systems
Main objective	Increase share RE
Description	Rehabilitation of solar systems (23) in Outer islands police stations
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Planned
Implementing entity	POIDIER & EPU – MISE
Progress indicators	Number of PV systems rehabilitated
Steps taken / envisaged	Earmarked for funding under the POIDIER project
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Better air quality, fuel savings, improved services
Annual GHG reduction (tons)	4
International market mechanism	To be explored

Table 3.14: Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institutions

Name of action	Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institutions
Main objective	Increase share RE
Description	Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institution
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Completed
Implementing entity	International Union for Conservation of Nature (IUCN), Clay Energy, EPU
Progress indicators	Started and completed in 2017 for Manoku

Steps taken / envisaged	Funding by Government of Kiribati and Italy Renewable Energy Programme (KIIREP) jointly for Manoku
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Solar PV hybrid 25 kWp installed and replacing 22 kVA diesel generator
Co benefits	Better air quality, improved services, Health benefits
Annual GHG reduction (tons)	29.2
International market mechanism	Not applicable

Table 3.15: Use of coconut fuel as biofuel for electricity generation

Name of action	Use of coconut fuel as biofuel for electricity generation
Main objective	Increase RE share in power generation
Description	Substitute fossil fuels with coconut oil biofuel
Gases	CO_2, CH_4, N_2O
Type	Energy – Electricity generation
Progress of implementation	Planned
Implementing entity	TBD
Progress indicators	Quantity of electricity generated from coconut oil
Steps taken / envisaged	Not viable presently but maintained in the long-term plan for future implementation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Reduced fuel imports, improved national accounts
Annual GHG reduction (tons)	12,780 (Source: INDC of Kiribati)
International market mechanism	To be explored

Table 3.16: Use of coconut oil as biofuel for road transport

Name of action	Use of coconut oil as biofuel for road transport
Main objective	Increase share of renewable energy in road transport
Description	Substitute fossil fuels with coconut oil biofuel
Gases	CO_2, CH_4, N_2O
Type	Energy – Road Transport
Progress of implementation	Planned
Implementing entity	TBD
Progress indicators	Quantity of diesel replaced with coconut oil
Steps taken / envisaged	Not viable now but maintained in the long-term plan for future implementation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Lower fuel imports, improved national accounts
Annual GHG reduction (tons)	12,550 (Source: INDC of Kiribati)
International market mechanism	To be explored

3.3.2. Measures from KIER

Table 3.17: Deployment of additional 1,500 and 1,000 kWp PV in the power system of South Tarawa

Name of action	Renewable energy deployment in the power system of South Tarawa – PV systems
Main objective	Increase share RE

Name of action	Renewable energy deployment in the power system of South Tarawa – PV systems
Description	Deployment of additional 1,500 kWp PV and 264 kW / 560 kWh Li-ion battery storage Deployment of an additional 1,000 kWp PV and additional 2,376 kW / 5,040 kWh Li-ion battery storage
Gases	CO_2, CH_4, N_2O
Type	Energy – Electricity generation
Progress of implementation	Under implementation
Implementing entity	PUB
Progress indicators	Amount of generating capacity installed
Steps taken / envisaged	Additional 1,458 kWp PV installed in 2018 for generation. There is no battery storage installed yet.
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity produced and sent to grid
Co benefits	Better air quality, Displacement of fossil fuel
Annual GHG reduction (tons)	3,645 (Actual 2,115)
International market mechanism	Not applicable

Table 3.18: Deployment of 200 kWp PV, 275 kW wind and 264 kW / 560 kWh battery storage in Zone 1

Name of action	Deployment of 200 kWp PV, 275 kW wind and 264 kW / 560 kWh battery storage in Zone 1
Main objective	Increase share RE
Description	Deployment of 200 kWp PV, 275 kW wind and 264 kW / 560 kWh battery storage in Zone 1, Kiritimati power system.
Gases	CO_2, CH_4, N_2O
Type	Energy – Electricity generation
Progress of implementation	Partly Implemented
Implementing entity	PUB and Ministry of Line and Phoenix Islands
Progress indicators	Successful deployment of PV, wind and battery systems
Steps taken / envisaged	installation of 150 kWp in Zone 1 completed with no battery storage
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity produced and sent to grid
Co benefits	Better air quality, Fuel savings
Annual GHG reduction (tons)	291.6 (Actual 218.7)
International market mechanism	Not applicable

Table 3.19: Deployment of 150 kWp PV, and 165 kW / 350 kWh battery storage in Zone 2

Name of action	Deployment of 150 kWp PV, and 165 kW / 350 kWh battery storage in Zone 2
Main objective	Increase share RE
Description	Deployment of 150 kWp PV, and 165 kW / 350 kWh battery storage in Zone 2, Kiritimati power system.
Gases	CO_2, CH_4, N_2O
Type	Energy – Electricity generation
Progress of implementation	Partly implemented
Implementing entity	PUB and Ministry of Line and Phoenix Islands
Progress indicators	Successful deployment of PV, wind and battery systems

Steps taken / envisaged	Zone 3 solar PV of 36.48kWp with a battery nominal voltage of 48V and 5,800Ah (278.4kWh) capacity
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity produced and used
Co benefits	Better air quality, Fuel savings, improved health, and livelihood
Annual GHG reduction (tons)	218.7 (Actual 53.1)
International market mechanism	Not applicable

Table 3.20: Solar Home system for additional households (6,000) in the Outer islands

Name of action	Solar Home system for additional households (6,000) in the Outer islands
Main objective	Increase share RE
Description	Solar Home systems for households (6,000) in the Outer islands
Gases	CO_2, CH_4, N_2O
Type	Energy - Residential
Progress of implementation	Ongoing
Implementing entity	EPU – MISE
Progress indicators	Number of households using PV systems
Steps taken / envisaged	NA
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Improved quality of living, better air quality, fuel savings
Annual GHG reduction (tons)	306.2 (Exact number installed not available to calculate emissions avoided accurately)
International market mechanism	Not applicable

Table 3.21: Ice plants

Name of action	Ice plants
Main objectives	Increase share RE
Description	ICE plants operating with PV systems
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional
Progress of implementation	Completed
Implementing entity	EPU-MISE
Progress indicators	Number of Ice plants operating with PV systems
Steps taken or envisaged	Funded by the Italian government
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Better air quality, better livelihood, improved health, fuel savings
Annual GHG reduction (tons)	524.9
International market mechanism	Not applicable

Table 3.22: School mini-grid small

Name of action	School mini-grid small
Main objectives	Increase share RE
Description	Small school mini grid
Gases	CO_2, CH_4, N_2O
Type	Energy - Institutional

Name of action	School mini-grid small
Progress of implementation	Ongoing
Implementing entity	EPU-MISE
Progress indicators	Number of schools with PV systems
Steps taken or envisaged	All boarding schools have their own mini-grid system. However, some of these systems are no longer operational due to financial and technical issues but these systems will be rehabilitated under the KIIREP funded by Italy. The funds have been transferred to GoK
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Amount of electricity generated and used
Co benefits	Improved livelihood, access to education, better air quality and health
Annual GHG reduction (tons)	72.2 (TBE for number of schools with system installed)
International market mechanism	Not applicable

Table 3.23: Short term deployment of PV reverse osmosis (RO) desalination systems

Name of action	Short term deployment of PV reverse osmosis (RO) desalination systems
Main objectives	Use RE to support reliable and affordable water supply
Description	Short term deployment of PV RO desalination systems
Gases	CO_2, CH_4, N_2O
Type	Energy – Commercial and Institutional
Progress of implementation	Planning stage
Implementing entity	MISE, PUB with finance from ADB, WB, GCF
Progress indicators	Number of RE-powered water desalination system installed
Steps taken or envisaged	Environment Impact Assessment completed in May 2021
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Volume of potable water produced and distributed
Co benefits	Improved quality of life, access to clean water, improved sanitation better air quality and health
Annual GHG reduction (tons) (2030)	5.8 (TBE for number of plants installed)
International market mechanism	To be explored

Table 3.24: Long term deployment of PV RO desalination systems

Name of action	Long term deployment of PV RO desalination systems
Main objectives	Use RE to support reliable and affordable water supply
Description	Long term deployment of PV RO desalination systems
Gases	CO_2, CH_4, N_2O
Type	Energy – Commercial and Institutional
Progress of implementation	Ongoing
Implementing entity	EPU-MISE
Progress indicators	Number of RE-powered water desalination systems installed
Steps taken or envisaged	Environment Impact Assessment completed May 2021
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	Volume of potable water produced and distributed
Co benefits	Improved quality of life, access to clean water, improved sanitation better air quality and health
Annual GHG reduction (tons)	8.7 (Exact number of systems installed not available to calculate emissions avoided accurately)
International market mechanism	Not applicable

Table 3.25: Contract for annual maintenance for 3-5 years, competitively bid

Name of action	Contract for annual maintenance for 3-5 years, competitively bid
Main objectives	Increase access to sustainable, reliable, and affordable energy services for all
Description	Improve annual maintenance of electricity generation system for 3-5 years competitively bid.
Gases	CO_2, CH_4, N_2O
Type	Energy Supply side – Electricity generation
Progress of implementation	Implemented
Implementing entity	PUB
Progress indicators	Amount of losses reduced.
Steps taken or envisaged	Daikai used to carry out the overhaul tasks but ceased in 2018 whence Knut is contracted for 3 – 5 years to assist with the overhaul and maintenance
Methodologies / Assumptions	NA
Estimated outcome	Reduction on total losses by 9.68% by 2025.
Co benefits	Fuel savings, Improved air quality
Annual GHG reduction (tons)	265 (Adopted from KIER where methodology not provided)
International market mechanism	Not applicable

Table 3.26: Rehabilitate distribution and transmission lines, including equipment and tools and repair of the electrical workshop at Betio

Name of action	Rehabilitate distribution and transmission lines, including equipment and tools and repair of the electrical workshop at Betio
Main objectives	Increase access to sustainable, reliable and affordable energy services for all
Description	Mitigate technical losses
Gases	CO_2, CH_4, N_2O
Type	Energy – Electricity distribution
Progress of implementation	Completed in 2017
Implementing entity	PUB
Progress indicators	Reduced losses observed
Steps taken or envisaged	Project fully implemented
Methodologies / Assumptions	NA
Estimated outcome	Reduce losses from 6.0% to 3.0%.
Co benefits	Fuel savings, Improved access to electricity for better standard of living
Annual GHG reduction (tons)	456 (Adopted from KIER where methodology not provided)
International market mechanism	Not applicable

Table 3.27: Meter audits to identify meter faults and preclude illegal power connections

Name of action	Meter audits to identify meter faults and preclude illegal power connections
Main objectives	Increase access to sustainable, reliable and affordable energy services for all
Description	Reduce non-technical losses
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned

Name of action	Meter audits to identify meter faults and preclude illegal power connections
Implementing entity	PUB
Progress indicators	Reduction in losses observed
Steps taken or envisaged	Reduction in technical losses
Methodologies / Assumptions	NA
Estimated outcome	Project implementation under preparation
Co benefits	Fuel savings, Improved access to electricity for better standard of living
Annual GHG reduction (tons)	695 (Exact number of actions completed not available to estimate emissions avoided accurately)
International market mechanism	To be explored

Table 3.28: CFL promotion – to replace incandescent lights with CFL

Name of action	CFL promotion – to replace incandescent lights with CFL
Main objectives	Improve energy efficiency in residential buildings
Description	CFL promotion – Replace 1408 incandescent lights with CFL.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Completed
Implementing entity	EPU-MISE
Progress indicators	Number of incandescent lamps replaced; Number of buildings with CFL
Steps taken or envisaged	Completed
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	All bulbs replaced
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	78
International market mechanism	Not applicable

Table 3.29: Replacement of 4 feet LTL tube lights with LEDs

Name of action	Replacement of 4 feet LTL tube lights with LEDs
Main objectives	Improve energy efficiency in residential building
Description	Replacement of 4 feet LTL tube lights with LED lamps
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	EPU-MISE
Progress indicators	Number of 4 feet LTL replaced; Number of buildings with LED lamps
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	51 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.30: Replacement of 2 feet LTL tube lights with LEDs

Name of action	Replacement of 2 feet LTL tube lights with LEDs
Main objectives	Improve energy efficiency in residential building
Description	Replacement of 2 feet LTL tube lights with LEDs
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	EPU-MISE
Progress indicators	Number of 2 feet LTL replaced; Number of buildings with LED lamps
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	30 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.31: Adopt and implement the use of energy efficient labels and standards for freezers, refrigerators through an amendment to the Consumer Act

Name of action	Adopt and implement the use of energy efficient labels and standards for freezers, refrigerators through an amendment to the Consumer Act
Main objectives	Improve energy efficiency in residential building.
Description	Amend the Consumer Act to set norms for energy efficient labels and standards for freezers and refrigerators
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Ongoing
Implementing entity	EPU-MISE
Progress indicators	% of freezers and refrigerators with EE labels sold
Steps taken or envisaged	Covered under the Minimum Energy Performance Standard and Labelling legislation
Methodologies / Assumptions	NA
Estimated outcome	In progress – Amendment to legislation under preparation
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	297 (Adopted from KIER where methodology not provided)
International market mechanism	Not applicable

Table 3.32: Replacing 4 ft. LTLs with LEDs in 40% of commercial buildings

Name of action	Replacing 4 ft. LTLs with LEDs in 40% of commercial buildings
Main objectives	Improve energy efficiency in commercial buildings
Description	Replacing 4 feet LTLs with LED lamps
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	EPU-MISE
Progress indicators	Number of 4 feet LTL replaced
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA

Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	20 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.33: Replacing 2 ft LTLs with 2 ft. LED

Name of action	Replacing 2 ft LTLs with 2 ft. LED
Main objectives	Improve energy efficiency in commercial buildings
Description	Replacing 2 feet LTLs with LED lamps
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	EPU-MISE
Progress indicators	Number of 2 feet LTL replaced
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	12 (Adopted from KIER where methodology not provided
International market mechanism	To be explored

Table 3.34: Replacing inefficient air conditioners in 40% of commercial buildings

Name of action	Replacing inefficient air conditioners in 40% of commercial buildings
Main objectives	Improve energy efficiency in commercial buildings
Description	Replacing inefficient air conditioners in 40% of commercial buildings
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Commercial
Progress of implementation	Planned
Implementing entity	EPU-MISE
Progress indicators	Number of aircons replaced % of buildings with efficient aircons
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	296 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.35: Replacing inefficient refrigerators in commercial buildings

Name of action	Replacing inefficient refrigerators in commercial buildings
Main objectives	Improve energy efficiency in commercial buildings
Description	Replacing inefficient refrigerators in 40% of commercial buildings.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Commercial
Progress of implementation	Ongoing
Implementing entity	EPU-MISE

Name of action	Replacing inefficient refrigerators in commercial buildings
Progress indicators	Number of refrigerators replaced % of commercial buildings with efficient refrigerators
Steps taken or envisaged	Covered under the Minimum Energy Performance Standard and Labelling legislation
Methodologies / Assumptions	NA
Estimated outcome	In progress – Amendment to legislation under preparation
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	380 (Adopted from KIER where methodology not provided
International market mechanism	Not applicable

Table 3.36: Replacement of tube lights to LEDs in government ministry buildings

Name of action	Replacement of tube lights to LEDs in government ministry buildings
Main objectives	Improve energy efficiency in government buildings.
Description	Replacement of tube lights by LEDs in government ministry buildings.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Institutional
Progress of implementation	Planned
Implementing entity	EPU-MISE
Progress indicators	Number of tubes replaced % of commercial buildings with LED lights
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	518 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.37: Replace an average of 10 inverter type alternating current units per ministry

Name of action	Replace an average of 10 inverter type alternating current units per ministry
Main objectives	Improve energy efficiency in government buildings.
Description	Replace an average of 10 inverter type alternating current units per ministry.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	TBD
Progress indicators	Number of inverter type systems replaced
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Better access to electricity, fuel savings
Annual GHG reduction (tons)	(TBE – No data to enable estimation)
International market mechanism	To be explored

Table 3.38: Ceiling Fans Regulations Switch and replacement of inefficient ACs to fans

Name of action	Ceiling Fans Regulations Switch and replacement of inefficient ACs to fans
Main objectives	Improve energy efficiency in government buildings.
Description	Fans replacing inefficient air conditioners.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Institutional
Progress of implementation	Planned
Implementing entity	TBD
Progress indicators	Number of aircons replaced
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	19 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.39: Building renovations and retrofits and proper insulation in all government buildings

Name of action	Building renovations and retrofits and proper insulation in all government buildings
Main objectives	Improve energy efficiency in government buildings.
Description	Renovate and retrofit, including fixing of door springs and proper insulation to keep cool air, etc. in all government buildings, including energy auditing activities
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Institutional
Progress of implementation	Planned
Implementing entity	TBD
Progress indicators	Number of buildings refurbished
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	Project concept prepared
Co benefits	Fuel savings, better air quality
Annual GHG reductions (ton) (2030)	60 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.40: Repairing water pipes leakages and installation of prepayment meters and tariff rates

Name of action	Repairing water pipes leakages and installation of prepayment meters and tariff rates
Main objectives	Improve energy efficiency in water and sewerage.
Description	Repairing water pipes leakages and installation of prepayment meters and tariff rates
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Institutional
Progress of implementation	Ongoing
Implementing entity	MPWU
Progress indicators	Reduction in electricity used for water pumping
Steps taken or envisaged	Survey of leakages completed

Name of action	Repairing water pipes leakages and installation of prepayment meters and tariff rates
Methodologies / Assumptions	NA
Estimated outcome	In progress
Co benefits	Better access to water, fuel savings, better air quality
Annual GHG reduction (tons)	124 (Adopted from KIER where methodology not provided)
International market mechanism	Not applicable

Table 3.41: Current sanitation project to repair leakages and improve sewerage infrastructure

Name of action	Current sanitation project to repair leakages and improve sewerage infrastructure
Main objectives	Improve energy efficiency in water and sewerage.
Description	Energy efficiency in PUB buildings through repairs of leakages and improved sewerage infrastructure
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Institutional
Progress of implementation	Planned
Implementing entity	STSISP
Progress indicators	Reduction in electricity used for sewage pumping
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Improved sanitation, fuel savings, better air quality
Annual GHG reduction (tons)	156 (Adopted from KIER where methodology not provided)
International market mechanism	To be explored

Table 3.42: Efficient lagoon and sea public transportation developed for nearby islands to South Tarawa

Name of action	Efficient lagoon and sea public transportation developed for nearby islands to South Tarawa
Main objectives	Improve energy efficiency in sea transport
Description	Improve efficiency of maritime transport for nearby islands to South Tarawa.
Gases	CO_2, CH_4, N_2O
Type	Energy – Domestic navigation
Progress of implementation	Planned
Implementing entity	MPWU
Progress indicators	Number of efficient sea ferry system developed for outer islands
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Improved livelihood, better access to resources, fuel savings
GHG reduction (tons)	TBE – No data to enable estimation
International market mechanism	To be explored

Table 3.43: Efficient use of fuel for transport for government sector

Name of action	Efficient use of fuel for transport for government sector
Main objectives	Improve energy efficiency in government transport
Description	Efficient use of fuel for transport for government sector.

Name of action	Efficient use of fuel for transport for government sector
Gases	CO_2, CH_4, N_2O
Type	Energy– Land Transport
Progress of implementation	Planned
Implementing entity	MPWU
Progress indicators	Reduction on fuel used for land transport for Ministries
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Fuel savings, better air quality
GHG reduction (tons)	TBE – No data to enable estimation
International market mechanism	To be explored

Table 3.44: Pilot study of 100 starter kits to implement in South Tarawa.

Name of action	Pilot study of 100 starter kits to implement in South Tarawa.
Main objectives	Substitute high emitting fossil fuel with cleaner LPG
Description	Pilot study of 100 starter kits to implement in South Tarawa
Gases	CO_2, CH_4, N_2O
Type	Energy – Residential
Progress of implementation	Planned
Implementing entity	MPWU
Progress indicators	Number of households with access to modern forms of cooking fuel (LPG) and Reduction in volume of household kerosene imports.
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Better air quality, improved livelihood, improved health
GHG reduction (tons)	TBE – No data to enable estimation
International market mechanism	To be explored

Table 3.45: Increase access to improved bioenergy cook stoves

Name of action	Increase access to improved bioenergy cook stoves
Main objectives	Improve energy efficiency in cooking.
Description	Implement the 100-pilot starter kit.
Gases	CO_2, CH_4, N_2O
Type	Energy – Residential
Progress of implementation	Planned
Implementing entity	SPC-EDD
Progress indicators	Number of households using improved cook-stoves
Steps taken or envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	No progress up to date
Co benefits	Better air quality, improved livelihood
GHG reduction (tons)	TBE – No data to enable estimation
International market mechanism	To be explored

3.3.3. Measures from NDC Roadmap

Table 3.46: Strengthening and Expanding the Standards and Labelling Programme for Appliances

Name of action	Strengthening and Expanding the Standards and Labelling Programme for Appliances
Main objective	To achieve energy efficiency through capacity building and technical assistance.
Description	Market survey for the 3 products/appliances being covered, developing the minimum energy performance standards (MEPS), the higher energy performance standards (HEPS), and the labels for the three products/appliances.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	TBD
Progress indicators	Reduction in peak demand and Energy savings by households
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, lower power outage risk
Annual GHG reduction (tons)	2,900 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.47: Utility Led Program to Manage Peak Demand and Savings in South Tarawa

Name of action	Utility Led Program to Manage Peak Demand and Savings in South Tarawa
Main objective	To achieve energy efficiency through capacity building and technical assistance.
Description	Provision of technical assistance and training to the Public Utility Board (PUB) and MISE to control peak demand and save energy in Kiribati
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	MISE
Progress indicators	Reduction in peak demand and Energy savings by households
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, lower power outage risk
Annual GHG reduction (tons)	6,800 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.48: Capacity Building for Integrated Energy Planning and Energy Statistics in Kiribati

Name of action	Capacity Building for Integrated Energy Planning and Energy Statistics in Kiribati
Main objective	To achieve energy efficiency through capacity building and technical assistance.
Description	Building capacity on energy statistics and integrated energy planning for key stakeholders in Kiribati such as MISE, PUB, Kiribati Green Energy Solutions (KGES) and Kiribati Oil (KOIL).
Gases	CO_2, CH_4, N_2O
Type	Energy Supply and Demand sides
Progress of implementation	Planned
Implementing entity	MISE
Progress indicators	Reduction in national energy consumption
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	2,000 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.49: Promotion of Sustainable Procurement

Name of action	Promotion of Sustainable Procurement
Main objective	To address energy efficiency in buildings, industry and government procurement.
Description	Technical assistance and capacity building for the Central Procurement Unit of the Ministry of Finance and Economic Development (MOFED)
Gases	CO_2, CH_4, N_2O
Type	Energy Demand side – Electricity generation
Progress of implementation	Planned
Implementing entity	MOFED
Progress indicators	Reduction in national energy consumption
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	1,200 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.50: Capacity Building in Energy Efficiency in Industry

Name of action	Capacity Building in Energy Efficiency in Industry
Main objective	To address energy efficiency in buildings, industry and government procurement.
Description	Provision of technical assistance and capacity building to support the upgrading of critical industrial equipment to promote energy efficiency and cost savings.

Name of action	Capacity Building in Energy Efficiency in Industry
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Electricity generation
Progress of implementation	Planned
Implementing entity	PUB
Progress indicators	Number of trainings organized
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, improved air quality, Health benefits
Annual GHG reduction (tons)	1,100 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.51: Supporting the Retrofitting of Major Hotels and Commercial Buildings

Name of action	Supporting the Retrofitting of Major Hotels and Commercial Buildings
Main objective	To address energy efficiency in commercial buildings
Description	Provide technical assistance and financial support to hotels and commercial buildings for carrying out energy audits and cost-effective retrofits in up to 15 hotels and commercial buildings.
Gases	CO_2, CH_4, N_2O
Type	Energy DSM – Commercial
Progress of implementation	Planned
Implementing entity	MISE
Progress indicators	Number of hotels and commercial buildings retrofitted
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, better air quality, Health benefits
Annual GHG reduction (tons)	900 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.52: Outboard motor transition

Name of action	Outboard motor transition
Main objective	Decarbonize maritime transport.
Description	Replace 2,010 of the 2-stroke outboard motors with either 4-stroke or electric outboards by 2030.
Gases	CO_2, CH_4, N_2O
Type	Energy – Domestic navigation
Progress of implementation	Planned
Implementing entity	Kiribati National Shipping Limited (KNSL)
Progress indicators	Number of 2-stroke motors replaced
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings

Name of action	Outboard motor transition
Annual GHG reduction (tons)	3,700 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.53: Low carbon mini-container ship

Name of action	Low carbon mini-container ship
Main objective	Decarbonize maritime transport.
Description	Invest in a mini-container ship of 80 twenty-foot equivalent unit (TEU) capacity to be operated by Kiribati National Shipping Limited (KNSL).
Gases	CO_2, CH_4, N_2O
Type	Energy – Domestic navigation
Progress of implementation	Planned
Implementing entity	Kiribati National Shipping Limited (KNSL)
Progress indicators	Reduction in fuel consumption
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Improved livelihood, fuel savings
Annual GHG reduction (tons)	1,400 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.54: Small Low Carbon Cargo/Passenger Freighter

Name of action	Small Low Carbon Cargo/Passenger Freighter
Main objective	Decarbonize maritime transport.
Description	Invest in a freighter of approximately 200 tons, with some passenger capacity, to be operated by KNSL
Gases	CO_2, CH_4, N_2O
Type	Energy – Domestic navigation
Progress of implementation	Planned
Implementing entity	Kiribati National Shipping Limited (KNSL)
Progress indicators	Reduction in fuel consumption
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Improved livelihood, fuel savings
Annual GHG reduction (tons)	400 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.55: Zero Impact Cruise Liner

Name of action	Zero Impact Cruise Liner
Main objective	Decarbonize maritime transport.
Description	Implementation of a pilot 'zero impact' small scale cruise liner with capacity of 40 – 50 passengers operating from Tarawa to the Phoenix Islands Protected Area (PIPA).
Gases	CO_2, CH_4, N_2O
Type	Energy – Domestic navigation

Name of action	Zero Impact Cruise Liner
Progress of implementation	Planned
Implementing entity	Ministry of information, Communication, Transport and Tourism Development
Progress indicators	Fossil fuel saved from operation of cruise liner
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Improved livelihoods, Fuel savings
Annual GHG reduction (tons)	800 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.56: Bicycle/E-Bike Financing Initiative

Name of action	Bicycle/E-Bike Financing Initiative
Main objective	Enhance the access and use of bicycles and e-bicycles to reduce reliance on motor vehicle use and associated fuel consumption.
Description	Replace 60% of motorbikes with 7,000 standard bicycles and 7,000 e-bicycles
Gases	CO_2, CH_4, N_2O
Type	Energy – Land transport
Progress of implementation	Planned
Implementing entity	Ministry of Information, Communication, Transport and Tourism Development
Progress indicators	Increase in number of bicycles in use
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, better air quality
Annual GHG reduction (tons)	1,400 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.57: Multi-modal Transit Initiative

Name of action	Multi-modal Transit Initiative
Main objective	Provide technical assistance, capacity building, and investment in motorized transit services.
Description	Establish Public Private Partnerships (PPPs) to operate up to 132 buses and the necessary operational infrastructure.
Gases	CO_2, CH_4, N_2O
Type	Energy – Land transport
Progress of implementation	Planned
Implementing entity	Ministry of information, Communication, Transport and Tourism Development
Progress indicators	Number of multi-modal buses in operation.
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings, better air quality

Name of action	Multi-modal Transit Initiative
Annual GHG reduction (tons)	7,000 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.58: Biofuel Blends in Land and Maritime Transport

Name of action	Biofuel Blends in Land and Maritime Transport
Main objective	Biofuels blends used in land and maritime transport
Description	Import and use biofuel blends for diesel and petrol, and the construction of necessary infrastructure to enable use of these fuels.
Gases	CO_2, CH_4, N_2O
Type	Energy – Land transport and Domestic navigation
Progress of implementation	Planned
Implementing entity	MICTD and MISE
Progress indicators	Volume of bio-fuels blends used in land and marine transportation.
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Displacement of fuels
Annual GHG reduction (tons)	3,100 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.59: Aviation Operational Training Programme

Name of action	Aviation Operational Training Programme
Main objective	Emissions reductions through improved on-the-ground and domestic in-flight systems management, air traffic management and associated operational efficiency measures.
Description	Improved management of airport operations through technical assistance for re-training the Air Kiribati and Airports Kiribati staff.
Gases	CO_2, CH_4, N_2O
Type	Energy – Domestic and International Aviation
Progress of implementation	Planned
Implementing entity	MICTD
Progress indicators	Reduction in fuel consumption of the airport operations.
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	Fuel savings
Annual GHG reduction (tons)	400 (Adopted from NDC Roadmap where no methodology is provided)
International market mechanism	To be explored

Table 3.60: Switch to electric and hybrid vehicles

Name of action	Switch to electric and hybrid vehicles
Main objective	Avoid fossil fuel use
Description	Review regulations regarding types of vehicles imported
Sector(s) and Gases	CO_2, CH_4, N_2O
Type	Energy – Land transport

Name of action	Switch to electric and hybrid vehicles
Progress of implementation	Planned
Implementing entity	MICTD
Progress indicators	Number of electric and hybrid vehicles penetrating the market
Steps taken / envisaged	Project under preparation
Methodologies / Assumptions	NA
Estimated outcome	None
Co benefits	FOREX savings, better air quality
GHG reduction (tons)	TBE when implemented
International market mechanism	To be explored

Table 3.61. Planting of mangroves

Name of action	Planting of mangroves
Main objective	Sequester CO_2 by mangroves
Description	Plant mangroves over 4.8 ha
Gases	CO_2
Type	AFOLU – Land
Progress of implementation	Ongoing
Implementing entity	MELAD
Progress indicators	Area of mangroves planted
Steps taken / envisaged	0.15 ha planted and implementation of next stage under preparation
Methodologies / Assumptions	IPCC 2006 guidelines
Estimated outcome	Project partially completed
Co benefits	Prevent coastal degradation, Enhance fish and crustaceans' reproduction rate
Annual GHG reduction (tons)	42.5
International market mechanism	Not applicable

3.3.4. Additional measures

Table 3.62. Change in manure management and composting

Name of action	Change in manure management and composting
Main objective	Reduce emissions from manure management
Description	Promote composting of swine excreta in lieu of the dry lot system
Gases	CH_4, N_2O
Type	AFOLU – Livestock
Progress of implementation	Planned
Implementing entity	MELAD
Progress indicators	Amount of manure composted
Steps taken / envisaged	None
Methodologies / Assumptions	IPCC 2006 guidelines
Estimated outcome	None
Co benefits	Improve environment, increase agricultural production
Annual GHG reduction (tons)	3,700
International market mechanism	To be explored

Table 3.63: Reduce removal of fuelwood

Name of action	Reduce removal of fuelwood
Main objective	Reduce usage of fuelwood for cooking by 75%
Description	Substitute fuelwood with other renewable energy sources
Gases	CO_2
Type	AFOLU - Land
Progress of implementation	Planned
Implementing entity	MELAD
Progress indicators	Amount (reduction) in fuelwood harvested
Steps taken / envisaged	Planned
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	None
Co benefits	Maintenance of forest cover
Annual GHG reduction (tons)	3,000
International market mechanism	To be explored

Table 3.64: Reduce amount of waste landfilled

Name of action	Planting of mangroves
Main objective	Cut down emissions from landfilling
Description	Diminish the amount of waste landfilled by 25%
Gases	CH_4
Type	Waste – Solid waste
Progress of implementation	Planned
Implementing entity	MELAD
Progress indicators	Amount of waste not sent to landfills
Steps taken / envisaged	Planned
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	None
Co benefits	Improved environment
Annual GHG reduction (tons)	1,300
International market mechanism	To be explored

Table 3.65: Reduce the amount of waste open burned

Name of action	Planting of mangroves
Main objective	Cut down open burning of waste
Description	Diminish the amount of waste open burned by 75%
Gases	CO_2, CH_4, N_2O
Type	Waste – Open Burning
Progress of implementation	Planned
Implementing entity	MELAD
Progress indicators	Amount (tons) of waste not open burned
Steps taken / envisaged	None
Methodologies / Assumptions	IPCC 2006 guidelines
Estimated outcome	None
Co benefits	Improved air quality
Annual GHG reduction (tons)	600
International market mechanism	To be explored

Table 3.66: Replacement of wet latrines and septic tanks

Name of action	Replacement of wet latrines and septic tanks
Main objective	Improve wastewater management
Description	Replace 75 % of wet latrines and septic tanks with dry latrines
Sector(s) and Gases	CH_4
Type	Waste – Domestic wastewater
Progress of implementation	Planned
Implementing entity	MELAD
Progress indicators	Number of wet latrines replaced
Steps taken / envisaged	None
Methodologies / Assumptions	IPCC 2006 Guidelines
Estimated outcome	None
Co benefits	Improved sanitation and health
GHG reduction (tons)	9,300
International market mechanism	To be explored

4. Constraints and gaps, and related financial, technical and capacity needs, including a description of support needed and received

4.1. Introduction

UNFCCC reporting requirements have evolved significantly and despite the progress made on numerous fronts when preparing the national reports, Kiribati still faces significant challenges. The context has changed drastically with the advent of the BTRs which is more demanding while implementation of both NDC mitigation and adaptation actions to respond to climate change is nowadays more pressing and critical. It is presently very difficult for Kiribati to meet the challenges described below as they are very ambitious and require meaningful financial, technical and human resources.

4.2. Preparation of UNFCCC reports

Kiribati prepared its INC and SNC when needed with funds from the GEF and contributions from key stakeholders. The development and operationalization of a permanent reporting framework was not seen as a must and has not been possible because it is too costly for the country to sustain, given the scarcity of resources, and the other development priorities. Enhancement ofthe reporting requirements, namely the enhanced transparency framework of the PA in accordance with its article 13 now demands for higher standards and a permanent framework to enable the sustainable production of these reports to guarantee their quality. That is, submission of the BTR and NC every two and four years respectively. In addition, there is a need to develop and establish permanent MRV systems for tracking and reporting emissions, implementation of NDC mitigation activities, support received and needed, including capacity building needs, and a robust M&E system for tracking and reporting implementation of adaptation actions. Full operationalization of the MRV systems will enable Kiribati to comply with the enhanced transparency framework when fully operationalized in the medium term.

Conscious of this situation and eager to improve compliance and the transparency level, Kiribati seeks to develop and strengthen existing institutional arrangements to enable it to meet the standards set by the MPGs laid out under Decision 18/CMA.1 of the COP. The challenges, being numerous and very daunting, will take time to be met through the development of the appropriate systems and processes along with the accompanying tools and extensive capacity building of the institutions and the national experts. Key challenges are:

- Inadequate capacity of the coordinating entity as well as lack of institutional and technical skills of the principal partners, namely institutions which will be called upon to implement NDC mitigation and adaptation actions.
- Maintaining an appropriately staffed permanent coordinating entity.
- Staff scarcity / unavailability in collaborating institutions due to their already overloaded schedules and insufficient capacity.
- Thematic technical working groups with appropriate capacity still under development.
- Lack of staff in ECD and resources, including adequate funds to develop, operationalize and maintain the appropriate systems in place.
- Lack of a centralized data collection and sharing network for UNFCCC reporting purposes.
- Inexistence of a central archiving system for storage of data and other information related to climate change actions and reporting.

Presently the Climate Change Unit of ECD comprises an adaptation and a planning sections. This is not suitable to report in accordance with the ETF of Article 13 of the PA. It is highly recommendable that an additional section be created under mitigation to oversee the 3 MRVs on emissions, tracking of mitigation and tracking of support as depicted in Figure 4.1.

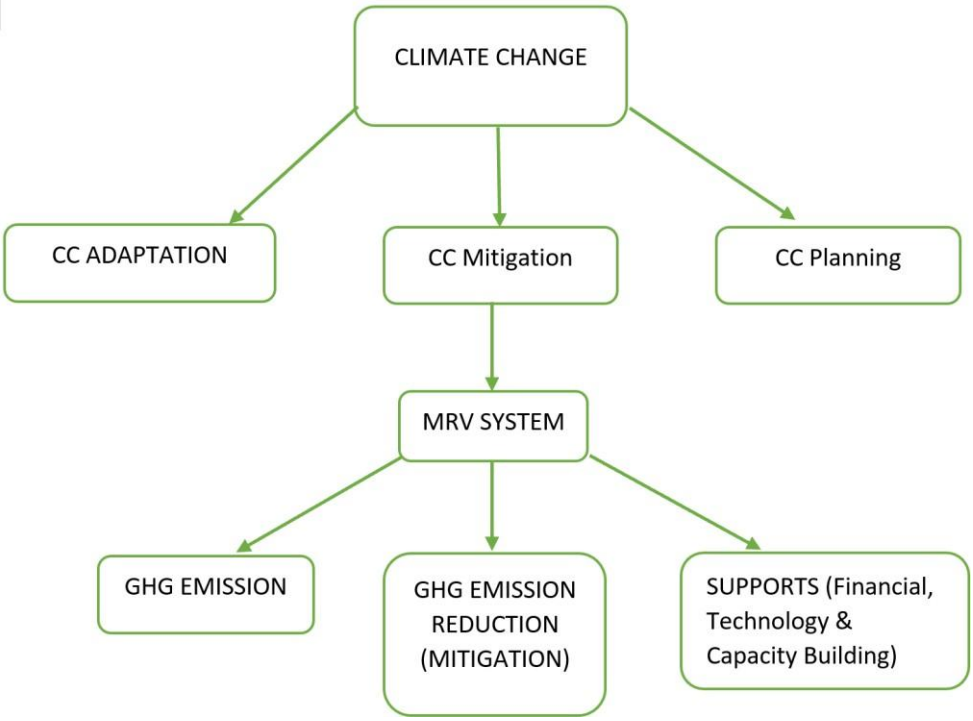


Figure 4.1: Recommended improvement in the Climate Change Unit

Already, government budget is strained due to the numerous national priorities, especially after the toll taken by the COVID-19 pandemic and it will prove difficult to allocate enough funds to cover all these expenses. It is hoped that funds will be made available through the multilateral organizations like the GCF and the GEF to support activities, including the very urgent capacity building needs, to enable Kiribati to develop, establish and implement the Enhanced Transparency Framework of the PA.

4.3. GHG inventory component

Kiribati has progressed in the compilation of its GHG inventory, especially the one reported in this BUR1 towards meeting the TACCC principles. The country has added new categories and improved its timeseries which is more consistent now. However, being both a SIDS and an LDC, it still confronts numerous constraints and gaps that need to be addressed to produce better quality GHG inventories for informing mitigation strategies and reporting. The following constraints were encountered during the preparation of the national inventory of GHG emissions presented in this report:

- Absence of a fully-fledged GHG Inventory Management System for institutionalization of the inventory process.
- Insufficient documentation of past inventories for ensuring continuity due to no proper archiving.
- Information required for the inventory were collated from various sources as the appropriate system has not yet been developed and operationalized even if MELAD has been endorsed with the responsibility for the collection of specific AD needed for estimating emissions according to IPCC methodologies.

- Almost all the AD are still not yet in the required format for feeding in the IPCC software to estimate emissions.
- End-use consumption data for most of the sectors and categories are not available and had to be generated based on scientific and consumption parameters.
- Reliable data on biomass consumed were not available. Fuelwood data were adopted from the FAO database while other biomass data was derived using statistical techniques.
- There were frequent inconsistencies in the available data, even when collected by the same institution.
- Lack of a well-defined QA/QC process.
- Insufficient solid waste characterization data, amount generated, while wastewater generated are not available and had to be derived based on demographic data.
- Lack of EFs to better represent national circumstances and provide for more accurate estimates.
- Emissions for some categories have not been estimated due to lack of AD.
- Insufficient capacity of National experts to compile an inventory.

The improvement of the GHG inventory component requires the development and implementation of a NIIP. This plan will be developed and key elements it must address are:

- A robust GHG inventory management system.
- Appropriate tools for collecting AD for computing inventories.
- An adequate and proper data capture, QC, validation, storage, and retrieval mechanism.
- National EFs to better represent national circumstances and improve estimates for key categories.
- National procedures for compilation of the inventory.
- Mobilization of the necessary resources to establish a GHG inventory unit within ECD for permanent inventory coordination and compilation.
- Improve the completeness of the inventory through the inclusion of categories not covered so far.
- A QC/QA plan as per the 2006 IPCC Guidelines to reduce uncertainties.
- Disaggregated data to improve inventory quality and address key categories at Tier 2 level.
- Maps for 1990 to 2020 to provide land use change data over 5 years periods for optimal estimation of emissions in the Land sector.
- Forest inventories to supplement available data on the Land sector.
- Add the missing years 1990 to 1999 to complete the full timeseries.

4.4. Mitigation component

Mitigation measures and actions are under implementation in the country despite the multiple constraints and gaps that Kiribati is facing, namely at the legal, institutional, and procedural levels. There is a need to improve the enabling environment in the country. Needs also exist for improving the technology assessment and transfer for mitigation, notwithstanding building of the necessary technical capacity of national experts for smooth and effective transfer. More in-depth mitigation assessments must be conducted to identify the most important measures and actions as well as prioritize those with the highest potential for successful implementation.

Barriers must be removed to speed up the process of implementation of mitigation actions, and the preparation of project proposals for funding.

Appropriate funding and timing within the schedules earmarked by the COP are important features to take into consideration when these measures and actions, especially the implementation aspect, are aligned with the country's development strategy and agenda. A sustainable flow of required funds is crucial to develop and implement mitigation projects. Up to now, Kiribati has tapped some funding to support the implementation of NDC mitigation and adaptation actions. This is not adequate and there is need for the international community to further consolidate the GCF and develop new instruments for availing the necessary funding and other support needed in a timely manner to Non-Annex I Parties to enable them to play their role in meeting the objectives of the Convention, and urgently because of their higher exposure and vulnerability to the impacts of climate change. A list of actions requiring funding and the estimated amounts for mitigation is provided in this BUR1.

The main constraints and gaps obstructing the implementation of mitigation actions, tracking and reporting thereon in the BUR are:

- Insufficient stakeholder consultation and engagement.
- Lack of an appropriate system to track and report on implementation of NDC mitigation actions.
- Absence of a centralized data collection and sharing network, specifically for addressing the implementation of NDC mitigation actions.
- Lack of appropriate tools for collecting AD and indicators for tracking and reporting on the implementation of mitigation actions.

4.5. Adaptation component

Kiribati is highly vulnerable because it is both a SIDS and an LDC at the same time. The pace at which adaptation measures are being implemented is too slow to enable the country to build its necessary resilience to climate change. Major constraints and gaps preventing optimal adaptation and resilience building in the different socio-economic sectors are:

- Inadequate stakeholder consultations and engagement to buy them all in the process.
- Lack of an appropriate system to track and report on implementation of NDC adaptation actions.
- Lack of tools for tracking progress in implementation of NDC adaptation actions.
- Lack of a centralized data collection and sharing network, specifically for addressing adaptation.
- Insufficient detailed vulnerability and risk assessments of key socio-economic sectors of the country to inform adaptation strategies.
- Inadequate in-depth adaptation assessments of key socio-economic sectors of the country.
- Lack of sufficient observations such as meteorological, hydrological and sea level rise data to inform vulnerability and adaptation assessments and develop risk management strategies.
- Early Warning Systems for informing the population of hazards.
- Timely dissemination of information to prevent losses and damage.
- Insufficient resources to implement adaptation actions.

4.6. Capacity Building component

The flow of technical and capacity building support is considered insufficient to-date to enable Kiribati to smoothly implement the identified strategies for mitigating and adapting to climate change. Kiribati has achieved some progress in enhancing the technical capabilities of a restricted number of national experts through capacity building for reporting to the Convention within the framework of GEF funded enabling activities for producing NCs and presently the BUR1. Since Kiribati has prepared only 2 NCs and is in the process of finalizing its NC3 (In press) and BUR1 presently with the latter two reports dragging over quite a long period of time due to severe lack of capacities, it is imperative that the country invests in capacity building with support from the international community and development partners.

Kiribati requires technical, and capacity building support to implement its NDC mitigation and adaptation actions to meet the objectives of the Convention and report on these as per Articles 7 and 9 of the PA. Technical capacity building concerns mainly mitigation and adaptation technologies to be identified in relation with the measures that are most prominent and prioritized for implementation in the NDC implementation plan and strategy. Several other overarching issues such as information sharing and networking, knowledge sharing, and sensitization also must be addressed for successful implementation of the NDC mitigation and adaptation actions.

As a developing country, Kiribati needs robust institutional structures to take on and implement programs and activities on climate change. Building human and institutional capacity to address climate change will be a fundamental component of the NDC implementation. Capacity building for climate change will thus include further development and strengthening of personal skills, expertise and capacity of relevant institutions and organizations on adaptation, mitigation and reporting. Capacity building targets a wide group of stakeholders, including the government, NGOs, local communities, and the private sector. A list of current technical and capacity building support received and needed is provided in Table 4.1.

Table 4.1: Technical and capacity building needs including support received

Activity	Status	Support needed	Support received
Mainstream climate change in national, local and sectoral policies, development plans and programmes, including gender consider	Ongoing	Technical assistance	None
Preparation of BURs and NCs	Ongoing	Additional technical assistance to strengthen existing institutional arrangements for enhancing coordination and build capacity of national experts	GEF funds under Enabling Activities for preparing NCs and BURs
Compilation of GHG inventories	Ongoing	Further capacity building for estimating emissions, generating national EFs, training the on IPCC 2006 Guidelines and software, and applying the EMEP EEA methods as appropriate	Capacity building of a restricted number of experts through contracting of an international consultant within the framework of the BUR1 preparation
Preparation of land use/cover maps for tracking land use changes and improve estimates of the Land sector	Planned	Technical Assistance to use satellite imagery for producing land use/cover maps and generate land use changes over time	None
Develop tools for tracking and reporting on GHG emissions,	Planned	Technical assistance for developing the tools including capacity building of stakeholders for using them	None

Activity	Status	Support needed	Support received
mitigation, adaptation and support received and needed			
Generate national EFs	Planned	Technical assistance/funds	None
Develop and implement MRV systems	Non-existent	Technical assistance/funds	Some funds under the BUR1 allocation
Improve knowledge on international market mechanisms to mobilize resources for implementing NDC mitigation and adaptation actions	Ongoing	Assistance to enhance capacity of national experts to understand and take advantage of international market mechanisms for appropriation of resources for NDC mitigation and adaptation projects	None
Improve energy efficiency in buildings	Ongoing	Capacity building of national experts to integrate energy efficiency concepts in new buildings	None
Reduce distribution losses in the electricity network	Planned	Capacity building of PUB officers to assess and implement measures to reduce losses	None
Energy audits	Ongoing	Assistance to train national experts and technicians to perform energy audits to improve energy efficiency	None
Switch from biomass to solar/LPG	Ongoing	Assistance to promote technology and evaluate impact	None
Improve wastewater treatment	Ongoing	Assistance to evaluate impact and other benefits of mitigation technologies	None
Develop disaster risk reduction plans and programmes	Ongoing	Technical assistance and capacity building	None
Develop educational and awareness materials on climate change	Planned	Technical assistance and capacity building	None
Undertake vulnerability and adaptation assessments	Planned	Technical assistance and capacity building	None

4.7. Financial component

Avenues concerning funding to the 2030 and 2035 time-horizons respectively have been identified in the First NDC and further detailed in the implementation roadmap for the Transport and Energy Efficiency sectors. These sums amount to some 4.629 M USD for mitigation and 69.021 M USD for adaptation. A small percentage of these have been mobilized so far and a few activities completed. In this context, the Climate Finance Division of the Ministry of Finance and Economic Development is now accredited with the GCF to mobilize finance from this entity for implementing projects on climate change.

The need also exists to develop assessment tools to inform decision-making, and to establish partnerships among national and local government agencies, business, professional and other private groups, community-based organizations, academic and scientific organizations and civil society organizations in order to realize Kiribati's objectives. Policy and incentive mechanisms must be introduced to facilitate and leverage private sector investment in climate actions, and it is expected that Public Private Partnerships will contribute both monetary and human resource capacity to implement the required actions. So far, the private sector has contributed only marginally to climate actions.

4.7.1. Financial Needs

Substantial funding is required to enable Kiribati to meet its reporting obligations and implement the Convention. Timely funding is crucial for preparing the necessary reports for the country to comply with the COP decisions.

Reporting is more stringent and frequent now to meet the ETF of the PA. Kiribati has only been able to develop very limited national capacity and needs to urgently develop and strengthen the existing reporting framework to meet its obligations. Human and other resources are still lacking. Countries should also be endowed with operational MRV systems to track emissions, mitigation, and support. Kiribati intends to make use of CBIT funds from the GEF to develop and implement its MRV systems to track the implementation of the NDC. Funding by the GEF for the preparation of the future BTRs within a 2-years cycle will be problematic.

Implementation of the Convention as per the country's low-carbon strategy is even more demanding because of the significant amounts of funds required to develop and implement mitigation and adaptation projects. Funding implementation of mitigation actions as estimated in the NDC is around 4.629 M USD for mitigation and 69.021 M USD for adaptation. Kiribati is a SIDS and LDC and is already facing difficult challenges to maintain the welfare of its population due to various constraints and this has worsened following the economic downturn resulting from the COVID-19 pandemic. Under such circumstances, the country will not be able to allocate funds to meet its climate change agenda and relies heavily on support from the international community. Table 4.2 provides an estimate of support needed and received since 2016 and earlier for projects still ongoing.

Table 4.2: Financial support received and needed

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
Preparation and submission of BTR1	Planned	352 from the GEF for the BUR1	
Preparation and submission of combined BTR2/NC4	Planned	500 from the GEF for the NC3	517 for the combined BTR2/NC4 and 100 for preparation of appropriate land use and land cover maps for the period 1990 to 2020
Mobilization of resources to establish a GHG inventory, a mitigation and an adaptation unit within ECD for the sustainable preparation of NCs and BTRs.	Understaffed		24 annually
Develop tools for tracking and reporting on GHG emissions, mitigation, adaptation and support received and needed	Planned		200
Generate national Efs	Planned		100
Develop and implement MRV systems	Non-existent		300
Kiribati adaptation programme (Phase III)	Completed 2019	3,000 – GEF	
PAS: Grid connected solar PV central station project	Completed 2019	1,000 – GEF	
Enhancing national food security in the context of global climate change	Completed 2016	4,446 – GEF	
Building resilience of health systems in Pacific Island LDCs to climate change	Approved Regional		76,000 – GEF
Enhancing Whole of Islands Approach to Strengthen Community Resilience to Climate and Disaster Risks in Kiribati	Planned		45,000 – GEF

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
South Tarawa water supply project (Additional funding)	Approved 2019		4,590 – GEF 20,000 – ADB
Promoting Outer Island Development through the Integrated Energy Roadmap (POIDIER)	Project under assessment		5,379 – GEF
Climate Information and Early Warning Systems, One Pacific Programme	Concept note Regional		106,000 – GCF
The Vaka Motu (boat for the islands) building indigenous community resilience with low emission sea transportation in the Micronesian region	Concept note Regional		10,000 – GCF
Gender Equity and Social Inclusion Action Plan (GESIAP) for South Tarawa water supply project	Ongoing		48 – GCF
Adapting tuna-dependent Pacific Island communities and economies to climate change (Project Preparation Funding application)	Approved		1,500 – GCF
Readiness Support	Completed		585.927 – GCF
Strengthened weather and climate services for resilient development for Pacific Islands	Concept note		10,000 – GCF
Capacity Building and Sector Reform for Renewable Energy Investments in the Pacific	Project under development Regional		5,000 – GCF 1,225 – TA special fund
Building Coastal Resilience through Nature-Based and Integrated Solutions	Project under development Regional		500 – TA special fund 500 – Regional cooperation and integration fund 1,675 – Ireland trust fund 69 – GEF 441 – GEF LDCF 2,500 – Asia Pacific climate finance fund 837.139 – GEF SCCF
Development of the Pacific Energy Regulators Alliance	Project under development Regional		350 – Regional Cooperation and Integration Fund 250 – TA Special Fund
South Tarawa Renewable Energy Project	Ongoing	Not available	8,000 – ADB 2,000 – Government of New Zealand 3,700 – Strategic Climate Fund
Preparing Floating Solar Plus Projects under the Pacific Renewable Energy Investment Facility	Ongoing Regional	332 – Clean Energy Fund under the Clean Energy Financing Partnership Facility	3,168 – Clean Energy Fund under the Clean Energy Financing Partnership Facility

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
Implementation of the Strategic Program for Climate Resilience: Pacific Region	Ongoing Regional	3,249 – Strategic Climate Fund	449 – Strategic Climate Fund
Development of Pacific Power Utilities Reform Network	Project under Development Regional		900 – Technical Assistance Special Fund
Pacific Disaster Resilience Program	Ongoing Regional	8,800 – Asian Development Fund	2,000 – TA Special Fund 1,000 – Ireland Trust Fund
Preparing the Pacific Regional Financing Facility	Ongoing Regional	71 – Regional Cooperation and Integration Fund	200 – TA Special Fund 329 – Regional Cooperation and Integration Fund 400 – Clean Energy Fund
Pacific Renewable Energy Investment Facility	Project under development		80,000 – Asian Development Fund 120,000 loan
Preparing the Pacific Renewable Energy Investment Facility (Phase 2)	Ongoing Regional	1,695	1,809 – TA Special Fund 1,000 – Strategic Climate Fund – SREP
Support to Climate Resilient Investment Pathways in the Pacific	Ongoing Regional	828	2,172 – TA Special Fund 1,000 – Climate Change Fund 1,000 – Strategic Climate Fund
Preparing Projects to Enhance Transport Connectivity and Resilience in the Pacific, Phase 2	Project under development		5,000 – TA Special Fund
Kiribati Education Improvement Program	Completed 2020	6,566 – AUSAID	
Pacific Technical Assistance Mechanism (PACTAM)	Ongoing Regional	Not available	Total cost: 15,611 – AUSAID
Pacific Women Shaping Pacific Development in Kiribati Program	Ongoing Regional	Not available	Total cost: 6,633 – AUSAID
Secretariat of the Pacific Regional Environment Programme (SPREP)	Ongoing Regional	Not available	Total cost: 11,524 – AUSAID
Governance for Resilient Development in the Pacific Gov4Res)	Ongoing Regional	Not available	Total cost: 5,293 – AUSAID
KIWA initiative	Ongoing Regional	Not available	Total cost: 60,000 – European Union (EU), Agence Française de Développement (AFD), Global Affairs Canada (GAC), Australian Government and New Zealand
KUC Tabiteuea water catchment rehabilitation project	Ongoing	Not available	Total cost: 23 – GEF
Rainwater harvesting system for new settlements at Main Camp, Kiritimati	Ongoing	Not available	Total cost: 35 – GEF

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
Climate Smart Technology for fetching freshwater	Ongoing	Not available	Total cost: 25 – GEF
Integrated livelihood adaptation project	Ongoing	Not available	Total cost: 49 – GEF
RAK Centre – Integrated agricultural demonstration Project	Ongoing	Not available	Total cost: 20 – GEF
Sanitation and water supply improvement project	Ongoing	Not available	Total cost: 18 – GEF
Strengthening sanitation through toilet and water supply improvement project	Ongoing	Not available	Total cost: 44 – GEF
Te Mamauri Community Small scale solar powered water	Ongoing	Not available	Total cost: 30 – GEF
Arabwata Climate Smart Technology and Watershed Management	Ongoing	Not available	Total cost: 30 – GEF
Climate smart technology and watershed management for Tangintebu communities	Completed	40 – GEF	
Green Learning at Itoin Mainiku High School	Completed	40 – GEF	
Tangkore Climate Smart Technology and Watershed Management for improved health and environment	Ongoing	Not available	Total cost: 30– GEF
Climate Smart Technology and watershed management for improved health and environment	Ongoing	Not available	Total cost: 40 – GEF
Rural Women Solar Electrification – Tabonibara Village Project	In abeyance		36 – GEF
Buariki Village Sustainable Development Project	Completed	32 – GEF	
Construction of Water Harvesting Infrastructure and Climate Smart Technology to improve the community's resilience and adaptation to Climate Change	Completed	45 – GEF	
Construction of Water Harvesting Infrastructure and Septic Toilet Systems, and improving Te Roti community's Adaptive Capacity to Natural Hazard	Completed	20 – AUSAID	
Construction of Water Harvesting Infrastructure and Septic Toilet Systems, and improving the Bonnano Community's Adaptive Capacity to Natural Hazards	Completed	20 – AUSAID	
Construction of Water Harvesting Infrastructure and Septic Toilet Systems, and improving the Mauanako Community's Adaptive Capacity to Natural Hazards	Completed	20 – AUSAID	
Construction of Water Harvesting Infrastructure and Septic Toilet Systems, and improving the Nei Kaue Community's Adaptive Capacity to Natural Hazards	Completed	20 – AUSAID	
Construction of Water harvesting infrastructure and Septic toilet systems, and	Ongoing	Not available	Total cost: 40 – AUSAID

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
improving the St. Patrick community's adaptive capacity to Natural Hazards			
Construction of Water harvesting infrastructure and Septic toilet systems, and improving the St. Patrick community's adaptive capacity to Natural Hazards	Completed	20 – AUSAID	
Construction of Water Harvesting Infrastructure and Septic Toilet Systems, and Improving the Te Roti community's Adaptive Capacity to Natural Hazards		Not available	Total cost: 40 – AUSAID
Katorika Bonriki West Sustainable Village Development Project	Completed	32 – GEF	
Kawan Bairiki Sustainable Village Development Project	Completed	33 – GEF	
Korokota Church Community Sustainable Village Development Project	Completed	35– GEF	
KUC Bonriki est Sustainable Village Development Project	Completed	35– GEF	
KUC Temaiku Village Sustainable Development Project	Completed	32 – GEF	
Santo Betero Tianere Parish Sustainable Development Project	Completed	43 – GEF	
Te Utu Temaiku Sustainable Village Development Project	Completed	39 – GEF	
Project Preparation Training	Regional	Not available – USAID	Not available – USAID
Humanitarian assistance to respond to the drought	Ongoing	Not available	500 – USAID
Kiribati Outer Islands Resilience and Adaptation Project	Ongoing	Not available	20
Preparation of the NDC Implementation Roadmap for Transport and Energy Efficiency Sectors	Completed 2020	Not available – GIZ, AUSAID and Government of New Zealand	
Strengthening good governance, policies & legislation	Planned		4,500
Improving knowledge and information generation, management and sharing	Planned		3,700
Strengthening and greening the private sector including small business	Planned		3,305
Increasing water and food security with integrated and sector specific approaches and promoting healthy and resilient ecosystems	Planned		3,145
Strengthening health service delivery to address climate change impacts	Planned		317

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
Promoting sound and reliable infrastructure development and land management	Planned		35,159
Delivering appropriate education, training and awareness programmes	Planned		5,011
Increasing effectiveness and efficiency of early warnings and disaster emergency management	Planned		3,021
Promoting use of sustainable renewable sources of energy and energy efficiency	Planned		10,278
Strengthening capacity to access finance, monitor expenditures and maintain string partnerships	Planned		237
Maintain the sovereignty and unique identity of Kiribati	Planned		121
Enhancing the participation and resilience of vulnerable groups	Planned		280
Solar PV mini grid system for Southern Kiribati Hospital – design, procure and install off-grid PV systems for the Southern main hospital (265kWp) to a level to support the fully equipped needs to operate the hospital	Planned		1,608
Outer Island Clinic solar system rehabilitation – design, procure, and install 58 systems in total on 20 outer Islands to provide power for lighting and for HF communication radio	Planned		154
Mereang Taabwai Secondary Schools solar PV mini-grid – design, procure and install off-grid PV systems (20 kWp) for the school to a level to support a fully equipped computer lab, dormitory lighting, refrigerator/freezers, office equipment and audio-visual equipment	Ongoing	335	
Junior Secondary School (JSS)system – design, procure and install off-grid PV systems for lighting and Charging Laptop computers of 2 classrooms and staff room in all JSS in the Outer Islands (410 Wp each)	Planned		191
Solar Home System for Households – procure and install 3900 solar home system to cover up all remaining households in the Outer Islands. The system will provide basic lighting, phone and radio charging which will improve socioeconomic condition in the Outer Islands	Ongoing	1,005	
Outer Island Council solar PV mini grid system – design, procure and install off-grid PV systems (5 kWp each) for island council	Planned		476

Activity/Project	Status	Support received (10^3 USD)	Support needed (10^3 USD)
administrative centres in the Gilbert and Line Group			
Outer Island Fish Centres – design, procure and install off-grid PV systems for the Fish Centres (3.75kWp each) in all the Islands to a level to support a fully equipped centres lighting, refrigeration and other equipment	Planned		409
Desalination Plant for vulnerable rural community – 19 systems for 12 community systems for solar water desalination plant will be procured and installed on 9 selected Islands. This activity will improve quality of life in households by providing portable water supply to the most vulnerable Islands in Kiribati	Planned		77
Outer Island Police Station solar system rehabilitation – 23 solar systems (120 Wp each) will be procured and installed in all of the outer Islands for communication, lighting, etc at the Police stations and an additional 8 Police posts	Planned		40
Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institution – design, procure and install off-grid PV systems (10 kWp) for each community institution to support the institution daily activities	Completed 2017	335	

5. Information on domestic measurement reporting and verification

5.1. Introduction

The Bali Action Plan introduced the principle of Measurement, Reporting and Verification (MRV) for both developed and developing country Parties for enhancing action at the international and national levels to mitigate climate change. Paragraphs 61 and 62 of decision 1/CP.16 made it mandatory for non-Annex I Parties to also Measure, Report and Verify domestically and internationally supported mitigation actions with the latter also subject to international MRV. Paragraph 61 states "Also decides *that internationally supported mitigation actions will be measured, reported and verified domestically and will be subject to international measurement, reporting and verification in accordance with guidelines to be developed under the Convention*" and paragraph 62 "Further decides *that domestically supported mitigation actions will be measured, reported and verified domestically in accordance with general guidelines to be developed under the Convention*". In line with these decisions, signatory Parties to the UNFCCC have the obligation to provide information on their domestic MRV system in place to track Emissions, Mitigation and Support received and needed as a chapter detailing these arrangements to the Conference of the Parties (COP) in their Biennial Update Report (BUR) and subsequently in their biennial Transparency Report (BTR) every 2 years.

Reporting transparently on implementation of the Convention through tracking of the NDC on mitigation and adaptation actions and support received and needed requires well-developed and operational MRVs. This requirement under decision 18/CMA.1, which is presently non-existent, will be catered for in the future domestic MRV system to be developed and deployed. Kiribati has conceptualized one such system within the framework of the preparation of its BUR1 for development and implementation in the future. The MRV system will be an online interactive platform where all stakeholders can feed in climate change data and information relative to implementation of the UNFCCC and reporting to the latter as per the ETF of the PA. It will also serve for sharing data between ministries and other relevant stakeholders for analysis and integration in development programmes and projects to support the low carbon development strategy of the country. The system will also serve as a repository of climate change data with all submissions quality controlled and archived in a user-friendly data base.

5.2. General procedures, principles and requirements for MRV

Under the UNFCCC, Parties are encouraged to establish the following general procedures to optimize limited resources for domestic MRV:

- Designate a single entity responsible for overall coordination of domestic MRV.
- Assign roles and responsibilities for implementation of the domestic MRV system, including identifying entities responsible for collection and management of source/relevant data.
- Construct timelines and work plans that include all stages of MRV and ensure sufficient time and resources are available to enable entities follow best practices.
- Collect sufficient AD, process information and EFs, and/or other metrics (source/relevant data) as are necessary to support the quantification of emissions and removals, to track the impact of the implementation of emission reduction and adaptation activities, and to subsequently verify the method chosen and its reported impact.
- Measure emissions/removals or other performance metrics of nationally appropriate mitigation and adaptation actions, evaluate progress of those actions and feedback for the development of enhanced mitigation and adaptation actions and needs of support.

- Consider ways to improve the quality of data and other information, taking into account Quality Assurance/Quality Control (QA/QC) results, and outputs of any analysis processes.

To ensure integrity of the domestic MRV system, the process should be guided by the five reporting principles of the IPCC Good Practice Guidance (GPG), which are Transparency, Accuracy, Completeness, Comparability and Consistency (TACCC) of information (UNFCCC, 2009). Kiribati intends to align to these principles when developing its domestic MRV system.

The Disaster Risk Management and Climate Change Act 2019 defines the governing structure regarding climate change in the country.

All government ministries, agencies and bodies are required to:

- Ensure mainstreaming and integration of climate change and disaster risk management considerations in the execution of their regular functions; and
- Facilitate effective participation of their representatives on KNEG and ensuring an internal system is in place for the representative(s) to keep their ministry, agency or other body updated.

Thus, the Disaster Risk Management and Climate Change Act 2019 provide the framework for developing and operationalizing the domestic MRV system.

5.3. Conceptualization of the MRV system

Kiribati will build on the existing Monitoring and Evaluation (M&E) system which is in place to optimize use of resources while gaining time for developing readiness to report in accordance with the ETF of the PA. The ETF clearly sets the MPGs for enhancing transparency of reporting in BTRs to the UNFCCC as contained in decision 18/CMA.1. The process has privileged a two-pronged approach consisting of a review and assessment of the present situation to identify existing gaps and barriers constraining reporting in line with the ETF of the PA and removing these gaps and barriers within the new domestic MRV system. The exercise will aim at addressing institutional arrangements, legal and procedural agreements, data and information, and financial gaps and barriers.

5.3.1. Institutional arrangements

The Ministry of Finance & Economic Development (MFED) is responsible for coordinating climate change financing at the national level. MELAD/ECD, through its Climate Change Unit (CCU) is mandated to implement externally funded and local climate change initiatives and projects, including reporting to the UNFCCC and strengthening national capacity for effective response and adaptation to climate change, with a particular focus on environmental protection and management. The multi-sectoral KNEG provides scientific and technical advice and a mechanism for cross-sectoral coordination (Disaster Risk Management and Climate Change Act 2019). Various Ministries and organizations have roles and responsibilities for climate change issues as outlined in the Kiribati Climate Change Policy (KCCP) but these are not yet clearly defined. The stakeholders collaborating in the above structure will be leveraged to participate in the 3 MRVs, namely on GHG inventory, Mitigation and Support, as appropriate. Key existing gaps are inter-sectoral and national-regional coordination weaknesses which will be addressed through consultations when assigning roles and responsibilities, further detailed under the individual MRV system.

5.3.2. Legal and procedural agreements

Except for the clear mandate assigned to MELAD-ECD, there exists no clear attribution of roles and responsibilities for reporting to the Convention and tracking Nationally Determined Contributions (NDC) actions on both mitigation and adaptation. Given that implementing and reporting on climate actions is more of a multisectoral nature with cross-cutting issues, many more stakeholders will be called upon to contribute to MELAD-ECD on these initiatives. This gap and barrier will be addressed through the

consolidation of the existing legislation, namely the Disaster Risk Management and Climate Change Act 2019, through the development of procedural agreements to formalize collaboration and the roles and responsibilities of all institutions within the MRV systems to enable Kiribati to meet the ETF of the PA.

An exhaustive analysis of all laws and regulations governing data and information exchange in the country with respect to climate actions will be done prior to the design, development and roll out of the MRV system. This will result in the identification of existing gaps and barriers and the appropriate corrective measures and actions to be taken for smoothing the process for data and information flows. This exercise will also avoid duplication of responsibilities and improve the institutional arrangements. Based on the Disaster Risk Management and Climate Change Act 2019, MELAD-ECD can develop the necessary procedures detailing how national institutions and organizations will contribute to the MRV systems. This will serve to internalize the process for producing NCs and BTRs in a sustainable manner.

5.3.3. Data and information management

Despite the efforts made to cover all existing sources and sinks, the national GHG inventory of the BUR1 is still incomplete and needs further improvement to meet the TACCC principles. Similarly, there is a dearth of information regarding implemented and planned mitigation and adaptation actions. Reporting on mitigation and adaptation actions of the country as per Annexes 4 and 7 of decision 18/CMA.1 and tracking of the NDC implementation require tools and templates to facilitate generation, collection and submission of data and information annually for incorporation in the centralized data network. Furthermore, Annexes V and VI of decision 18/CMA.1 describe the reporting requirement for information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the PA. Enhanced transparency in the reporting of support received and needed, requires the country to collect data and other information on these items. Concurrently, all data and information collected will need to be properly managed in the centralized database and archived appropriately.

An Environmental Information & Data Management (EIDM) system has been developed and is operational regarding collection and storage of data on adaptation and generally on the environment in a centralized database. However, it needs to cater for additional data required for climate change reporting in accordance with the ETF of the PA for reporting on emissions, NDC tracking, and support received and needed. Further development will comprise strengthening of the existing data and information collection network under the responsibility of the Environment Information and Data Management Section for an automatic annual flow and storage in a centralized data network. Concurrently, the necessary tools and templates for data and information collection for feeding in and retrieving from the central data repository for climate reporting, including the BTR, will be developed and shared with stakeholders for their use.

5.3.4. Capacity Building

Kiribati resorted to ad-hoc reporting to the UNFCCC due to lack of capacity of a restricted number of national experts. Capacity building has been slow during the implementation of the Enabling Activities which explains why the country is still at its NC3 and BUR1. When performing the exhaustive situational analysis on the gaps and barriers, special attention will be paid to the capacity building needs to prepare the country for inhouse reporting in the future as ad-hoc reporting is no longer sustainable given the frequency and standard required. Capacity building will be primordial to the deployment and successful operationalization of the domestic MRV system. All stakeholders will be capacitated on using the tools and templates as well as the centralized data network for handling data and information required.

5.3.5. Financial resources

Being an LCD and a SIDS, Kiribati seriously lacks financial resources to implement climate measures and supplement GEF allocations for Enabling Activities for reporting to the Convention. While Kiribati acknowledges the support received from the GEF, bilateral partners, and other multilateral organizations to implement climate change activities, lack of resources and capacity prevented the routine collection of data and information on financial and other support received. Similarly, support needed by the country for implementing the Convention has not been assessed regularly and in a systematic manner due to the inexistence of an appropriate platform, except during the preparation of the INDC. The forthcoming MRV will address this gap within the MRV support component. Key financial barriers can be summarized as follows:

- Insufficient State contribution for climate change projects and initiatives.
- Insufficient capacity to evaluate financial support needed.
- Lack of funds to develop the required data infrastructure for centralizing information collection and management on support.

5.4. Kiribati's proposed MRV system

Collection of data and other information for producing the last GHG inventory, and information on mitigation actions and support received and needed used for the preparation of the BUR1, indicate that the present systems and arrangements for the MRV of Emissions (GHG inventory) are still weak and need strengthening while the MRV for Mitigation and Support are in their infancies. Based on this observation and the available policies and plans, new concepts have been identified for the development and operationalization of the three components of the domestic MRV, the intent being to meet the requirements of the ETF of the PA.

Since climate change affects directly or indirectly all socio-economic development sectors and is embedded in almost all the Sustainable Development Goals (SDGs), therefore all Ministries through their various Departments, Institutions and Agencies, Non-Governmental Organizations (NGOs), Civil Society Organizations (CSOs) and other community organizations will need to actively collaborate and contribute to the implementation of climate change activities at local, Outer Islands and national levels. The existing local and Outer Islands structures should also be integrated for implementation of climate change activities within their areas of jurisdiction. It is most encouraging that Kiribati has already included all stakeholders within the institutional and governing structure for climate change within its KCCP. The missing link is the assignment of clear roles and responsibilities within this structure for reporting purposes.

Unfortunately, data required specifically for compiling GHG inventories, tracking mitigation actions, assessing needs and reporting on support received have not been integrated within the present M&E system during its development and up to now. Thus, data are mostly dispersed with individual public and private sector institutions and organizations, demanding for collection on an ad-hoc basis when the NCs and BURs are produced. The GHG inventory is viewed as the core component within the MRV system for capturing emissions and other mitigation actions. Hence, particular attention will be given to the MRV emissions component.

The stakeholders identified for participation, as well as their potential role and responsibilities, are presented under each MRV component below. The overall responsibility for implementing all MRV activities will rest with MELAD-ECD supported by MFED on the financial aspect and NSO for archiving. Key ministries having the mandate of the respective IPCC sectors will lead the process regarding sectoral data

and information collection for the three MRV components. These key ministries will also oversee the agencies under their jurisdiction responsible for executing climate actions under or concurrently to those of the NDC in collaboration with MELAD-ECD to track these actions. MELAD-ECD will store all data and information collected in the Kiribati Environment Management Information System (KEMIS) after the latter has been reassessed and upgraded to accommodate climate information for reporting to the Convention, informing decision making and other uses. It is recommendable that Kiribati accesses funds available under the CBIT from the GEF for updating, implementing and operationalizing the proposed MRV system. The provision for procedural agreements such as memorandum of understandings under the Disaster Risk and Climate Change Act 2019 and institutional arrangements will guarantee the engagement of all the stakeholders and provide for a regular flow of information.

Archiving of all quality-controlled data, other information and reports under the 3 MRVs will be within KEMIS (MELAD-ECD) and backed up at the National Statistics Office. The database and analysis of data will also be useful for feeding the required information to decision makers, thus enabling them to review and update sectoral policies and plans with respect to implementation of the Convention, particularly the country's low carbon development agenda.

5.4.1. MRV emissions

Good quality AD are the key elements for compiling TACCC GHG inventories. Data providers are stakeholders who generate, measure, or record the crucial data and information required for the estimation of GHG emissions and removals. Activity areas or categories are regrouped under the four IPCC sectors (i) Energy, (ii) Industrial Processes and Product Use (IPPU), (iii) Agriculture, Forestry and Other Land Use (AFOLU) and (iv) Waste. The Ministry having jurisdiction over the agencies falling under a particular IPCC sector is proposed as the lead institution for all data and information collection on climate actions for reporting for that sector. Categories identified in the Key Category Analysis (KCA) of the latest inventory will be prioritized for TIER 2 emission estimates which require disaggregated data. Country specific EFs will also have to be developed for estimating emissions at the TIER 2 level.

Data and information shall thus flow from the data providers using the appropriate tools and templates to be developed. The data providers will be the first institution to do the quality control as per a QA/QC plan to be developed in line with the 2006 IPCC Guidelines. The quality control procedures will be documented and recorded in the template alongside the data. The next level of quality control and quality assurance will be under the responsibility of the lead ministry before the data is sent to MELAD-ECD. At this stage, the latter will share the data with the KNEG for review and quality assurance, and eventual release for storing in the centralized database and use by stakeholders.

MELAD-ECD will use this data for computing emissions and removals. The inventory calculation steps will be quality controlled, and quality assured by the KNEG and approved for use by MELAD-ECD for writing up the national inventory report. The latter will then be submitted to Cabinet for approval. Finally, the OB will then endorse the document which is subsequently submitted to the UNFCCC. The MRV emissions with roles and responsibilities of institutions is provided in Figure 5.1.

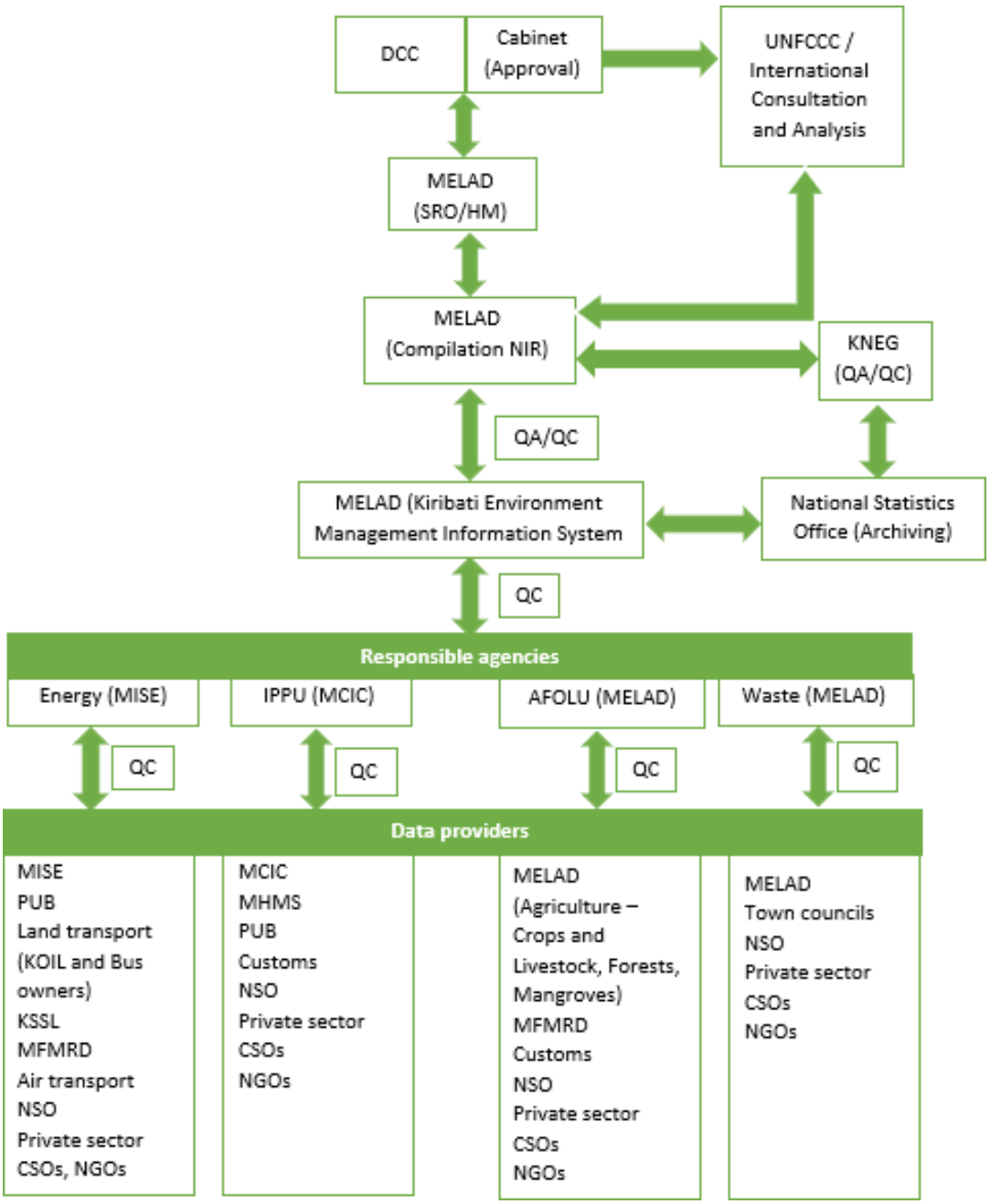


Figure 5.1: Roles and responsibilities of institutions for MRV emissions

5.4.2. MRV mitigation

MRV mitigation will serve to track implementation of NDC actions of the country. A mapping exercise has been completed to identify mitigation actions already implemented and planned for inclusion in this report. As for MRV emissions, the ministry responsible for the respective IPCC sectors have been identified to act as lead institution for collecting the data and other information required. The agencies responsible for executing mitigation actions shall generate, collect, quality control and upload the data, using the tools and templates developed for that purpose, on to the centralized data network after approval by the parent ministry. Once again, the data providers, e.g., PUB for electricity generation, must be imparted with the necessary capacity to use the tools and MPGs to report annually or at other intervals within the year on progress made in implementing such actions. In many circumstances, there is an overlap between the data required for MRV emissions and those for MRV mitigation as those captured for reporting on mitigation will feed into the GHG inventory estimates on a category basis. Hence, the MRV mitigation structure follows the same lines as the one for MRV emissions.

However, the nature of the information is different as specific information, required by the MPGs of Decision 18/CMA.1, must be tracked. Thus, the tools and templates necessary for the appropriate tracking of these mitigation actions must be tailored to enable the country to report transparently as per BTR requirements. Most of these mandatory items have already been identified and used for reporting actions in the mitigation chapter. Additional capacity building, including of policy makers, will be necessary to strengthen the system to cater for more projects to be implemented by a wider range of stakeholders.

Data and information will be quality controlled at source by the executing agency followed by the lead ministry prior to documentation and submission to MELAD-ECD. Further quality control and quality assurance will be done by the KNEG which approves the data and information for reporting. MELAD as the reporting agency then arranges the data and information in the appropriate format, provides analysis where needed, and includes them in the BTR to also inform the international community on progress on implementation of NDC actions. The BTR chapter on Mitigation shall be vetted by the KNEG as technically sound and appropriate before inclusion in the BTR report for approval by the Cabinet. Once approved by Cabinet, the report shall be endorsed by the OB and submitted to the UNFCCC. The roles and responsibilities of institutions for MRV mitigation are given in the Figure 5.2.

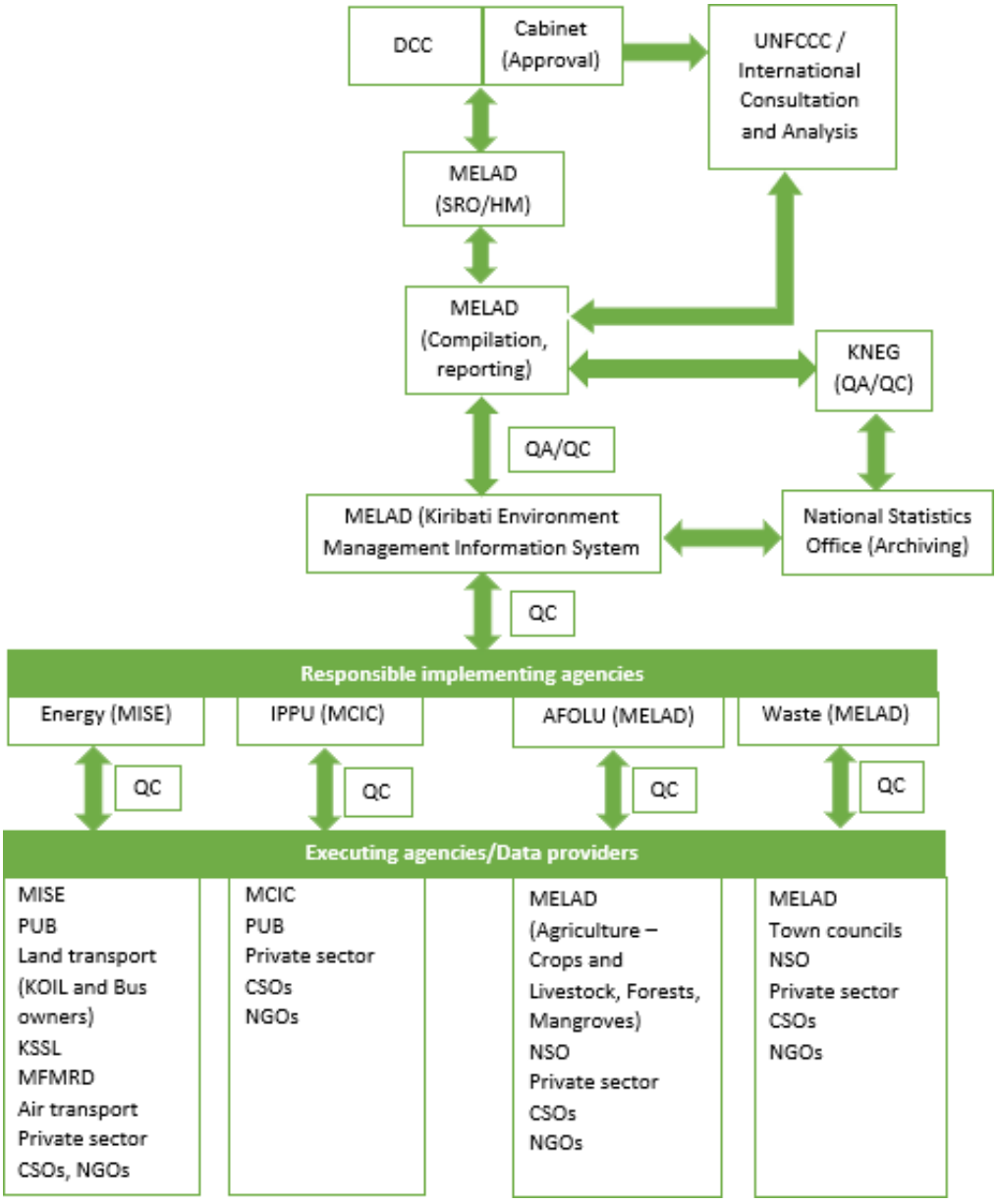


Figure 5.2: Roles and responsibilities of institutions for MRV mitigation

5.4.3. MRV support

The PA emphasized transparent reporting of support needed and received by developing country Parties while donor countries will report on support provided. This upgraded and more detailed reporting structure will necessitate the development and implementation of an appropriate system by developing country Parties for tracking support received and needed. In parallel, Kiribati must design appropriate tools and templates to enable the Ministry of Finance, concerned implementing ministries and executing agencies, to collect needed information and submit for transmission to MELAD-ECD on the sources and progress on utilisation of funds and technology transfer or capacity building to inform the Convention accordingly in the country's BTR. Support for both mitigation and adaptation actions must be tracked, and thus, all executing agencies will be involved in addition to the Ministry of Finance and MELAD-ECD.

The MRV support (Figure 5.3) for climate actions somewhat differs from those of emissions and mitigation as there are no technical data and information to be generated, collected and fed in the centralized data collection network after strict quality control and quality assurance for use in reporting. However, since funding is required for the realization of the objectives of the Convention and donors endeavour to follow how efficiently they have been used for achieving the NDC actions relating to mitigation and adaptation, Parties should report on these elements. There already exist a Climate Finance Division within the Ministry of Finance for tracking the use of funds received from development partners and it will need consolidation to become the MRV support for reporting financing of climate actions. The Ministry of Finance could assume the responsibility for collecting and compiling all information relating to financial support received and provide them to MELAD-ECD for inclusion in the BTR. On the other hand, MELAD-ECD could lead the collection of information with the collaboration of implementing ministries and executing agencies on technology transfer and capacity building for reporting in the BTRs. Once more, tailored tools and templates will need to be developed for collecting information on the different elements of support and concerned stakeholders trained on their use for providing information to the Ministry of Finance.

However, the chapter on support needed and received will be prepared by MELAD-ECD in collaboration with the Ministry of Finance for inclusion in the BTR. Cabinet and the OB will approve and endorse the final report before submission to the UNFCCC. The proposed institutional arrangements for MRV support along with roles and responsibilities of stakeholders is provided in the Figure 5.3.

5.5. Development, implementation and operationalization of the domestic MRV system

The development, implementation and operationalization of the domestic MRV system will be rolled out in four steps as follows.

i. Designing of the MRV system
ii. Development of tools, templates, guidelines and indicators
iii. Implementation of the prototype for the Energy sector
iv. Refinement of the prototype and upscaling it to the four IPCC sectors.

5.5.1. Designing of the MRV system

Each of the above step listed at section 5.5 will in turn be split into four components which are considered essential to buy in all stakeholders concerned and ensure the sustainability of the system through its institutionalization:

(i) wide stakeholder consultations,

(ii) development of institutional arrangements inclusive of legal and procedural agreements,

(iii) consolidation of the data collection framework, and

(iv) upgrading the existing data infrastructure into a centralized information management system to accommodate climate change information, including capacity building of stakeholders.

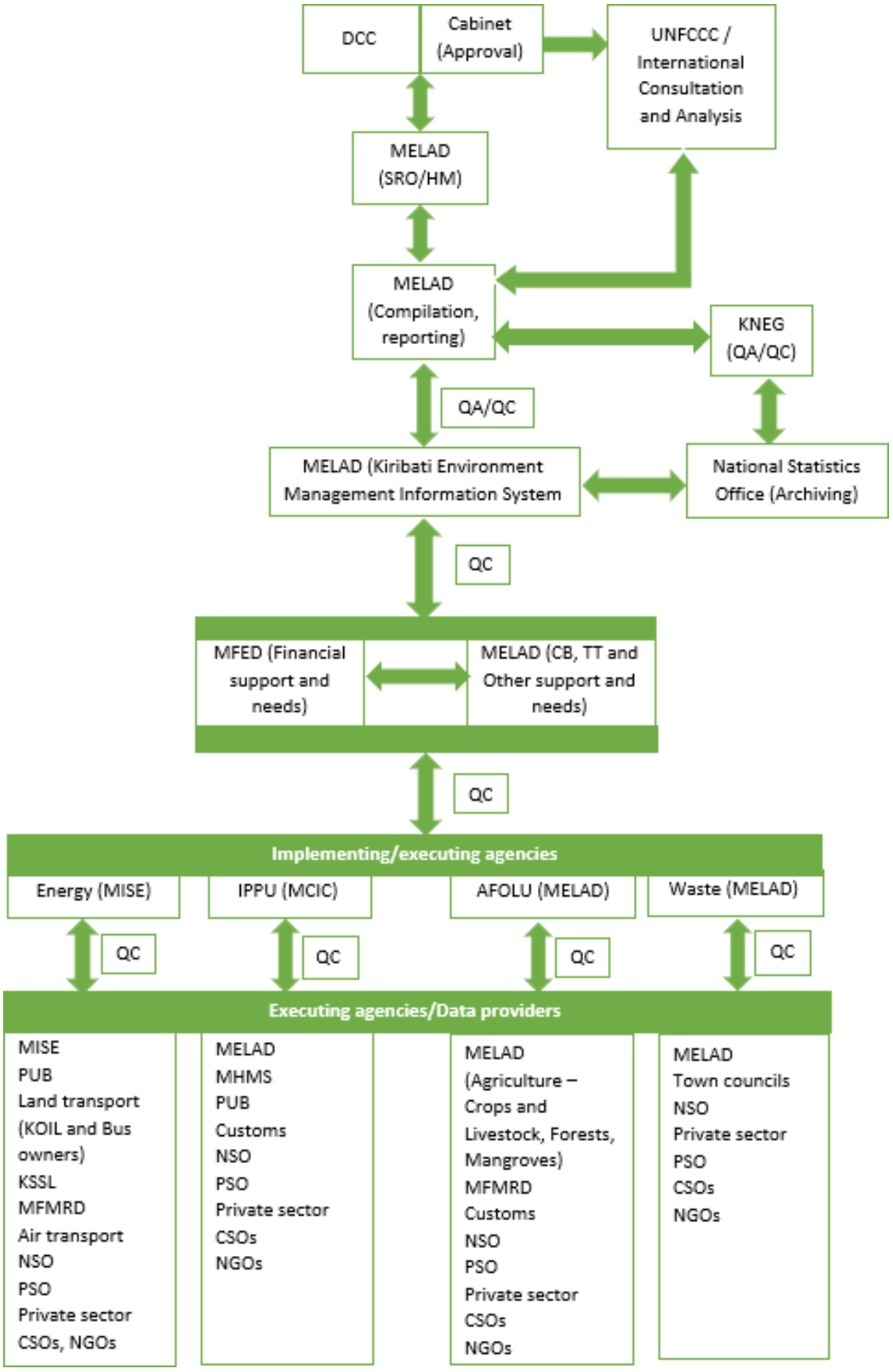


Figure 5.3: Roles and responsibilities of institutions for MRV support

5.5.2. Development of tools, templates, guidelines and indicators

Ensuring an automatic annual flow of AD to estimate emissions requires specific data sets. Additionally, NDC tracking requires indicators to assess progress in achievement of the targets set for mitigation

activities, generate BAU and baseline emissions, along with extensive supplementary information on each action, including estimates of emissions avoided or increased removals relative to BAU emissions. There is a need to develop data collection templates, reporting tools as well as data generation and sharing procedures and agreements. The development of tools and indicators will comprise the following activities: development and testing of templates to collect GHG inventory data and information required for producing TACCC inventories; identification of key mitigation activities, indicators, targets, and co-benefits; development and testing of mitigation reporting tools integrating the indicators; development of data generation and sharing protocols for both the GHG inventory and mitigation tracking; and capacity building of stakeholders on generation of data and the use of the templates and tools. When completed, these activities will provide the necessary tools and templates to the stakeholders as well as the capacity needed to adopt and use them within the network and infrastructure (hardware and software) developed for storage and sharing of data and other climate information.

5.5.3. Implementation of the prototype for the Energy sector

This step will allow for the testing of the prototype MRV system for the Energy sector. Institutions falling under the Energy sector will generate required data and other information, collect these using the templates developed and share them within the information management system in place in MELAD-ECD for producing GHG inventories. Similarly, the Energy sector stakeholders will proceed with the adoption and use of the tools developed for collecting and sharing information on selected NDC mitigation actions implemented. Constant backstopping must be in place to accompany these stakeholders in the adoption and use of the templates, tools and information management system. Close collaboration between MELAD-ECD as responsible entity for producing the BTR, and MISE which is the Energy responsible implementing entity for energy mitigation activities is critical for this phase. This achievement will serve to model collaboration between MELAD-ECD and other agencies implementing mitigation actions.

5.5.4. Refinement of the prototype and upscaling to the four IPCC sectors

Based on the feedback from the Energy sector stakeholders, the prototype can be revised and refined for testing again. A second round of testing on another year's data for the GHG inventory and different mitigation actions will be undertaken, giving more room to the stakeholders to work on their own to perform the same exercise anew for new datasets. The feedback from the stakeholders will serve to address shortcomings and improve the Energy prototype for upscaling to the remaining IPCC sectors IPPU, AFOLU and Waste. Concurrently, capacity building will be extended to stakeholders of these three sectors. After the full roll out of the 3 components of the MRV system for the 4 IPCC sectors, data and other information collected and stored can be published and shared with the widest group of stakeholders and the public for comments to be integrated in the system for further finetuning.

The development of the three components of the MRV system will be done with funds specifically earmarked for the purpose of preparing developing country Parties to comply with the ETF of the PA through the GEF's CBIT funding window. Under this alternative, the process can be completed during the 3 year's project duration and testing done concurrently when preparing the first BTR. Full deployment is planned over the next 4 to 5 years within the framework of the preparation of the next two BTRs and one NC and this option will ensure efficient use of GEF funds to be tapped for commissioning these reports.

6. Other information relevant to the achievement of the objective of the Convention

Kiribati is among the most environmentally fragile countries in the world. It is also one of the countries most vulnerable to the impacts of climate change. The country's ability to react to risks caused by climate change is hindered by its extremely vulnerable social, economic and geographical situations. Climate change and the ensuing sea level rise are predicted to increasingly affect coastal areas and therefore the living conditions of most people. According to a study cited by the IPCC, five nations (the Maldives, Tuvalu, the Marshall Islands, Nauru and Kiribati) may become uninhabitable by 2100, creating 600,000 stateless climate refugees, which is an unprecedented situation. The main issues severely faced by Kiribati, largely in relation to the consequences of climate change, are coastal erosion, coastal inundation, loss of mangroves and coral reefs, severe impacts on freshwater resources, serious impacts on agriculture, and meaningful impacts on public health. The increased incidence of natural disasters such as droughts, floods and weather extremes represent additional tremendous risks to sectors and resources vital to human and national development, and the provision of basic human needs.

The country's high dependence on natural marine resources for tourism and fisheries, which are already being affected by climate change and its accompanying sea level rise, compounds the vulnerability of the country. Several reports have highlighted the very high vulnerability of Kiribati to climate change.

The Climate and Ocean Risk Vulnerability Index (CORVI) Rapid Assessment report identified significant ecological and financial risk, highlighting Tarawa's very high vulnerability to coastal flooding as well as the country's economic and budgetary reliance on revenue from offshore foreign-flagged purse seine tuna fishing.

The World Health Organization in its Kiribati's country profile quoted "*climate change could increase the risk of vector- and water-borne diseases and threaten food safety and security*".

To cope with climate change, GOK has implemented policy measures towards building adaptive capacity and enhancing resilience of the most vulnerable people essentially by reducing exposure and sensitivity to climate impacts.

In addition, Government has mainstreamed climate change adaptation through development and effective implementation of strategies to fully integrate climate change concerns into national programmes, to ensure that the working environment is sensitive to climate change and sustainable development. GOK developed the Kiribati Joint implementation Plan (KJIP) for climate change and disaster risk management in line with the KV20 and the KDP as well as ministerial strategic plans and sectoral policies. KJIP identified 12 major strategies that are listed below.

1. Strengthening good governance, policies, strategies and legislation.
2. Improving knowledge and information generation, management and sharing.
3. Strengthening and greening the private sector, including small and medium sized enterprises (SMEs).
4. Increasing water and food security with integrated and sector specific approaches and promoting healthy and resilient ecosystems.
5. Strengthening health service delivery to address climate change impacts.
6. Promoting sound and reliable infrastructure development and land management.
7. Delivering appropriate education, training and awareness programmes.

8. Increasing effectiveness and efficiency of early warnings and disaster and emergency management.
9. Promoting the use of sustainable renewable sources of energy and energy efficiency.
10. Strengthening capacity to access finance, monitor expenditures and maintain strong partnerships.
11. Maintaining the existing sovereignty and unique identity and cultural heritage of Kiribati.
12. Enhancing resilience through strategic partnerships for community participation and engagement ownership and inclusion of vulnerable groups.

Kiribati appreciates past and ongoing financial or technical support received from its development partners that has enabled the effective partial implementation of this plan for the enhancement of sustainable development and build the resilience of communities. GOK has improved its capacity to access and utilize the existing Climate Finance Mechanisms through the creation of a Climate Change Division in MFED. GOK will need further financial, technical and capacity building support to continue to roll out the KJIP and the adaptation activities earmarked in its revised NDC. Adaptation funding estimated to the 2030-time horizon amounts to 69 M USD that the country needs to mobilize to cope with climate change impacts.

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