INITIAL BIENNIAL UPDATE REPORT 2019

under the
UNITED NATIONS FRAMEWORK
CONVENTION
ON CLIMATE CHANGE (UNFCCC)

Islamic Republic of Afghanistan
National Environmental Protection Agency

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Ministry of Energy and Water

Ministry of Finance

Ministry of Industry and Commerce

Ministry of Mines and Petroleum

Ministry of Rural Rehabilitation and Development

Ministry of Urban Development and Land

National Statistics and Information Authority

FOREWORD

I am pleased to present the First Biennial Update Report of the Government of the Islamic Republic of Afghanistan to the United Nations Framework Convention on Climate Change, in fulfilment of our commitment under Article 4, paragraph 1(a) and Article 12 of the Convention and Decision 1/CP.16.

The BUR contains the most updated information on national circumstances, greenhouse gas inventory for 2012-2017 time series. Apart from the information related to the mitigation actions and their effects, the report also provides an overview of the planned programmes and projects that are beneficial to the mitigation of climate change. The country is planning to implement its mitigation programmes up to 2030 depending on technical and financial support provided by bilateral and multilateral financial entities.

The Special Report on Global Warming released in October 2018 by the Intergovernmental Panel on Climate Change shows that the human-induced global warming has reached 1°C above the pre-industrial average global temperature. However, the South East Asia region, which includes Afghanistan, has already experienced much higher average temperature in some parts. Afghanistan is a least developed country and amongst the poorest twenty countries in the world that has negligible per capita emissions. In 2017, per capita emission of Afghanistan, excluding the Land Use, Land Use Change and Forestry (LULUCF) sector were 1475.37 kg which only accounts for approximately 0.08% of the total global GHG emissions. Despite being one of the lowest contributors to the global greenhouse gas emissions, it has witnessed a mean increase of 1.8°C, which is above the target of 1.5°C recommend in the report.

Although, we have demonstrated our commitment to channelling our own scarce resources to ameliorating the impacts of climate change and fulfilling our own end of the bargain; we are looking for our international partners to continue supporting us in addressing the global phenomena of climate change in our country.

Afghanistan's First Biennial Update Report would not have been possible without the contribution of valuable data from the government line ministries and agencies. I wish to congratulate all those involved in the process of preparing the First Biennial Update Report, particularly the members of the National Study Teams and the National Climate Change Committee. The report was prepared involving all key stakeholders within multi-disciplinary study teams and through a broad consultative process coordinated by the National Environmental Protection Agency.

Finally, I would like to take the opportunity to thank the United Nations Framework Convention on Climate Change, Global Environment Facility, and UN Environment Afghanistan office for their financial and technical support for the preparation of this report.

Schah-Zaman Maiwandi

Director General

National Environmental Protection Agency

Islamic Republic of Afghanistan

ACRONYMS

ACCSAP	Afghanistan Climate Change Strategy and Action Plan
ACEP	Afghan Clean Energy Project
ACU	Aid Coordination Unit (ACU)
AD	Activity Data
ADB	Asian Development Bank
AESS	Afghanistan Energy Sector Strategy
AF	Adaptation Fund
ANDMA	Afghanistan National Disaster Management Authority
ANDS	Afghanistan National Development Strategy
ANPDF	Afghan National Peace and Development Framework
ANREP	Afghanistan National Renewable Energy Policy
APSM	Afghanistan Power Sector Master Plan
AREDP	Afghanistan Rural Enterprise Development Programme
ARTEMIS	Assessment and Reliability of Transport Emission Models and Inventory Systems
ASERDP	Afghanistan Sustainable Energy for Rural Development Programme
ASY	Afghanistan Statistical Yearbook
BAU	Business As Usual
BCM	Billion Cubic Metres
BGS	British Geological Survey
BRT	Bus Rapid Transit
BUR	Biennial Update Report
CARD-F	Comprehensive Agriculture and Rural Development – Facility
CCFF	Climate Change Financing Framework
CCNIS	Climate Change National Information System
CDM	Clean Development Mechanism
CEC	Committee for Environmental Coordination
CFU	Climate Finance Unit
CH_4	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
COP	Conference of Parties
COPERT	Computer Programme to Calculate Emissions from Road Transport
CPAs	Component Programme of Activities
CSO	Central Statistics Organization
CTCN	Climate Technology Centre and Network
DABS	Da Afghanistan Breshna Sherkat
DFID	Department for International Development (UK)
DOM	Dead Organic Matter
DSW	Domestic Solid Waste
EF	Emission Factor
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EITI	Extractive Industries Transparency Initiative
ENPEP	Energy and Power Evaluation Programme
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GCV	Gross Caloric Value
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GIRoA	Government of Islamic Republic of Afghanistan
GT	Gas Turbine
GWP	Global Warming Potential
HBEFA	Handbook Emission Factors for Road Transport (model)
HDI	Human Development Index
HFA	Hyogo Framework for Action
HFC	Hydrofluorocarbons
HH	Households
HPP	Hydropower Plant
HRSG	Heat Recovery Steam Generator
ICE	Inter-ministerial Commission for Energy
ICIMOD	International Centre for Integrated Mountain Development
ICRE	Interministerial Commission on Renewable Energy
ICS	Improved Cooking Stove
ICTU	Information necessary for Clarity, Transparency, and Understanding

IDA	International Development Assistance
IDLG	Independent Directorate of Local Governance
IDP	Internally Displaced People
IEA	International Energy Agency
INC	Initial National Communication under the UNFCCC
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Products Use
IRES	International Recommendations for Energy Statistics
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
KCA	Key Categories Analysis
KPI	Key Performance Indicator
kWh	Kilowatt hour
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LEAP	Long-range Energy Alternatives Planning
LEDS	Low Emission Development Strategies
LPG	Liquid Petroleum Gas
LTO	Landing and Takeoff
MAIL	Ministry of Agriculture, Irrigation and Livestock
MCA	Multi-Criteria Analysis
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreement
MEW	Ministry of Energy and Water
MHP	Micro Hydro Plants
MHP	Micro Hydro Power
MoEc	Ministry of Economy
MoEd	Ministry of Education
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoMP	Ministry of Mines and Petroleum
MOU	Memorandum of Understanding
MPS	Most Probable Scenario
MRRD	Ministry of Rehabilitation and Rural Development
MRV	Measurement Reporting and Verification
MUDL	Ministry of Urban Development and Land
MW	Mega Watt
MWh	Mega Watt hour
N2O	Nitrous Oxide
NAMA	Nationally Appropriate Mitigation Actions
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NCCC	National Climate Change Committee
NCSA	National Capacity Self-Assessment
NCSP	National Communication Support Programme
NCV	Net Caloric Value
NEPA	National Environmental Protection Agency
NES	National Environment Strategy
NFMP	National Forestry Management Policy
NGO	Non-governmental Organization
NMT	Non-Motorized Transport
NMVOC	Non-methane Volatile Organic Compounds
NOX	Nitrogen Oxides
NPP	National Priority Programme
NRAP	National Rural Access Programme
NREL	National Renewable Energy Laboratory
NSP	National Solidarity Programme
NST	National Study Team
ODA	Official Development Assistance
PIN	Project Idea Note
PMO	Project Management Office
PoA	Program of Activities
PV	Photovoltaic
RCP	Representative Concentration Pathway
RECC	Renewable Energy Coordination Committee
REDD	Reducing Emissions from Deforestation and Forest Degradation

REFEF	Renewable Energy & Energy Efficiency Fund
RRES	Rural Renewable Energy Strategy
Ru-WatSIP	Rural Water Supply, Sanitation and Irrigation Programme
SAARC	South Asian Association of Regional Cooperation
SCWE	Supreme Council for Water and Environment
SEI	Stockholm Environment Institute
SHS	Solar Home System
SME	Small and Medium Enterprises
SNC	Second National Communication under the UNFCCC
STAR	GEF's System for Transparent Allocation of Resources
SWH	Solar Water Heater
TCCCA	Transparency, Completeness, Consistency, Comparability, Accuracy
TCF	Trillion Cubic Feet
TCS	Traditional Cooking Stoves
TWG	Technical Working Group
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNPP	Urban National Priority Programme
USAID	United States Agency of International Development
USD	United States Dollar
USGS	United States Geological Survey
WB	World Bank
WCS	Wildlife Conservation Society
WHO	World Health Organization
WMO	World Meteorological Organization

TABLE OF UNITS

cm	centimetre
g	gram
Gg	gigagram
GWh	gigawatt hour
ha	hectare
hr	hour
kg	kilogram
km	kilometre
km^2	square kilometre
kPa	Kilopascal
kt	kiloton
ktoe	kilo tonnes of oil equivalent
kWh	kilowatt hour
m	metre
m^3	cubic metre
mm	millimetre
Mt	million tonnes
Mtoe	million tonnes of oil equivalent
MW	megawatt
MWh	megawatt hour
^oC	degree Celsius
PJ	Peta Joule
t CO_2eq	tonnes of carbon dioxide equivalent
t	tonne
TJ	Tera Joule
toe	tonnes of oil equivalent
yr	year

CONTENTS

EXECUTIVE SUMMARY

Band-e Amir, Bamyan, Afghanistan

Introduction

The Government of the Islamic Republic of Afghanistan (GIRoA) ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 2002. GIRoA has prepared and submitted its Initial National Communication (INC) in 2012 and Second National Communication (SNC) in 2018. As part of its obligations under Article 4, paragraph 1 (a) and Article 12 of the convention and Decision 1/COP.16, Afghanistan also needs to prepare and submit its Biennial Update Reports every two years, which contains updates of national GHG (GHG) inventories, including a national inventory report and information on mitigation actions, needs and support received.

Afghanistan's National Environmental Protection Agency (NEPA) with technical assistance from The United Nations Environment Programme and financial support from the Global Environment Facility (GEF) has prepared Afghanistan's First Biennial Update Report (BUR) under the UNFCCC, with the ultimate goal of strengthening the country's technical and institutional capacity to integrate climate change priorities into national development policies, strategies, and plans.

The total budget for preparing Afghanistan's First BUR was 377,000 USD with 342,000 USD funded by GEF and 35,000 USD government in-kind contribution. This report, in its six chapters, provides updated information on the following:

- Afghanistan's National Circumstances (Chapter One)
- The national GHG inventory for 2012 to 2017 (Chapter Two)
- Mitigation actions and their effects (Chapter Three)
- Constraints, gaps, financial, technical and capacity building needs (Chapter Four)
- Domestic MRV system (Chapter Five)
- Technical annexes (Chapter Six)

During the preparation phase of the BUR, strong emphasis was placed on updating the GHG inventory for the 1990-2017 time series, putting in place a National Information System, quantification of mitigation actions and their effects and establishing a sustainable and low-cost Measurement, Reporting and Verification (MRV) system for mitigation actions and support needed and received.

The process of preparation of Afghanistan's First BUR was conducted under the stewardship of the National Environmental Protection Agency (NEPA) with technical assistance from National Study Teams (NST) composed of representatives of government line ministries and agencies who were trained and technically supported by international consultants.

This process has, therefore, strengthened the coordination among and between members of the NSTs, particularly for the development of the GHG inventory and Climate Change Information National System (CCNIS). Awareness on the need to collect and archive data for GHG inventories and to develop time series projections of GHG emissions has increased among the government agencies. However, the institutional arrangements for MRV are still under process.

National Circumstances

The Islamic Republic of Afghanistan is a landlocked country located in south-central Asia, which shares a total of 5,531 km borders with Iran to the west (936 km), Pashtonkhwah and Balochistan (Pakistan) to the east and south (2,310 km), Turkmenistan to the northwest (744 km), Uzbekistan to the north (137 km), Tajikistan to the northeast (1,206 km), Jammu and Kashmir (Pakistan) to the northeast (102 km) and China in far northeast (96 km). It lies between latitudes 29°N and 39°N, and longitudes 60°E and 75°E. It has a total surface area of 652,864 km^2.

Afghanistan has a continental climate with very harsh winters in the Central Highlands, and the northeast, where the average temperature in January is below -15°C, and hot summers in the low-lying areas of the Sistan Basin of the southwest, the Jalalabad Basin in the east, and the Turkestan Plains along the Amu River in the north, where temperatures average over 35°C in summer.

The National Statistics and Information Authority (NSIA) estimated the country's population at 31 .6 million in 2017, which is expected to be increased to 32.2 million in 2019/20, making it the 39th most populous country in the world. Based on the population census from 1979 and data from 2003 and 2005, Afghanistan also has a fast population growth rate of 2.03% per annum, with persons under 15 years of age accounting for 47.4% of the total population. Afghanistan's population is split nearly even along gender lines, with 16.4 million men and 15.8 million women.

According to the Ministry of Education (MoED), 9.6 million students were enrolled in primary, secondary, high schools, vocational high schools, technical vocational institutes, teacher training institutes and religious educations facilities, including Afghans studying abroad in 2017, which shows 2% increase compared to the previous year.

Based on data from the Ministry of Energy and Water's (MEW) meteorological stations, Afghanistan's total annual renewable water potential for 2007-2016 was 66.33 billion m^3, of which surface water availability was 49 billion m^3 while groundwater storage was 17.1 billion m^3. Over 25 years between 1990 – 2015, Afghanistan lost 406.16 km^2 (13.8%) of its total glaciated area, with 3.6% lost between 1990 and 2000, and 4.7% between 2000 and 2010. The glaciated area loss was about 6.25% between 2010 and 2015, which indicates that the glaciated area loss is higher in recent decades. It is projected that by 2030, the potential of surface water will have decreased to 43.3 billion m^3 across its five river basins.

According to Afghanistan's National Biodiversity Strategy and Action Plan (NBSAP), the country is home to more than 700 species of mammals, birds, reptiles, amphibians, fish, butterflies, and a staggering 3,500-4,000 native vascular plant species, though recent studies suggest that biodiversity loss is accelerating across the country.

Of Afghanistan's total surface area, 1.51% is forest and woodlands, 11.7% comprises arable areas, 46.97% is covered by permanent pastures and bare areas cover 34.45%. The remaining 5.37% of the land is covered by urban areas, water bodies and snow cover. Agriculture is the foundation of Afghanistan's economy and

livelihoods, supporting some 80% of the country's population, either directly or indirectly. Afghan saffron, recognised as being amongst the world's best, covered 5,205 ha of the agricultural land. The total production of saffron in 2017/18 was recorded to be 10,689kg. Almost some 95% of all saffron was produced in Herat province.

Wheat, barley, rice and maize are the main agricultural crops. The wheat harvest in 2016/17 from both irrigated and rainfed areas was 4.3 million tonnes, which was a 6.0% decrease compared to the previous year. Meanwhile, rice production was 0,34 million tonnes in 2017/18, a decrease of 5.1% compared to the previous year. These decreases in production were because of decreases in the total area of cultivation of these crops.

Most of Afghanistan's mountains are barren rather than forested. In the mid-1990s, an estimated 2.9% of the land was forested, but since that time, war, illegal exploitation, and the need for firewood have removed as much as 90% of forest cover. In 2005, an estimated 3.2 million m^3 of timber was harvested, about 45% of which was used for fuel.

In 2016, the Ministry of Agriculture, Irrigation and Livestock (MAIL) began implementation of the Kabul Greenbelt Project. Over the next decade, the project aims to create more than 10,000 ha of green space around Kabul, including 4,000 ha of forested area. In addition, 500 ha of greening is planned in the Asmayi and Shir Darwaza mountains, Qargha, and Qasaba near the Kabul International Airport with saplings and seeds chosen for their drought-resistant properties.

As a consequence of the measures and steps taken towards self-efficiency in electricity production, the proportion of Afghan households with access to electricity has sharply increased since 2007/08. The percentage of the Afghan population with access to grid-connected electricity increased from 26% in 2011/12 to 30.9% in 2016/17. Besides the grid-connected electricity, a big percentage of Afghan households use various sources of energy only for lighting purposes, mainly in areas where access to grid-connected electricity is poor.

Exploration in the 1960s and 70s resulted in the discovery of significant resources of metallic minerals, including copper, iron and gold, and non-metallic minerals, including halite, talc, mica, magnesite, celestine , barite, beryl, fluorite, chromite, gypsum and limestone. While northern Afghanistan is the host of energetic sources as natural gas, petroleum and coal deposits, north-east and east are known with deposits of precious and semi-precious stones as emerald, kunzite, tourmaline, amethyst, aquamarine. Aragonite, apatite and uranium deposits are known in Helmand. More recently, in November 2009, American geologists discovered untapped mines in Afghanistan worth about 1 trillion USD of which lithium has the top position of the newly discovered deposits, this could generate more than 2 billion USD in annual revenues for the Afghan government. Other new deposits, previously unknown, containing vast veins of iron, copper, cobalt and gold and critical industrial minerals, are so big and include so many minerals essential to modern industry that Afghanistan could be transformed in one of the most important mining centers in the world. With such substantial mineral deposits, if managed fairly and transparently, the extraction of these natural resources could counterbalance a major part of Afghanistan's current financial dependency on foreign aids.

Economic growth in 2017 was 2.67%, up slightly from 2.26% in 2016 and 1.45% in 2015. In terms of sectoral contributions to Gross Domestic Production (GDP), in 2017/18, the service sector led the country's growth and accounted for more than half (50.7%), which is a 0.9% decrease from the previous year. Agriculture is the second highest contributor to the GDP, comprising 20.3% of the country's total GDP in 2017/18. Despite the drought and increasing temperatures, the agriculture sector increased by 3.8% in 2017/18 compared to the previous year. The Doing Business 2019 Report identified Afghanistan as one of the top ten improvers in doing business alongside China, India, Azerbaijan, and Djibouti. Afghanistan climbed 16 positions in the rankings, advancing from 183rd in 2018 to 167th in 2019.

Afghanistan is a land-locked country, uses only land and air transportation. The total registered vehicle in 2017/18 were 1,936,686, which shows an increase of 1.6% from the previous year. In air transport, Afghanistan has four international airports and some local airports as well. Air traffic has been increasing substantially since 2001. Only in 2017/18, the government-owned airline (Ariana) curried 285,000 passengers and 1,652 tonnes of goods from different airports. In the private sector, only one airline (Kam Air) was active with 7 aeroplanes which carried 749,000 passengers to different routes.

Afghanistan is one of the predominately rural societies. According to the Afghanistan 2019-20 population estimation report, out of the total estimated population of 32.2 million, 7.7 million people lived in various cities of Afghanistan, representing nearly 23.9% of the population. Afghanistan with 4.4 % per annum urban growth rate is among the highest in the world. It is expected that the population of Afghan cities will envisage nearly 40% in 2050 or 50% in 2060.

In 2007, Afghanistan approved the Environment Law, which established the regulatory framework for the sustainable use and management of Afghanistan's natural resources base and provides for the conservation and rehabilitation of the environment towards achieving the country's social, economic, reconstruction, and ecological development goals. The National Environmental Protection Agency (NEPA) is an independent institutional entity, responsible for coordinating, monitoring conservation and rehabilitation of the environment, and the implementation of the law. This BUR was prepared by NEPA in partial fulfilment of Afghanistan's reporting obligations and commitments to the UNFCCC.

National Greenhouse Gas Inventory

As part of Afghanistan's first BUR, GHG inventory has been provided for the time series 2012-2017 using the 2006 IPCC guidelines and software for national GHG inventories. For the first time, Afghanistan prepared a time series national GHG inventory for the period of 1990 – 2017 for all anthropogenic emissions by sources and removals by sinks of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O). The GHG precursors and air pollutants, respectively, carbon monoxide (CO), oxides of nitrogen (NOx), non-methane volatile organic compounds (NMVOCs), and sulphur dioxide (SO_2) are prepared in line with the EMEP/EEA air pollutant emission inventory guidebook 2016.

In 2017, Afghanistan's total national GHG emissions excluding LULUCF for the three main gases (CO_2, CH_4 and N_2O) amounted to 43,471.39 Gg CO_2eq. It shows an 8.9% increase in the emission of GHG compared to 2012.

The most important GHG in Afghanistan is carbon dioxide (CO_2) with a share of 48.2% in 2017. The CO_2 emissions primarily result from fuel combustion activities. Methane (CH_4), which mainly arises from livestock farming, contributes to 37.8% of the national total GHG emissions, and nitrous oxide (N_2O) with Agricultural Soils as the main source contributes to the remaining 14.1% of the national total in 2017.

The important sectors regarding GHG emissions in Afghanistan excluding LULUCF are IPCC sector 1, Energy with 49.8% of total national GHG emissions in 2017 (43.4% in 2012), followed by the (IPCC sectors 3 Agriculture) with 46.2% of total national GHG emissions in 2017 (52.6% in 2012).

In 2017, GHG emissions from IPCC sector Energy amounted to 21,649.43 Gg CO_2 equivalents. Some 99% of the emissions from this sector originate from *IPCC category 1.A. Fossil Fuel Combustion.* GHG emissions from IPCC sector Industrial Processes and Other Product Use (IPPU) amounted to 245.78 Gg CO_2 equivalents, which correspond to 0.6% of the total national emissions.

Meanwhile, GHG emissions from IPCC sector Agriculture amounted to 20,073.90 Gg CO_2 equivalent, which corresponds to about 46.2% of total national emissions. From 2012 to 2017 emissions decreased by 4.4%, mainly due to decreasing GHG emissions from manure management.

Also, GHG emissions from IPCC sector Waste amounted to 1,502.27 Gg CO_2 equivalents, which correspond to 3.5% of total national emissions. From 2012 to 2017, emissions from this sector increased by 12.7%, mainly due to an increase in the solid waste disposal and increased population.

Greenhouse Gas Source and Sink Categories	2012	2013	2014	2015	2016	2017	Trend 2012 – 2017	2012	2017
	Gg CO_2 equivalent							Share [%]	
1. Energy	17,324.81	18,155.72	18,784.66	19,614.68	20,664.69	21,649.43	25.0%	43.4%	49.8%
2. Industrial Processes and Product Use	260.30	261.31	223.77	233.87	278.59	245.78	-5.6%	0.7%	0.6%
3. Agriculture	21,006.13	21,227.59	21,800.63	20,729.34	20,490.89	20,073.90	-4.4%	52.6%	46.2%
4. Land-Use, Land-Use Change and Forestry (LULUCF)	NE	NE	NE	NE	NE	NE	NE	_	_
5. Waste	1,333.39	1,358.72	1,386.69	1,417.30	1,446.59	1,502.27	12.7%	3.3%	3.5%
6. Other	NO	NO	NO	NO	NO	NO	NO	0.0%	0.0%
Total national emissions and removals	39,924.62	41,003.34	42,195.75	41,995.19	42,880.77	43,471.39	8.9%	100.0%	100.0%

Mitigation Action and their Effects

Afghanistan's Climate Change Strategy and Action Plan (ACCSAP), which is a long-term strategy document and action plan outlines the climate change priorities, strategies and actions covering both adaptation and mitigation. Besides, it seeks to fill key gaps and to identify strategic financial and operational linkages to support the activities included under the ACCSAP.

GIRoA developed several Nationally Appropriate Mitigation Actions along with National Adaptation Programmes of Action. These programmes represent a series of policies and measures the country conditionally commits to implement until 2030 in the Energy, IPPU, Agriculture and waste sectors with an estimated mitigation impact of 13.6% reduction in total national GHG emissions excluding Land use, Land Use Change and Forestry (LULUCF) compared to 'business as usual' scenario.

The NAMAs are expected to fulfil the conditional goals of Afghanistan's NDC. Technical development of NDC is anticipated through participatory approach; therefore, international support is crucial to achieving the set goals. ACCSAP clearly states that implementing the communicated NAMAs is conditional depending on the level of international support received.

Over the past two decades, Afghanistan, with support from several implementing partners has implemented a large number of mini and small scale projects in the Renewable Energy and Energy Efficiency domains. A total of 450 Mini Hydro Power installations are reported totalling to 6.9 MW of installed capacity.

Afghanistan's NAMAs were determined in broad terms that need to be translated into more specific coherent activities that are readily Measurable, Reportable and Verifiable. A recent case study conducted by NEPA with technical support from UNEP clearly identified programmes and projects that are intended to fulfil the goals stated in the NDC. Four Soft programmes relevant to all NAMAs were identified, and eight hard projects based on CDM Approved Methodologies were appraised. Adopting Approved CDM Methodologies is not intended only for generating credited emission reductions, but also to increase the

transparency and credibility of reported estimations and building trust among potential supporting entities. The target year was shifted to 2035. MRV Protocol was developed for each of the mitigation programmes and actions as part of Afghanistan's MRV System.

Baseline and Mitigation Scenarios

The GIRoA has communicated its NDC for which the base year was estimated based on the 2005 GHG inventory data. In order to identify a real case base year, a case study was conducted in which 2015 was estimated as the base year. The NDC set targets for mitigation and adaptation are based on conditional programmes and projects, i.e. will be perused if and only if specific conditions are fulfilled. Other activities that are foreseen to be implemented by the government and the private sector, which in their turn are subject to conditions that may not be fulfilled were carefully evaluated before inclusion in the BAU scenario. Only must do, committed and highly probable activities were considered in the BAU (baseline) scenario.

A new study on climate change mitigation options for Afghanistan was conducted in 2018, which provides detailed information regarding the mitigation actions identified and listed in table 20 below. This study shows that Afghanistan has the potential in emission reductions of 17.4% by 2035 (17.34%)

For the purpose of identifying mitigation actions, the adopted baseline considered only key category sectors that will host mitigation actions; other categories are irrelevant to the estimation of INDC.

Afghanistan National Development Strategy which reflects Afghanistan's long-term goals tackles climate change issues under pillar (iii) Economic and Social Development where energy, water, transport, urban development, agriculture and rural development are the major components. To achieve the overall goal of the ANDS to tackle climate change, the ACCSAP has been developed which recommends the development of Low Emission Development Strategy for each sector to achieve the sustainable development goals.

Several mitigation actions for which the emission reduction was estimated were identified to fulfil the scope of the communicated NAMAs. The mitigation opportunities were selected based on a set of evaluation criteria derived from the need to complement and enhance national efforts towards LED achievement.

Domestic MRV System

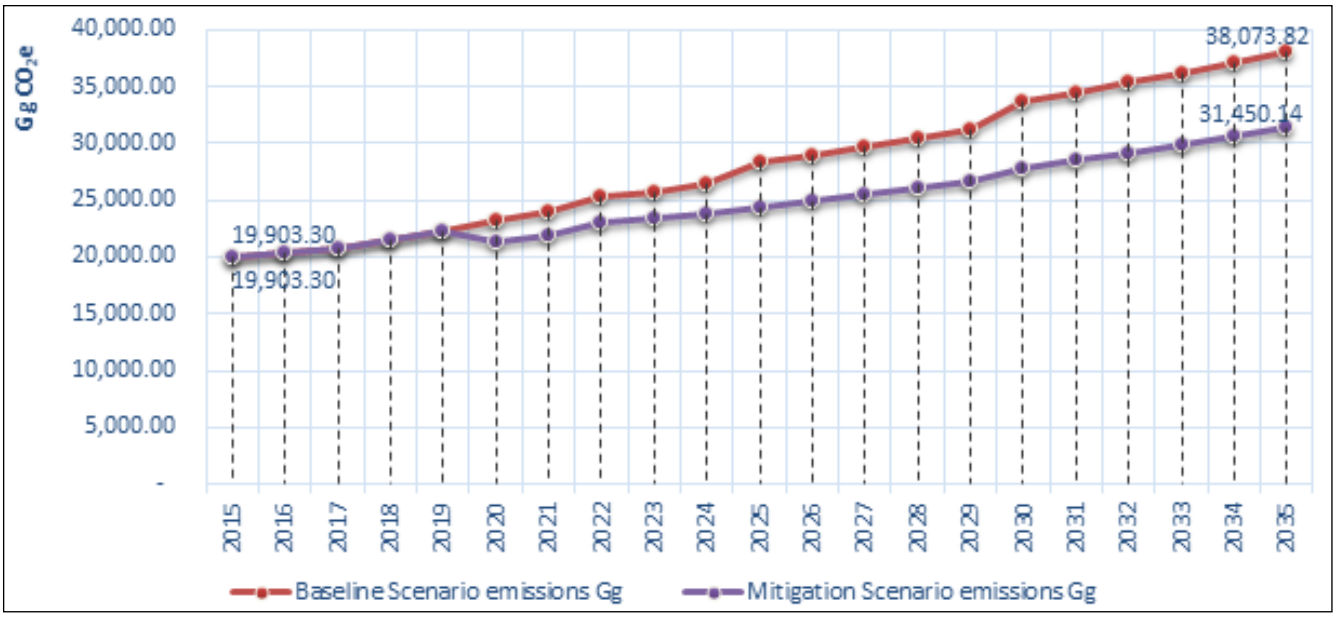
The Bali Action Plan adopted in COP 13 introduced the principles of applying the Measurement, Reporting and Verification (MRV) for GHG mitigation actions and commitments, as well as support for GHG mitigation actions in developing countries.

The key function of MRV is enhancing transparency through the tracking of national GHG emission levels, the tracking of climate finance flows received or the impact of mitigation actions. MRV facilitates sharing information and lessons learned and allows assessing whether set targets have been achieved.

As per Article 9 of the Environmental Law, NEPA is the supreme governmental agency responsible for developing strategies and action plans as well as the implementation of the MEAs, including UNFCCC and its related goals. This includes preparation of National Communications and Biennial Update Reports and the applying of the domestic MRV system.

The National Climate Change Committee (NCCC) composed of deputy ministers from line ministries and agencies is the highest body determining and approving climate change related policies in the country. NCCC directs, monitors and approves all climate change related activities.

The GIRoA initiated a process to improve climate change governance in the country. As part of the activities, recently, two case studies on climate change mitigation were conducted to identify the needs for technology, finances and capacity building to achieve its NDC targets.



To track the NDC targets, NEPA lacks a sustainable structure for the continuous process of data and information gathering, processing, and archiving. Recently, and as a consequence of the GIRoA decision to start preparing and communicating BUR, the necessity for a formal and permanent operational structure became evident; and a case study was conducted in 2018 to assess the technology and capacity building needs for climate change mitigation and MRV in Afghanistan. This study proposes the following actions:

- Developing of overarching policy guidelines
- Formation of the CCNIS Technical Working Group (TWG)
- Elaborating a framework of the CCNIS
- Evolution of web-based data systems
- Capacity building

To improve climate change governance, the establishment of a Climate Change National Information System CCNIS was proposed to ensure producing transparent, consistent, comparable, complete and accurate inventories, and standard quality results. The CCNIS proposal was complement with new guidelines and procedures for NAMAs and Support Received MRV System and other relevant protocols.

Line ministries and national agencies are responsible for the contentious provision of information and feedback to NEPA. The recommended approach for cooperation between NEPA and the national agencies involved in climate change in the short term is the adoption of a National Official Setup Instrument - WP-MoU (Working Package Memorandum of Understanding) specifying the type of information required by NEPA to be supplied by the relevant institution on a regular basis. This instrument serves all climate change related activities such as GHG Inventory and BUR preparations and does not require amendments in the regulatory or institutional frameworks prevailing at the moment.

The proposed system is designed in accordance with the existing regulatory and institutional frameworks. Therefore, it is expected to become functional in the short term without any significant structural changes. On the long term, GIRoA can pursue the development of a more comprehensive and stable framework for CCNIS.

Finance, Technology and Capacity Building Needs and Support Received

According to decision 2/CP.17, non-Annex I Parties are to provide updated information on constraints and gaps, and related financial, technical and capacity-building needs, as well as updated information on financial resources, technology transfer, capacity-building and technical support received from the Global Environment Facility, Parties included in Annex II to the Convention and other developed country Parties, the Green Climate Fund and multilateral institutions for activities relating to climate change, including for the preparation of the current BUR.

Efforts by Afghanistan to reduce its GHG emissions and enhance its resilience to the increasing impacts of climate change have been supported by both national and international resources. As per Article 4.3 of the UNFCCC, Afghanistan has received capacity building, technical and financial support from international sources to enable the country to fulfil its obligations under the convention including for the preparation of this BUR.

Due to lack of the technical capacity and a system for preparation of the GHG inventories inside the country, Afghanistan outsourced the preparation of its time series GHG inventory. The country has embarked on the process to establish the appropriate framework to produce future GHG inventories in-house through more active participation of the key stakeholders.

One of the major constraints for the preparation of the GHG inventory is the non-availability and inaccuracy of data. For example, the data of the energy balance from the IEA is different from the data provided by the NSIA. Moreover, in Afghanistan, different institutions use different formats and report differently on their activities.

Through its INC, SNC, NDC, and ACCSAP, Afghanistan has broadly identified its needs for the technology transfer, but unfortunately, the GIRoA lacks the capacity to identify and implement its exact technology needs for each sector to achieve its NDC targets set for 2030.

As a Least Developed Country and having the issue of the lack of resources and technical capacity, Afghanistan faces many challenges in order to address climate change issues and meet UNFCCC obligation. However, Afghanistan, being amongst the world's lowest contributors to the global GHG emission and most vulnerable countries to climate change, remains determined to address climate change by utilizing its limited resources and expects the necessary technical and financial support from developed country (Annex 1 Parties) in strengthening national capacities to respond to the climate change issue.

1 NATIONAL CIRCUMSTANCES

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1.1 GEOGRAPHIC PROFILE

Afghanistan is a landlocked country located in south-central Asia (see Figure 1), which shares a total of 5,531 km of borders, with Iran to the west (936 km), Pashtonkhwah and Balochistan (Pakistan) to the east and south (2,310 km), Turkmenistan to the northwest (744 km), Uzbekistan to the north (137 km), Tajikistan to the northeast (1,206 km),Jammu and Kashmir (Pakistan) to the northeast (102 km) and China to the far northeast (96 km)[1]. It lies between latitudes 29°N and 39°N, and longitudes 60°E and 75°E and has a total surface area[2] of 652,864 km^2. Afghanistan has some of the most complex and varied geology in the world, with more than a quarter of its territory having an altitude of 2,500 m, and it is split east to west by the Hindukush mountain range, forming a central core from where ridges fan out to the west and south, with the Parapamisus mountains extending westwards towards Iran. In the far northeast, the Hindu Kush rises into the high-altitude Wakhan Corridor, home to the country's highest point of 7,315 m at Noshak Peak. This narrow strip of land, where the Pamir and Karakoram mountains meet, separates Tajikistan from Pakistan and is where Afghanistan shares a short border with China. Its most extensive flatlands are located in the southwest (centred around the internal drainage basin of the Helmand River) and the north (between the northern foothills of the Hindu Kush and the Amu Darya (Oxus) River, marking Afghanistan's borders with Tajikistan and Uzbekistan). Both the southwest and north regions include large areas of sandy desert.

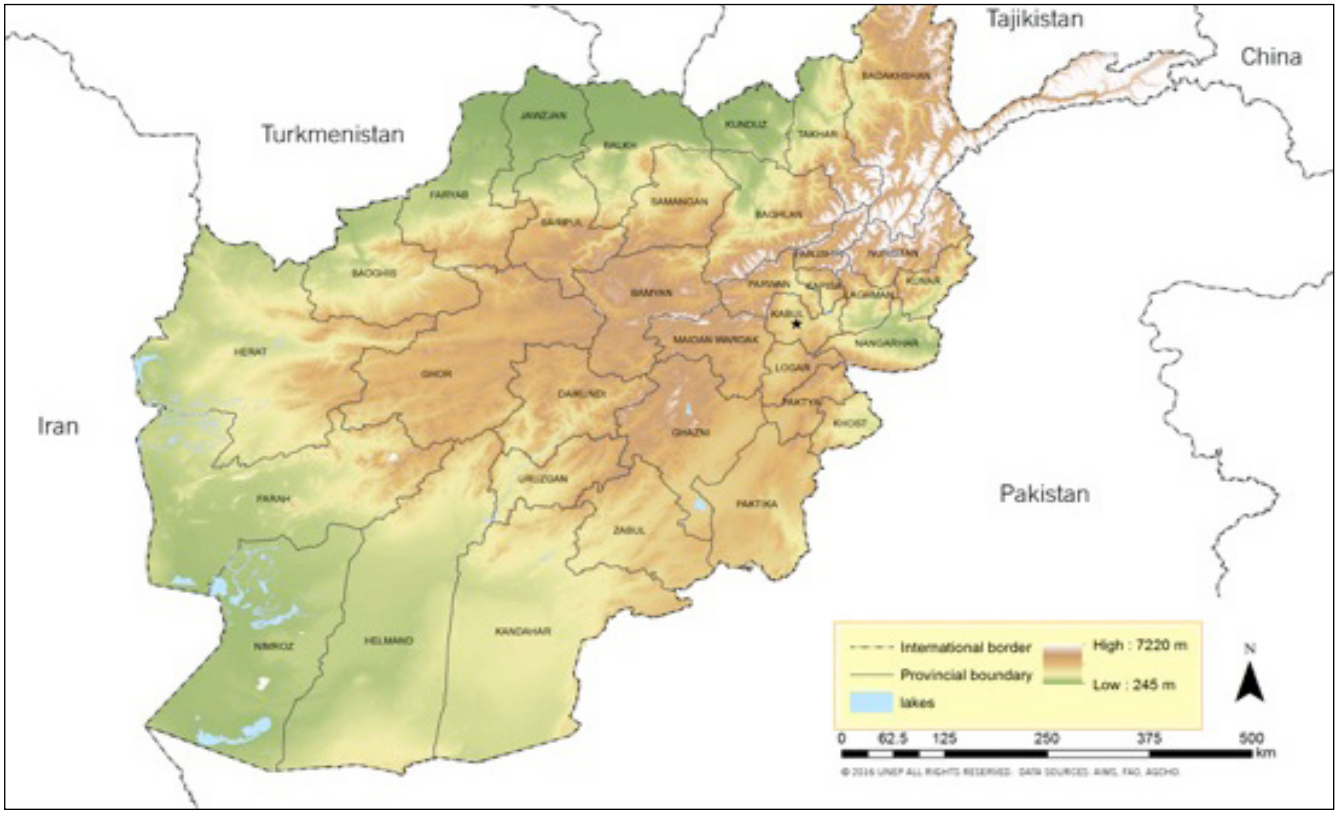


Figure 1: Political Map of the Islamic Republic of Afghanistan

1.2 POPULATION AND DEMOGRAPHICS

The NSIA estimated the country's population at 31.6 million in 2017[3] which is expected to increase to 32.2 million in 2019/20[4], making it the 39th most populous country in the world[5]. Based on the population census from 1979 and data from 2003 and 2005, Afghanistan has a fast population growth rate of 2.03% per annum, with persons under 15 years of age accounting for 47.4% of the total population[6] (see Figure 2). Afghanistan's population is split nearly even along gender lines, with 16.4 million men and 15.8 million women.

The country is also ethnically, culturally, and linguistically diverse, comprising of Pashtuns, Tajiks, Hazaras, Uzbeks, Aimaks, Turkmens, and other groups, with Pashto and Dari designated as the country's two official national languages.

According to the Human Development Index for 2016, Afghanistan was ranked 169th among 188 countries, making it the lowest in the South Asia region. Poverty is widespread with 55% of the country's total population living under the poverty line in 2017[7].

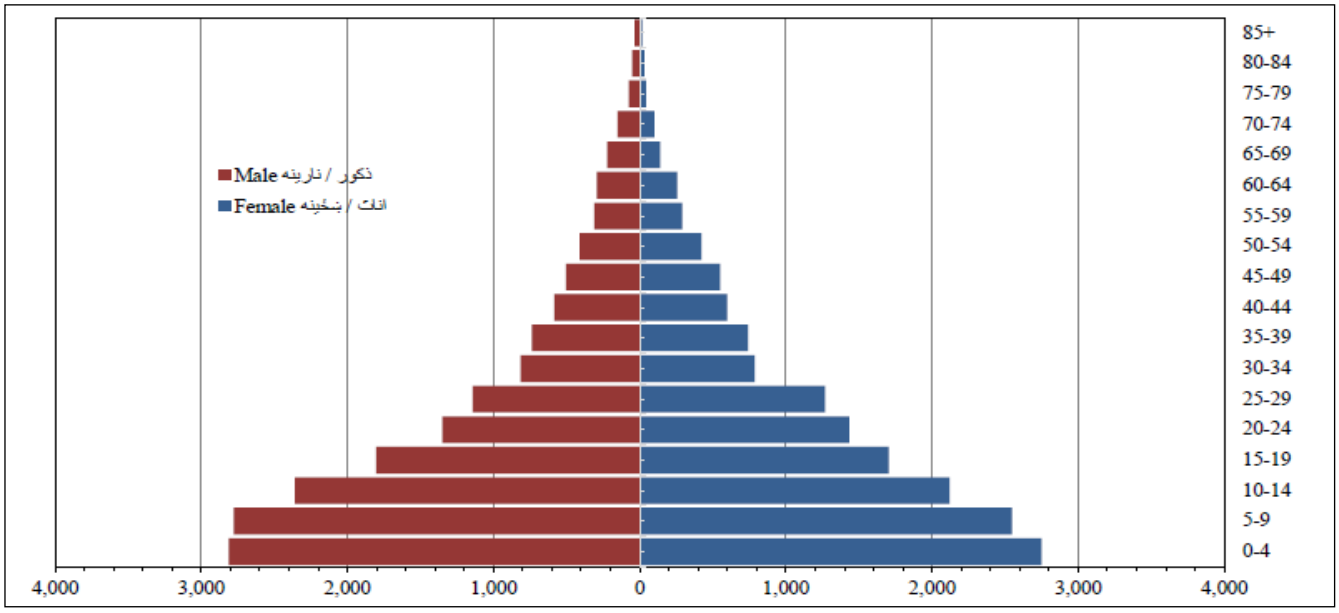


Figure 2: Population by Sex and Age Groups (2019/20), thousand-person[8]

1.3 EDUCATION

Four decades conflict in the country has severely hampered progress in the education sector. Nevertheless, after the collapse of Taliban regime, considerable gains have been made in this sector: more schools and higher tertiary institutions have been established, more children go to schools, and literacy rates are also increasing with more than half of youth (15-24 years old) able to read and write.

According to MoEd, approximately 9,6 million students were enrolled in primary, secondary, high schools, vocational high schools, technical vocational institutes, teacher training institutes, religious educations and Afghans studying abroad in 2017 (see Figure3). The number of students has been increased by 2% compared to the previous year[9].

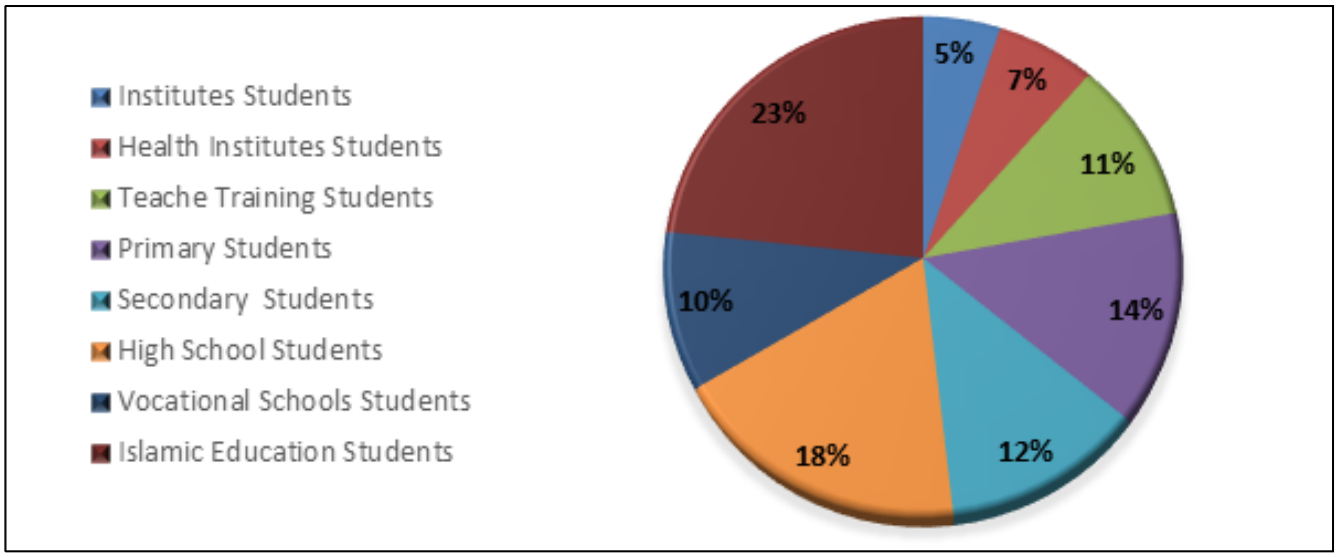


Figure 3: Share of the various educational courses[10]

In higher education, more than 369,000 students attended 160 government-owned and private universities and institutions of higher educations in 2017/18 (see Figure 4).

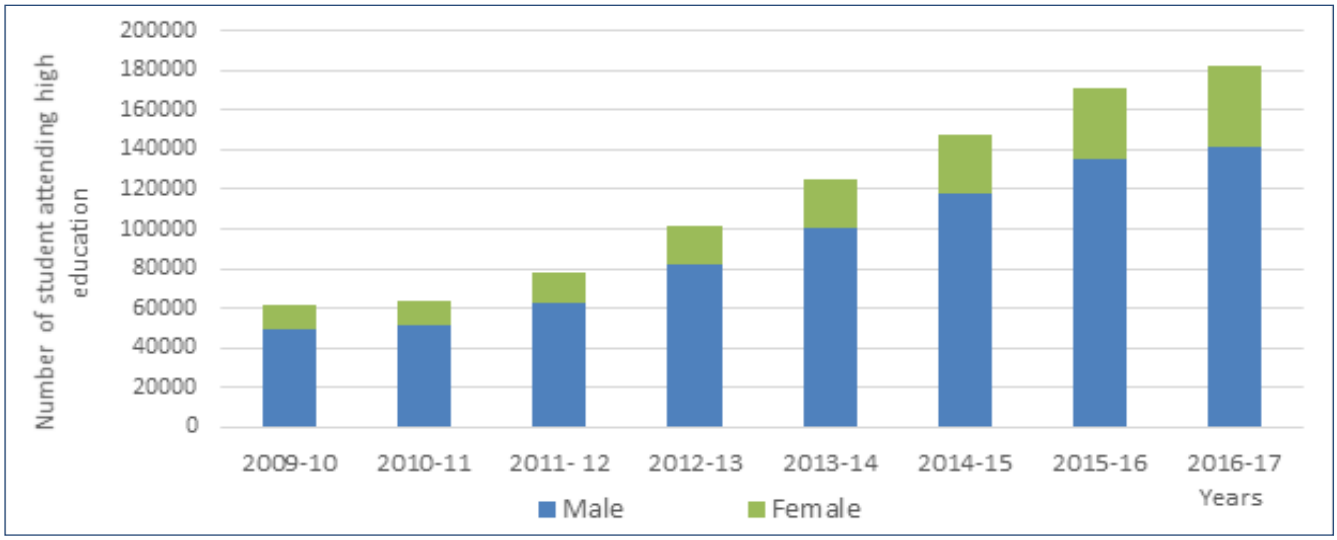


Figure 4: Students Attending High Education 2009-10 to 2016/17[11]

1.4 CLIMATE

Afghanistan has a continental climate with very harsh winters in the Central Highlands, the northeast and the Wakhan Corridor, where the average temperature in January is below -15°C, and hot summers in the low-lying areas of the Sistan Basin of the southwest, the Jalalabad Basin in the east, and the Turkestan Plains along the Amu River in the north, where temperatures average over 35°C in summer[12].

According to the recent climate change analysis conducted by NEPA and UNEP based on GHG scenarios, a strong increase in mean temperature, considerably higher than global mean projections is expected in the period 2021-2050 compared to baseline period of 1976-2006 used for these projections[13].

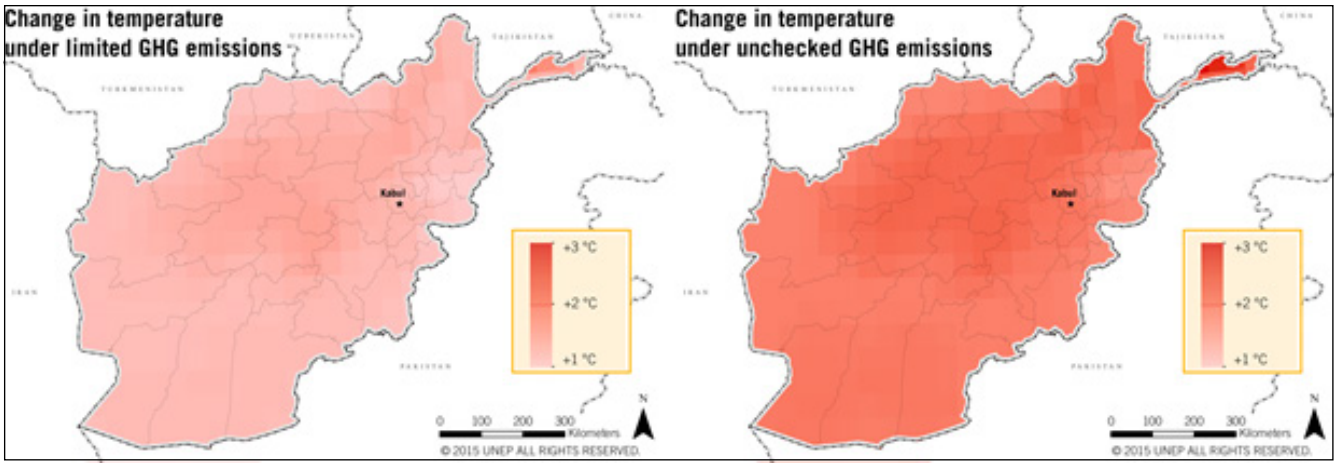


Figure 5: Mean annual temperature projection (2021-2050)[14]

Afghanistan's mean temperature has been increased by 1.8 °C since 1950. Under an optimistic (RCP4.5) scenario, this warming is likely to continue by approximately 1.5°C until 2050, followed by a period of stabilisation and then additional warming of approximately 2.5°C until 2100. In contrast, the pessimistic (RCP8.5) scenario shows extreme warming across the whole country of approximately 3°C until 2050, with further warming by up to 7°C by 2100[15] (see Figure 5).

Under both scenarios, there are regional differences, with higher temperature increases expected at higher altitudes than the lowlands. In the Central Highlands and the Hindu Kush, warming over a 30-year period in the near future (2021¬2050) is projected to range from 1.5°C to 1.7°C compared to the base period (1976–2006), while in the lowlands the increase ranges from 1.1°C to 1.4°C. The band of uncertainty for these projections is approximately +/- 2°C and all model runs show the same tendency, confirming projections from earlier studies that relied solely on general circulation models (GCMs)[16].

The average precipitation ranges from around 5 cm per annum in desert/lowland areas to around 100 cm per annum in mountainous/highland areas. The mountainous terrain provides the country with numerous sources of water, largely from snowmelt in warmer months[17]. Mean rainfall has decreased slightly at an average rate of 2% per decade, mainly due to decreases in spring precipitation. The projected change in annual precipitation varies across the country, with some areas expected to see increased precipitation and while it will decrease in other areas (Figure 6).

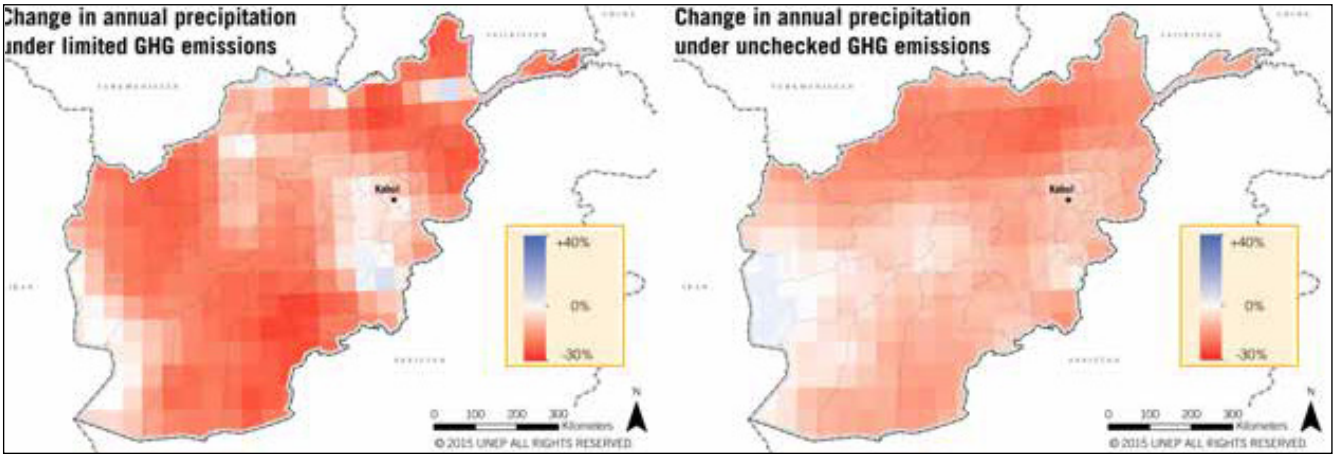


Figure 6: Mean annual precipitation projection[18]

1.5 WATER RESOURCES

Based on data from MEW's meteorological stations, Afghanistan's total annual renewable water potential for 2007-2016 is 66.33 billion m^3 per year, which comprises surface water availability of 49 billion m^3 and groundwater storage of 17.1 billion m^3. Although the country has sufficient water to meet its needs, these resources are not evenly distributed or equally accessible at all times of the year. There are essential countrywide variations within and across river and sub-river basins, which do not always correspond with the location of the irrigable land and the settled populations (see Figures 7 and 8). For example, while the Panj-Amu river basin holds almost 57% of the country's available water resources, it only accounts for 23% of the irrigated land. Contrastingly, the Northern river basin comprises 15% of all irrigated land, yet only 2% of the country's total water resources flow within the basin's hydrological borders. This represents less than 700 m^3 per capita per year, which is perilously close to absolute water scarcity[19].

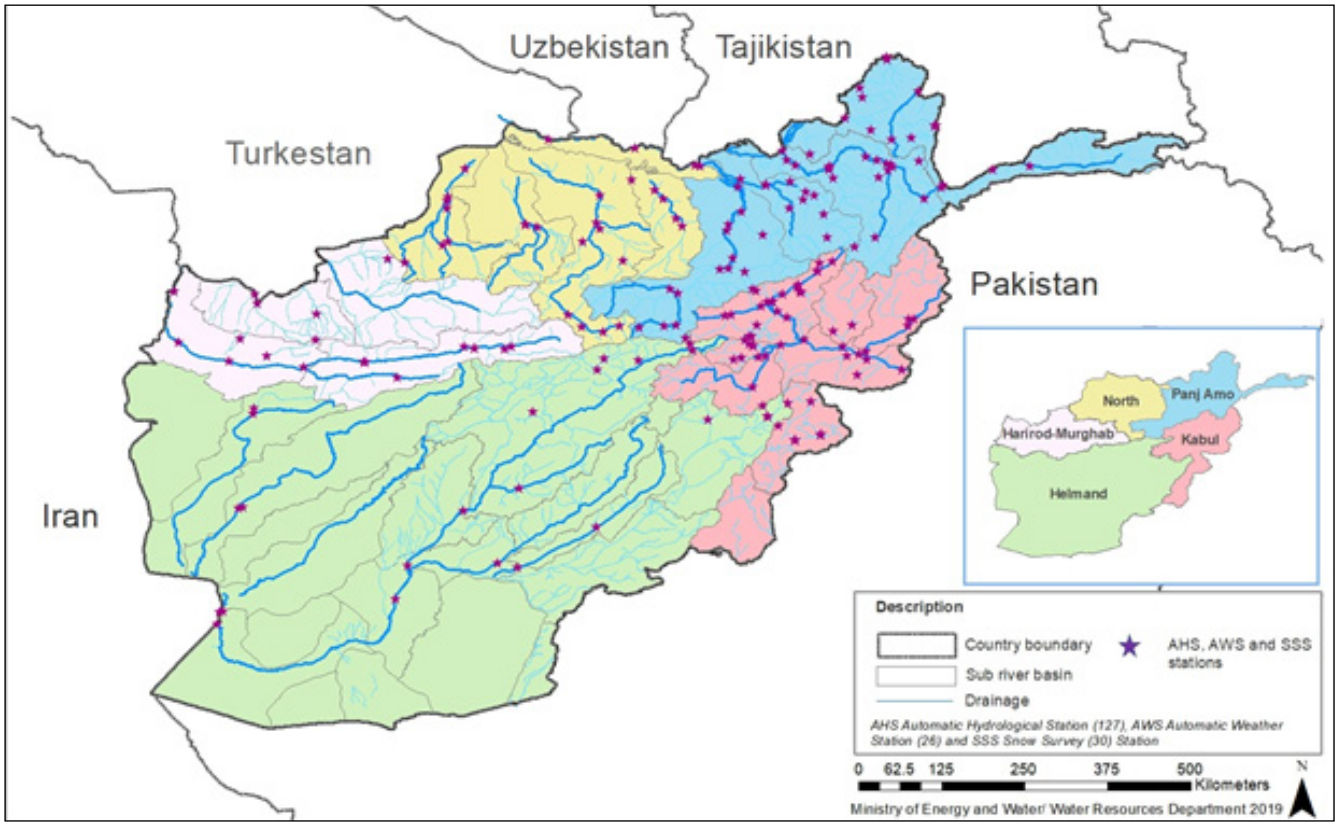


Figure 7: Afghanistan's Five River Basins and 34 Sub-basins[20]

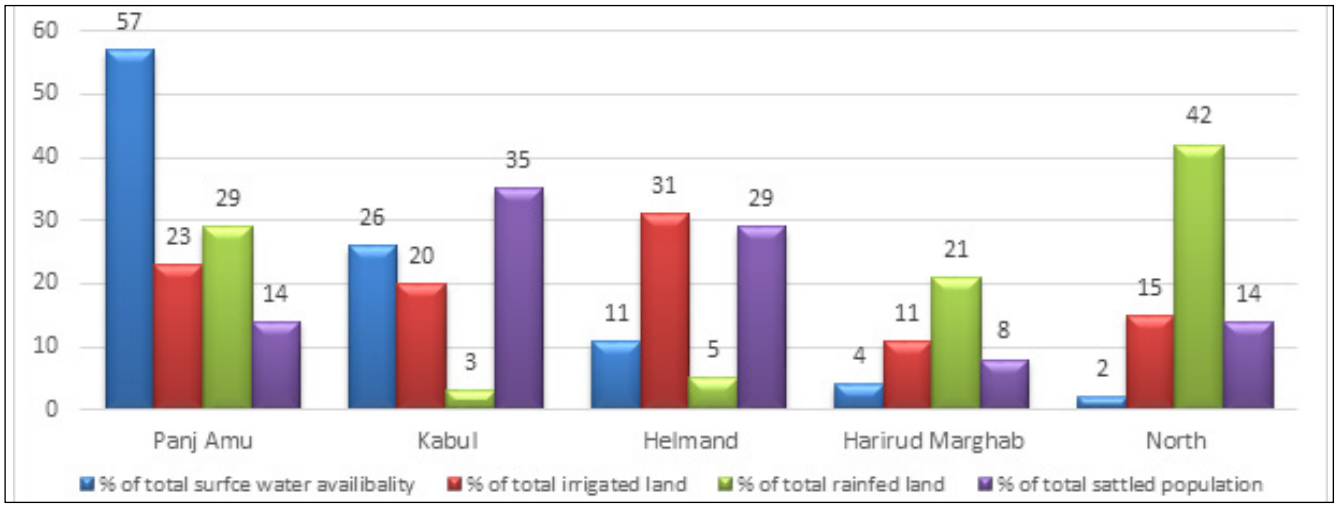


Figure 8: Afghanistan River Basins Profile[21]

Considerable intra-and inter-annual variations also characterise the availability of water in Afghanistan. Compared with neighboring countries, Afghanistan's storage capacity of 72 m^3 per capita in 2015 and 140 m^3 in 1980 is the lowest in the region and far lower than the average for Asia of 353 m^3 per capita[22]. Thus, if water becomes abundant during certain periods in the year, it cannot be stored to meet demand during periods of shortage. This reduces the opportunity to harness surface resources and renders the country more vulnerable to drought and other water-related climate shocks.

It is projected that by 2030, the potential of surface water will be decreased to 43.3 billion m^3 distributed across the five river basins[23] (see Table 1). This equates to an overall surface water and groundwater availability of 2,200 m^3 per capita per year, which is considerably higher than the Falkenmark indicator of 1,700 m^3 per capita per year that is considered sufficient to satisfy average population demands for domestic, food production, industrial, energy, and environmental needs.

Table 1: Estimated Changes in Water Availability in Afghanistan's Five River Basins[24]

River basin	Water availability for 1969-1980 in Billion m^3	Water availability for 2008-2016 in Billion m^3	Water availability for 2016-2030 in Billion m^3	Change in water availability till 2016 in %	Change in water availability till 2030 in %
Kabul	19.3	17.1	15.3	-11.3	-20
Panj Amu	21.5	18.7	17.3	-13.8	-21
Helmand	10.4	8.4	7.1	-19.0	-32
Harriru-Murghab	3.4	2.53	1.6	-25.0	-52
Northern	2.1	2.2	2	+1.5	-5
Afghanistan	**Total Water Availability**			**Average Change**	
	57	**49**	**43.3**	**-13.5**	**-26**

These changes will occur in conjunction with a steady increase in population and demand for water. Climate change is projected to reduce renewable surface water and groundwater resources in most dry subtropical regions; thereby, intensifying competition for water between sectors[25]. Current climate change projections show that precipitation levels in Afghanistan will remain relatively stable up to 2100 (see figure 9), but the overall increase in temperature across the country will lead to an increase in evaporation and transpiration that will not be compensated by a sufficient increase in precipitation, thereby negatively impacting the water cycle and availability of water resources[26] (see Figure 10).

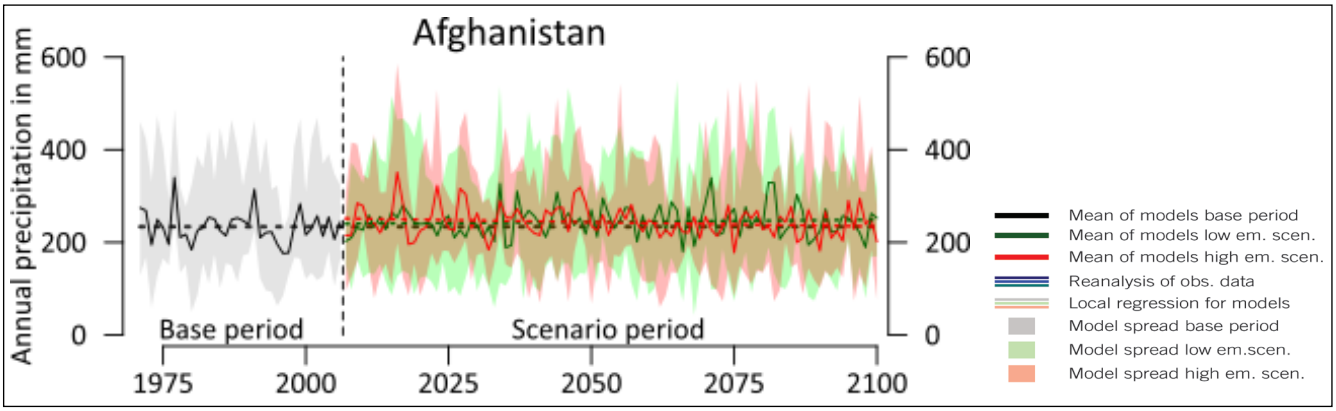


Figure 9: Mean annual precipitation projections for Afghanistan 1975 – 2100[27]

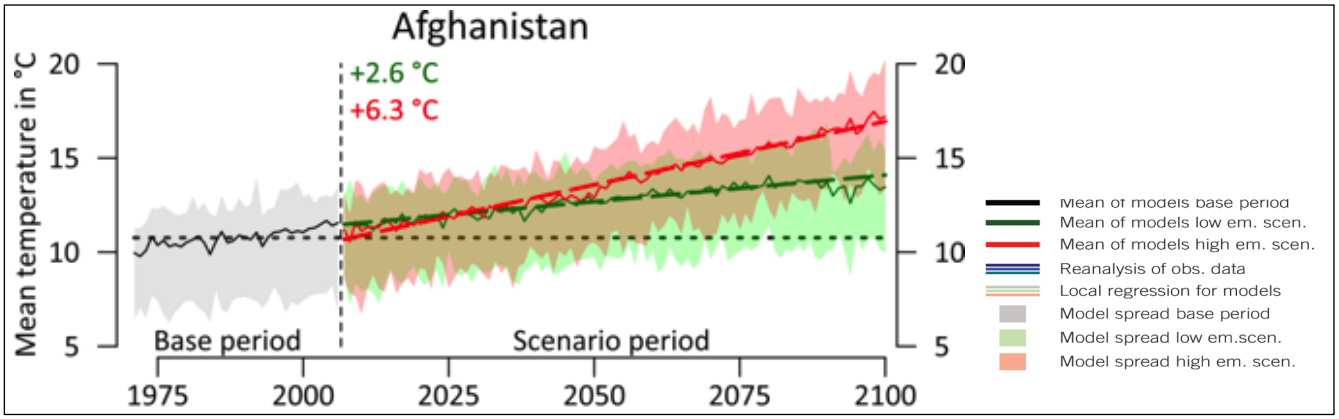


Figure 10: Mean annual temperature projections for Afghanistan 1975 – 2100[28]

Moreover, warmer temperatures will also change seasonal precipitation patterns, likely causing earlier snowmelt and causing more precipitation to fall as rain rather than snow. This will increase the risk of flooding during the spring and drought during the summer. These risks are further compounded by massive degradation of forests and rangelands, where vegetation formerly helped to stabilise watersheds and attenuate runoff, while also limiting desertification and soil erosion.

Over 25 years between 1990 – 2015, Afghanistan lost 406.16 km² (13.8%) of its total glacial area (see Figure 11), with 3.6% lost between 1990 and 2000, and 4.7% between 2000 and 2010. The glacial area loss was about 6.25% between 2010 and 2015 which indicates that the glacial area loss has been increasing in the recent decades[29].

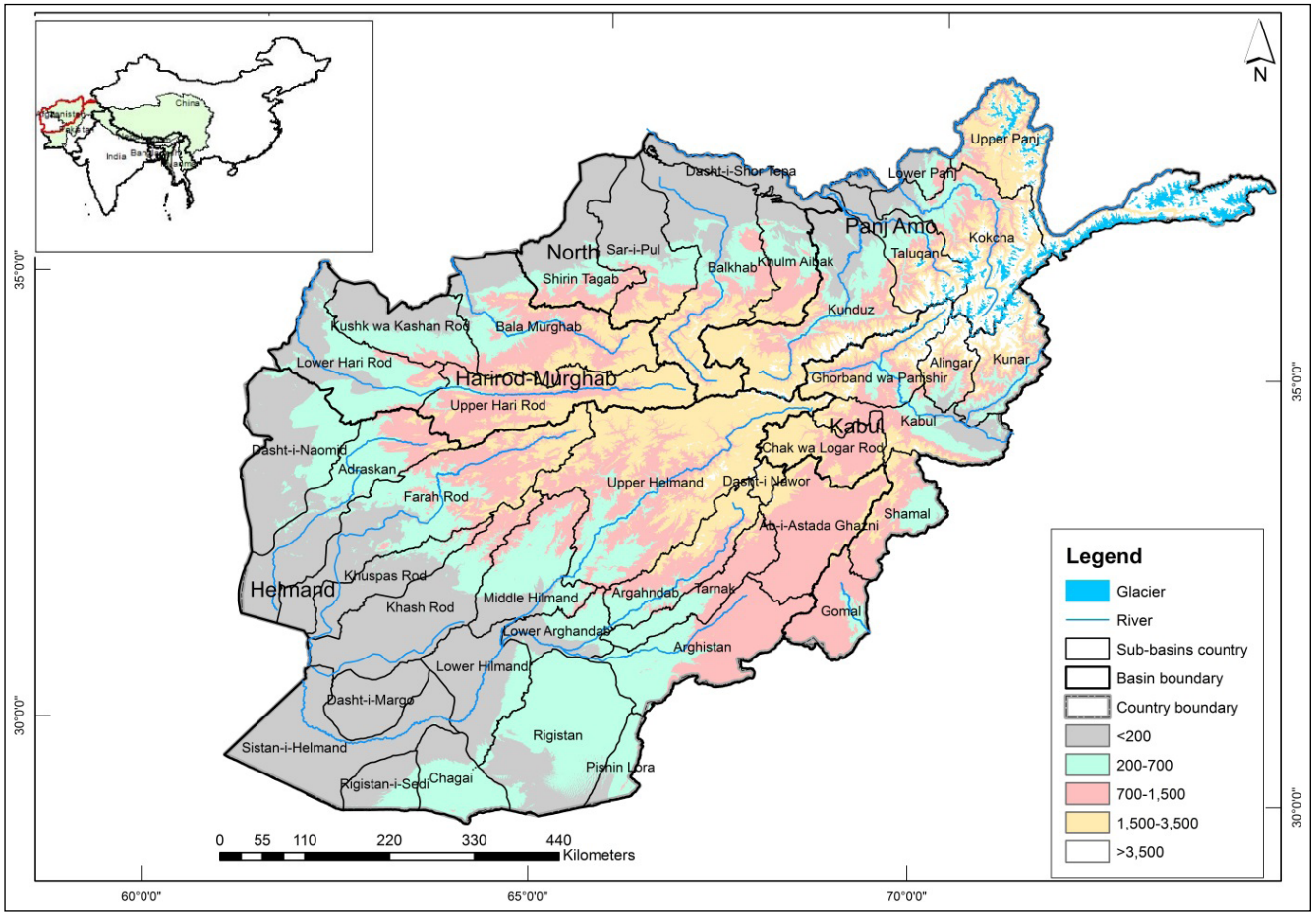


Figure 11: Distribution of glaciers in Afghanistan in 2015[30]

1.6 BIODIVERSITY AND ECOSYSTEMS

Afghanistan is a country rich in living resources and natural beauty. Its striking landscapes of mountains, deserts, open woodlands and forests are home to a vast array of species existing in a multitude of ecological conditions. This biodiversity is manifested in many ways; the number of species, differences in groups of species in various areas, the widely differing ecosystems found in various parts of the country and the genetic variation found in natural species and in agricultural crops and animals, with temperature and precipitation changing considerably at different elevations. The species that occupy these habitats are uniquely adapted to their ecosystems and, therefore, vulnerable to the impacts of climate change.

According to Afghanistan's NBSAP, the country is home to more than 700 species of mammals, birds, reptiles, amphibians, fish, butterflies, and a staggering 3,500-4,000 native vascular plant species, though recent studies suggest that biodiversity loss is accelerating[31].

1.7 AGRICULTURE, FORESTS AND OTHER LAND USE

Forest ecosystems play a major role in the global carbon cycle. Forest ecosystems are important for water regulation and flood management in river basins. They are also a source of timber products, income for the rural populations as well as home to local ethnic peoples. Of Afghanistan's surface area, 1.51% is forest and woodland, and 11.7% is arable area while 46.97% of the land is under permanent pastures. Bare areas cover 34.45% of the country's surface area while the remaining 5.37% of the land is covered by settlements, water bodies and permanent snow (see Figure 12).

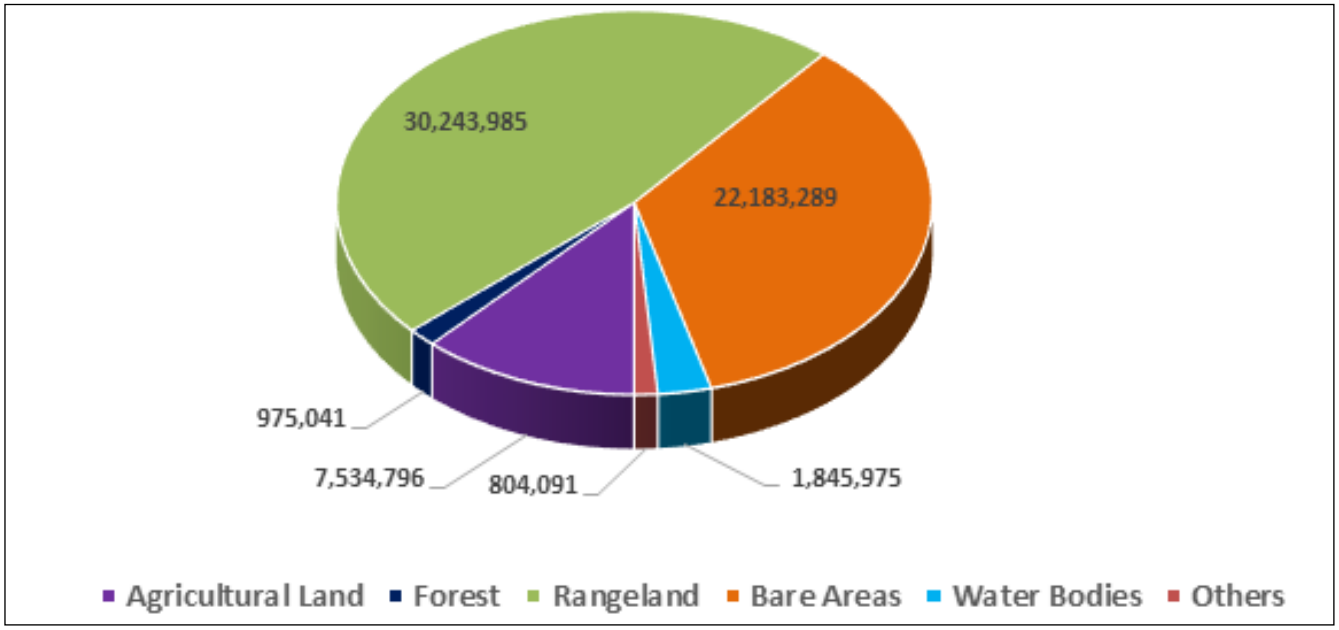


Figure 12: Afghanistan's land use matrix (2016)[32]

1.7.1. Agriculture and Livestock

Agriculture is the foundation of Afghanistan's economy and livelihoods, supporting some 80% of the country's population, either directly or indirectly[33]. Although the relative importance of agriculture is expected to decline in the future along with economic development, the sector will increase in absolute size and presents a primary focus for economic recovery, poverty reduction, and poppy eradication.

Of the country's total agricultural area, 49% comprises of fallow land while only 19% is made up of forests and woodland. The irrigated land area accounts for 24% of the total agricultural area while the remaining 8% being rainfed cultivated areas. Figure 13 below illustrates the agricultural land matrix:

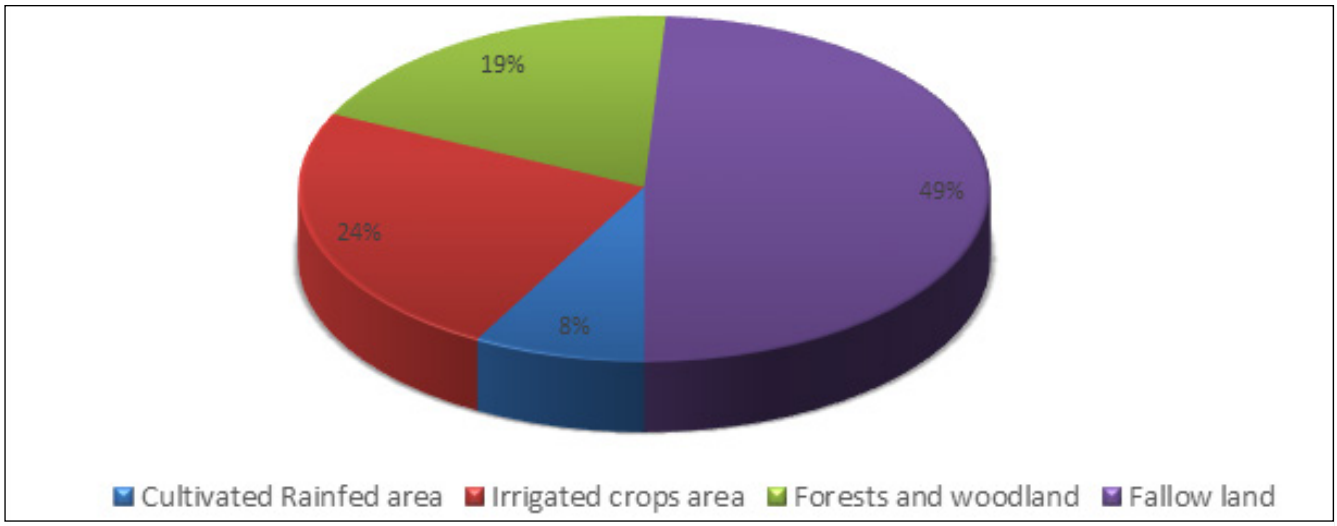


Figure 13: Afghanistan Agricultural Land Matrix (2017/18)[34]

Wheat, barley, rice and maize are the major crops. The wheat harvest in 2017/18 from both irrigated and rainfed areas was 4.3 million tonnes, which is a 6.0 % decrease from the previous year. Rice production was over 0.3 million tonnes in 2017/18, which was a decrease of 5.1% compared to the previous year. The decrease in production is because of decreases in the areas of cultivation[35]. The changes in cultivated land under the major cereal crops over the period 2013-2017 are shown in Figure 14.

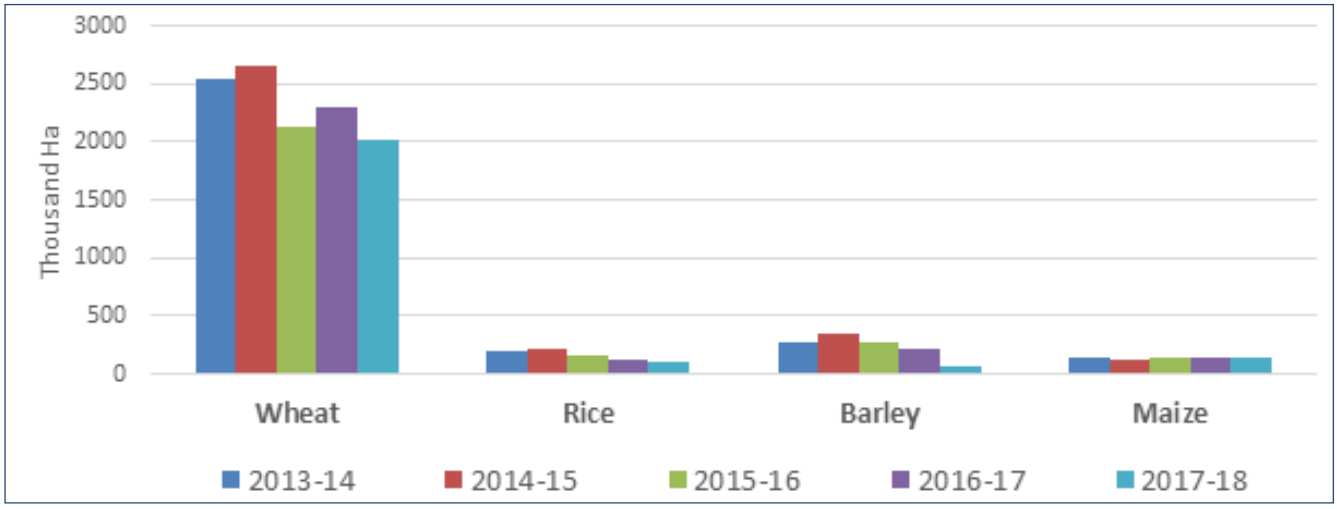


Figure 14: Cultivated land under major cereal[36]

Afghan saffron, recognised as one of the world's best quality, covered 5,205 ha of the agricultural land. The total production of saffron in 2017/18 was recorded as 10,689 kg. Almost 95% of the total saffron was produced in western Herat province[37].

As an integral part of the agricultural sector, livestock's products are a significant source of income for farmers and nomads in particular. The statistics from provincial agricultural directorates show that in 2017/18 there were 4.9 million cattle, 13.9 million sheep, 7.6 million goats and 13.6 million chickens in Afghanistan[38]. Figure 15 below illustrates livestock statistics for 2017/18.

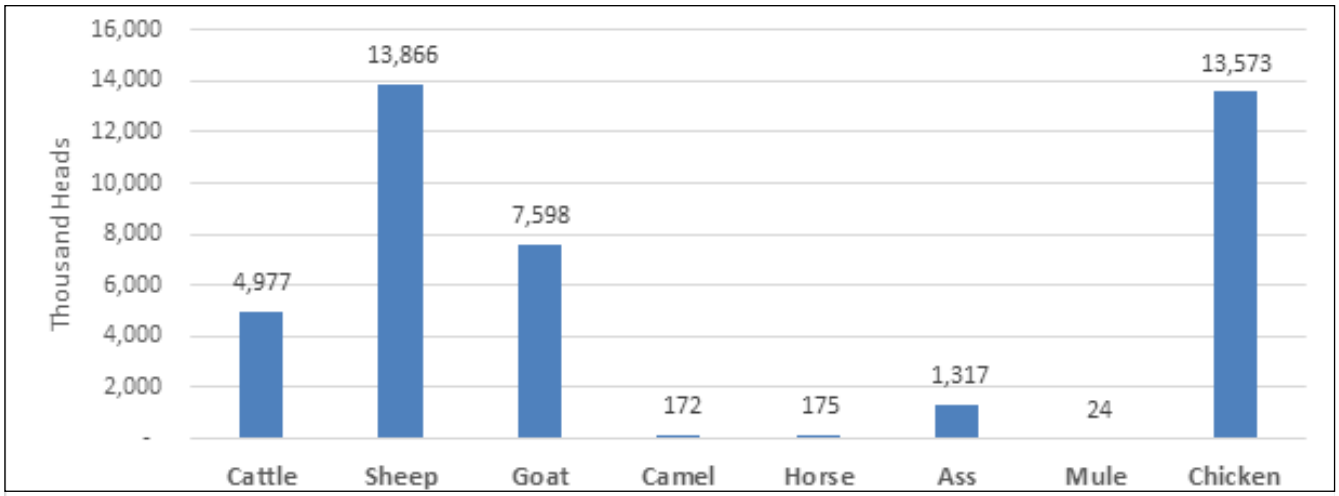


Figure 15: Livestock Statistics 2017/18[39]

1.7.2. Forests and Rangelands

Of the total 65 million ha of land in Afghanistan, 30.2 million ha is made up of pastures, 8 million ha of desert and 0.97 million ha of forests[40]. Most of Afghanistan's mountains are barren rather than forested. In the mid-1990s, an estimated 2.9 % of the land was forested, but since that time war, illegal exploitation, and the need for firewood have removed as much as 90 % of these resources. In 2005 an estimated 3.2 million m^3 of timber was harvested, about 45 % of which was used for fuel[41]. Today Afghanistan's forests account for only approximately 1-2% of the country's total land cover[42,43].

At present, the Northern Pistachio Belt and Eastern Forest Complex are increasingly overexploited as a result of a rapidly growing population and limited governance in forest management[44].

In addition, the trees and plants that make up Afghanistan's forests and rangelands face several climate change risks and adaptation challenges as temperatures increase and availability of water resources decreases. Specific threats include: 1) firewood collection; 2) overgrazing of livestock; 3) felling of trees for construction and timber; 4) insufficient incentives for reforestation; 5) limited community awareness of and involvement in forest management; 6) clearing for agricultural and urban expansion; 7) pistachio root excavation; 8) unsustainable nut harvesting; 9) local conflicts and uncertain land tenure rights; 10) soil erosion; and 11) limited law enforcement[45].

In 2016, MAIL began implementation of the Kabul Greenbelt Project. Over the next decade, the project aims to establish more than 10,000 ha of green space around Kabul, including 4,000 ha of forested area. this includes 500 ha planned for greening in the Asmayi and Shir Darwaza mountains, Qargha and near the Kabul International Airport Qasaba area with saplings and seeds chosen for their drought-resistant properties.

According to Afghanistan's land cover data, approximately 30 million ha (46.97% of the country's total area) was covered by rangelands in 2010. No changes were recorded in this land category in the 2016 land cover data[46]. Afghanistan's rangelands are of crucial importance to the livestock's production.

1.8 ENERGY AND INFRASTRUCTURE

Although Afghanistan is rich in energy resources, more than three decades of near-constant conflict has destroyed or severely degraded much of the country's infrastructure, including the energy sector. As a result, Afghanistan relies heavily on electricity imports from neighboring countries, which account for more than three quarters of Afghanistan's total electricity supply[47]. In order to reduce reliance on imported electricity, Afghanistan has made it a national priority to promote the domestic generation of electricity. Over the last decade, significant reconstruction efforts have been made to reconstruct all levels of the energy supply chain, in particular, the electricity sector.

As a consequence of the measures and steps taken towards self-efficiency in electricity production, the proportion of Afghan households with access to electricity has sharply increased since 2007/08. The proportion of the Afghan population with access to grid-connected electricity increased from 26% in 2011-12 to 30.9% in 2016/17[48]. Besides grid-connected electricity, a large percentage of Afghan households use various sources of energy only for lighting purposes, mainly in areas where access to grid-connected electricity is poor.

According to the Energy Efficiency Policy (EEP) of Afghanistan, more than 97% of the rural population use solid fuels (i.e. firewood, dung cakes, crop residues) for combustion to meet their cooking and space heating needs, usually in inefficient devices[49]. Table 2 below provides information regarding the status of the energy sector in the country.

Table 2: Renewable Energy Potential and Development Status in Afghanistan

Resource	Potential	Energy Sector Projects Current Status[50]		
		Installed	Under Construction	Planned
Hydropower	MEW and DABS estimate Afghanistan's hydropower potential to be around 23,310 MW.[51] Nearly all of this amount is located in the Panj-Amu river basin, which has an estimated hydropower potential of 20,137 MW. Next most significant is the Kabul river basin with 1,941 MW, followed by the Northern (760 MW), Helmand (270 MW), and Harirod (202 MW) river basins.	MEW records indicate that thousands of completed macro, mini and micro hydropower projects across the country have the combined installed capacity of 319 MW.[52] Recently two new HPP namely, 1) Salma HPP completed in 2018 with an installed capacity of 42 MW; 2) Kajaki second turbine which has the capacity of 18.5 MW, was connected to the grid.	The following eight HPP projects are under construction: 1. Panjshir HPP with the capacity of 4MW, 2. Ghor HPP with the capacity of 4.05MW, 3. Shorabak HPP with the capacity of 7MW, 4. Manogai HPP with the capacity of 2.1MW, 5. Rehabilitation of Chak-e-Wardak HPP with the capacity of 3.9MW, 6. Shah wa Aros HPP with the capacity of 1.2MW, 7. Kamal Kahn HPP with the capacity of 9MW, 8. Kajaki2- HPP with the capacity of 100MW.	GIRoA planned HPP projects to which technical and financial support from international donors is needed are listed below: 1. Baghdara HPP with the capacity of 240MW, 2. Qala-e- Mamai HPP with the capacity of 445MW, 3. Shaal HPP with the capacity of 798MW, 4. Sagai HPP with the capacity of 300MW, 5. Sorobi2- HPP with the capacity of 180MW.
Wind	Commercially exploitable wind resources exist in many parts of the country, with an estimated total energy potential of 147,563 MW, out of which only 66,726 MW has feasible energy capacity.[53] Major wind resource areas include northwestern Nimroz, western Farah, western Herat, eastern Balkh, northern Takhar and wind corridor areas include Near Jabal Saraj, Sarobi, and Tirgari in eastern Afghanistan.	According to MEW, following two wind energy projects have been completed with the total capacity of 400 KW 1. 300 KW wind hybrid with solar in Herat 2. 100KW wind project in Panjshir	NA	GIRoA planned wind power projects to which technical and financial support from international donors is needed are listed below: 1. Herat WPP with the capacity of 25MW, 2. Parwan WPP with the capacity of 25M, 3. Herat2- WPP with the capacity of 50MW, 4. Mazar WPP with the capacity of 50MW, 5. Herat3- WPP with the capacity of 25MW.

Solar	Afghanistan has excellent solar energy resources, typically averaging over 5.5 kWh/m^2/ day annual global horizontal insolation and estimated at least 300 days for most of the country, with the south having the highest insolation. Estimates of solar energy potential for the country are approximately 65,982,912 MW, of which approximately 222,852 MW of installed capacity potential is located in feasible areas.[54]	The following solar energy projects were completed by MEW during 2015-2018: Bamiyan SPP with a capacity of 1 MW, Herat hybrid solar and wind power plant with capacity of 2MW, DABS rooftop project with a capacity of 30KW, Takhar SPP with the capacity of 200KW Kandahar Province SPP with the capacity of 30 MW	The following five solar energy projects are under construction: 1. 10 MW in Kandahar province, 2. 5.5MW in Dikundi province, 3. 5MW in Ghor province, 4. 20KW rooftop in the vocational-technical institute of MEW, 5. 20 MW solar project in Kabul, Sorobi district.	GIRoA planned a package of 2000 MW solar projects to be completed in five zones (Kabul, Herat, Balkh, Nangarhar and Kandahar) until 2024. GIRoA needs the technical and financial support of international donors. All future the solar projects will be included in this package. The following projects are planned in this phase: 1. 20MW floating solar in Naghlu dam, 2. 45MW rooftop solar programme in all cities of Afghanistan, 3. 50MW solar energy project in Herat, 4. 50MW solar project in Mazar, 5. 60MW solar project in Hesar Shahi, 6. 40MW Kabul, Chahar Asiyab district10 MW project in Farah province.
Biomass/ Biogas	MEW estimates that the electrical energy production potential from 3,723,015 tons/ year of municipal solid waste is 819,063 MWh/year, electrical energy production potential from 39,187,641 tons/year of animal manure is 7,367,277 MWh/year, and electrical energy production potential from 6,494,820 ton/year of crop residue is 27,083,399 MWh/year.[55]	An estimated 200 small biogas digesters have been installed in Kandahar, and about 100 plants have been installed in the Jalalabad area.	NA	GIRoA has planned to utilize energy from biomass resource from deferent technologies. The planned projects to which financial and technical support is needed are listed below: 1. 20MW mtunicipal solid waste to energy power plant at Kabul province, 2. 6MW municipal solid waste to energy power plant at Balkh province, 3. 6MW municipal solid waste to energy power plant at Herat province, 4. 6MW municipal solid waste to energy power plant at Nangarhar province, 5. Launching National family-sized Biogas programme, which includes installation of 5,000 biodigester systems in five zones of Afghanistan at the first phase.
Geothermal	In Afghanistan, active geothermal systems are located in areas of the Hindu Kush, which runs along with the Herat fault system, up to the Wakhan corridor in the Afghan Pamir. There is potential for direct-use applications of these resources, such as in the food processing, fruit drying, refrigeration, fish hatchery and farming, carpet and wool processing, recreation and tourism and other small-scale industries. Development of potential geothermal prospects for commercial use, reconnaissance surveys are required to identify resources.	Prospects of low to medium temperature geothermal resources are widespread all over Afghanistan, but no substantial harvesting of geothermal energy has been initiated.	NA	NA

Apart from renewable energy sources, surveys have also shown that there are oil and natural gas resources in northern Afghanistan. It is estimated that there are 3.4 billion barrels of crude oil, 444 billion m3 of natural gas, and 562 million barrels of natural gas liquids in the country[56] (see Table 3).

Table 3: National Production of Coal and Natural Gas in Afghanistan[57]

Hydrocarbon Product	Years				
	2013/14	2014/15	2015/16	2016/17	2017/18
Coal (thousand tons)	1,347.00	1,517.40	1,384.40	1698.2	2191.4
Natural Gas (million m^3)	154.50	141.90	146.20	165.3	156.1

1.9 GEOLOGY AND MINERAL RESOURCES

Afghanistan has some of the most complex and varied geology in the world. The oldest rocks are Archean and they are succeeded by rocks from the Proterozoic and every Phanerozoic system up to the present day[58]. The country also has a long and complicated tectonic history, partly related to its position at the western end of the Himalayas. Around the Early Cretaceous period, the Indian plate disengaged from Gondwanaland and subsequently collided with the Eurasian plate in the Paleogene resulting in further orogenesis[59], crustal thickening and crustal displacement, broadly referred to as the so-called Himalayan orogenic episode. South of the Harirod fault, the remnant of the Afghan microplate has been and is still being squeezed south-westward at rates in excess of 1cm/year by this crustal shortening.

The bedrock geology of Afghanistan can also be thought of as a jigsaw of crustal blocks separated by fault zones, each with a different geological history and mineral potentiality. This jigsaw results from a series of tectonic events dating from the Jurassic up to the present. The diverse geological foundation has resulted in a significant mineral heritage with over 1,400 mineral occurrences recorded to date. Historical mining concentrated mostly on precious stone production, with some of the oldest known mines in the world established in Afghanistan to produce lapis lazuli for the Egyptian Pharaohs. The deep blue groundmass of lapis with bright yellow pyrite spots give Afghan lapis the name of Afghanite and it has been compared to starry night skies when polished.

Exploration in the 1960s and 1970s resulted in the discovery of significant resources of metallic minerals, including copper, iron and gold, and non-metallic minerals, including halite, talc, mica, magnesite, celestine, barite, beryl, fluorite, chromite, gypsum and limestone. While northern Afghanistan has energetic sources as natural gas, petroleum and coal deposits, the north-east and east have deposits of precious and semi-precious stones as emerald, kunzite, tourmaline, amethyst and aquamarine. There are known aragonite, apatite and uranium deposits in Helmand.

More recently, in 2009, American geologists discovered untapped mines in Afghanistan worth about USD 1 trillion of which lithium is the most prominent; this could generate more than USD 2 billion in annual revenues for the Afghan government. Other new deposits, previously unknown, containing vast veins of iron, copper, cobalt and gold and critical industrial minerals, are large and diverse eough that could transform Afghanistan to one of the most important mining centres in the world. With such substantial mineral deposits, if managed fairly and transparently, the extraction of these natural resources could counterbalance a major part of Afghanistan's current financial dependency on foreign aids[60,61].

1.10 ECONOMIC PROFILE

Afghanistan's economic growth has been experiencing large fluctuations since 2001 as it relies largely on international aid. Since the National Unity Government has taken over leadership, it has tried to mobilise the country's natural resources, and improve domestic economic growth. As a consequence of the measures taken towards self-efficiency, Afghanistan was declared as one of the top ten improvers in doing

business alongside China, India, Azerbaijan, and Djibouti in the World Bank Doing Business 2019 report. Afghanistan climbed 16 positions in the rankings from last year, advancing from 183rd in 2018 to 167th in 2019. It showed remarkable improvement in at least four of the 10 indicators measured: Starting a Business (47th), Protecting Minority Investors (26th), Resolving Insolvency (74th), and Getting Credit (99th)[62].

Economic growth in 2017 was 2.67, up slightly from 2.26 in 2016 and 1.45 in 2015[63]. In terms of sectoral contributions to GDP (see Figure 16), in 2017/18, the service sector led the country's growth and accounted for more than half (50.7%), which is a 0.9% decrease from the previous year. Agriculture is the second highest contributor to the GDP, and in 2017/18, contributed a share of 20.3% in the country's total GDP. Despite the drought and increasing temperatures, the contribution of the agricultural sector to the GDP increased by 3.8% in 2017/18 compared to the year before.

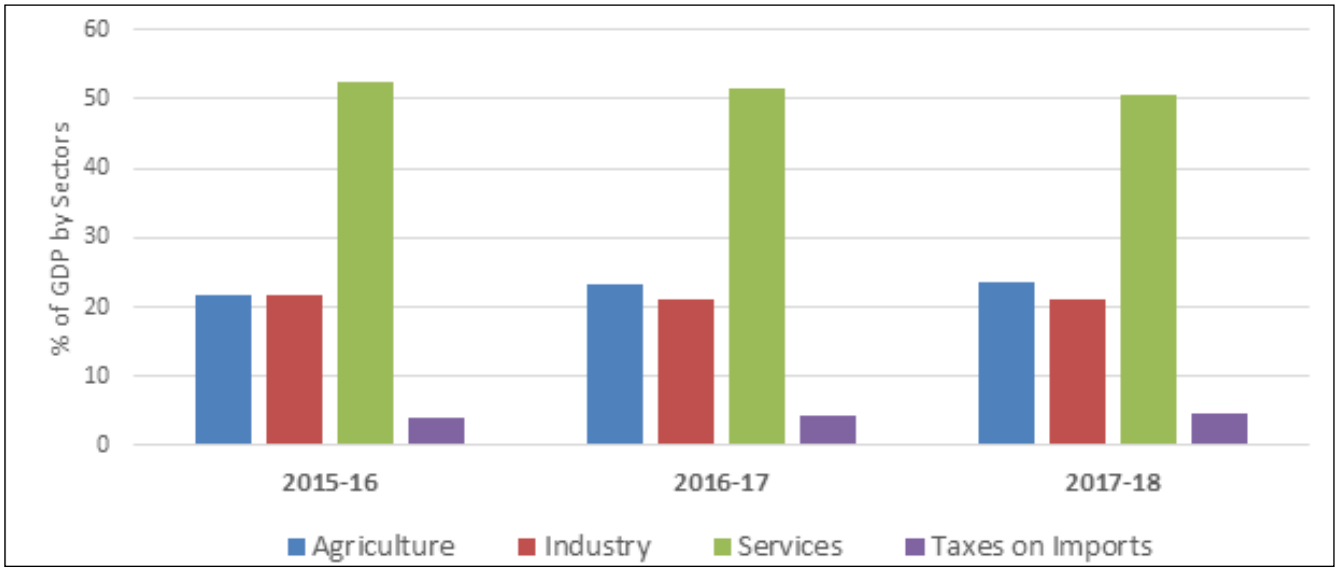


Figure 16: Changes in Sectoral Contributions to GDP from 2015/16 to 2017/18[64]

In terms of foreign trade, in 2017/18 imports of goods were increased by 19.3% compared to 2016/17, which also include the import of electricity. On the other hand, exports also increased by 39.5% in 2017/18 compared to the year before. The reasons for a considerable increment in exports are the establishment of air corridors and opening new routes that connect Afghanistan with Central Asia and Europe.

1.11 TRANSPORTATION SECTOR

Afghanistan, a land-locked country, uses only land and air transportation. Major roads connecting provinces to the capital have been constructed and rehabilitated. Afghanistan's Ring Road, which connects the country's five major cities (Herat, Kabul, Kandahar, Jalalabad, and Mazar-e-Sharif) is in progress with more than 80% of Afghans now living within 50 km of it[65].

The total registered vehicles in 2017/18 were 1,936,686 (see Table 4), which is an increase of 1.6% from the previous year. The construction of roads has been increased by 12.5% in 2017/18 compared to 2016/17.

Table 4: Afghanistan Land Transportation[66]											
Total Vehicles		Number of lorries		Buses		Passenger cars		Motorcycle		Rickshaw	Foreigner's vehicle
GS	PS	GS	PS	GS	PS	GS	PS	GS	PS		
54,228	1,882,458	16,758	303,835	5,784	103,028	25,319	1,138,712	6,367	277,128	20,604	39,151
*PS: Private Sector *GS: Government Sector											

In air transport, Afghanistan has four international and some local airports. Air traffic has been increasing substantially since 2001. Only in 2017/18, the government-owned airline (Ariana) carried 285,000 passengers and 1,652 tonnes of goods from different airports. In the private sector, only one airline (Kam Air) was active with seven airplanes which carried 749,000 passengers on different routes.

1.12 INDUSTRIAL SECTOR

The industrial sector accounted for 21.0% of the country's GDP in 2017/18. Almost all of the industrial products are produced for domestic use. Due to the political instability, there was a decrease of 14.2% in the value of industrial products from the private sector in 2017/18 compared to 2016/17[67]. Table 5 below illustrates the major active establishments.

Table 5: Total Number of Major Active Industrial Establishments[68]			
Industry	Number of Establishments		
	2015/16	2016/17	2017/18
Chemical Industries	41	38	40
Construction Materials	79	72	70
Machinery and Metal Works	61	58	55
Pharmacy	8	10	12
Printing	72	70	69
Carpentry and Paper	19	17	15
Light Industries	60	55	60
Food Industries	173	189	180
Other Industries	165	155	150
Total Industries	**678**	**664**	**651**

1.13 URBANIZATION AND URBAN AREAS

Afghanistan has a predominately rural society. According to the Afghanistan 2019/20 population estimate report, out of the total estimated population of 32.2 million, 7.7 million people live in various cities of Afghanistan, representing nearly 23.9% of the population[69]. Afghanistan with 4.4 % per annum urban growth rate is among the highest in the world. It is expected that the population of Afghan cities will increase by nearly 40% in 2050 and 50% in 2060[70]. Urbanisation is mostly due to returned refugees from neighboring countries, internally displaced persons (IDPs) who have been forced to leave their homes and rapidly growing population leading to a high population density in urban areas.

Rapid and unplanned urbanisation across the country has put significant pressures on city infrastructure, creating several challenges and constraints such as:

- Low coverage of basic services and inadequate public resources to meet growing needs
- A rapid pace of urbanisation partly due to returning refugees and rural-urban migrants, leading to high population density
- Widespread urban poverty and limited access to productive employment
- A high proportion of informal settlements and associated problems
- Lack of capacity and coordination among urban sector institutions
- Limited scale of private sector investment in urban enterprises, facilities or services
- Lack of accurate data on which to base critical policy decisions
- Land and titling insecurity, the absence of a proper land registration system, land grabbing, and inadequate legal instruments and institutions
- Lack of available financial funds due to the limited interest of donors in the urban sector[71]

In order to address these issues, the government has developed a new Urban National Priority Programme (U-NPP) to guide 1) strengthening urban governance and institutions; 2) ensuring adequate housing and access to basic services; and 3) harnessing urban economy and infrastructure[72].

1.14 PREPARATION PROCEDURES FOR BIENNIAL UPDATE REPORT

The GIRoA, with technical support from UNEP and financial assistance from the GEF, prepared this First BUR. The following steps were taken to prepare the BUR:

- Establishment of a Project Management Office (PMO) by NEPA and UNEP, led by the BUR Project Coordinator;
- Onganisation of the Inception Workshop with key stakeholders to discuss the composition of the NSTs to lead the research and preparation of the BUR. The details on the composition of the NSTs are provided in Annex 3.
- Delivering of trainings to the NSTs on tools and guidelines for GHG inventory, baseline and mitigation scenarios and domestic MRV system.
- NSTs selected their working modalities, including roles and responsibilities, data sharing hierarchy, peer review of guidelines and procedures, Quality Assurance and Quality Control (QA/QC) procedures and archiving. The details of the working modalities are illustrated in Figures 17 below.
- Onganisation of workshops to review the results of the GHG inventory and mitigation scenarios.
- Onganisation of a Validation Workshop to present the completed draft of the BUR and seek formal approval from all NST members, the PMO and senior leadership.
- The final draft of the BUR was presented to the NCCC for their recommendation and approval for submission to the UNFCCC.

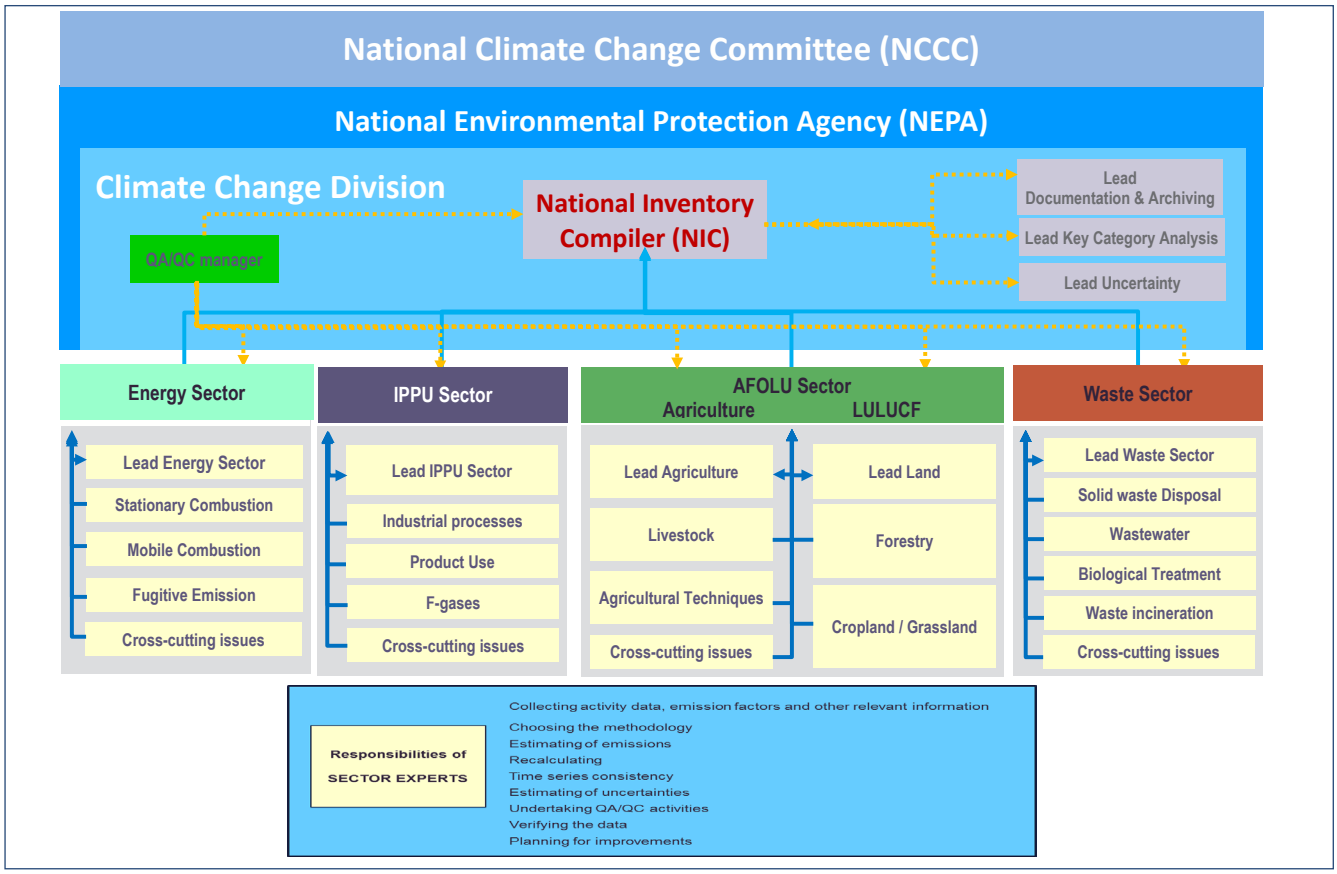


Figure 17: GHG Inventory Team working modality

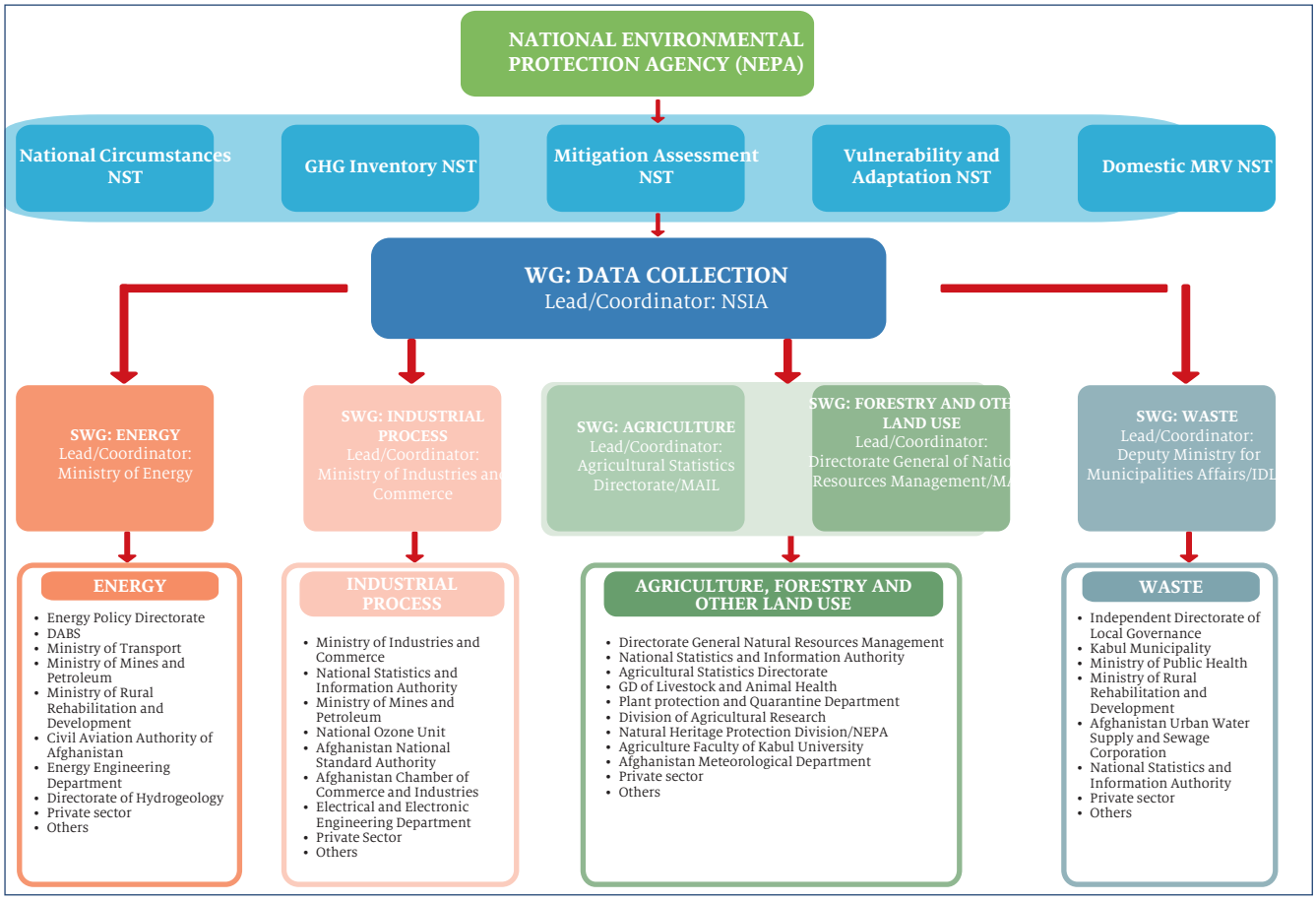


Figure 18: Composition of the Afghanistan National Study Teams

Under the overall supervision of NEPA, for preparation of this BUR, five NSTs were established (Figure 18). These NSTs were overall responsible for preparation of the relevant chapters of the BUR. Under the NSTs, a technical working group composed of four sectoral working groups (SWGs) was established responsible for the data collection. NSIA was the acting head of the data collection working group, providing data to the NSTs and the SWGs. Finally, the PMO composed of the NEPA and UNEP team finalised the BUR and shared with the Climate Change Division of the NEPA. After technical review by NEPA, the line ministries and NSTs, the report was presented to the NCCC for their comments and recommendations.

Yak milking, Ishtemich valley region - Afghanistan © UNEnvironment

2 NATIONAL GHG INVENTORY

KABUL, 2015 © UNEnvironment/Zahra Khodadadi

2.1. INTRODUCTION

The GHG inventory described in this chapter details Afghanistan's national anthropogenic emissions and removals for the time series 2012 – 2017. Estimations were carried out for four sectors, namely the Energy; Industrial Processes and Product Use; Agriculture; and Waste sectors. For the first time Afghanistan prepared a time series national GHG inventory for the period of 1990 – 2017 for all anthropogenic emissions by sources and removals by sinks of CO_2, CH_4, and N_2O.

The GHG inventory was compiled according to the recommendations for inventories as specified in:

- The UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention[73],
- The guidelines for the preparation of national communications from Parties not included in Annex I to the Convention (Decision 17/CP.8; FCCC/CP/2002/7/Add.2)[74],

Furthermore, the national GHG inventory was prepared in line with the 2006 IPCC Guidelines for National GHG Inventories[75] for the various IPCC sectors.

IPCC sector name	IPCC sector code
Energy	1
Industrial Process and Product Use (IPPU)	2
Agriculture, Forestry and Other Land Use (AFOLU)	
Agriculture	3
Land Use, Land Use Change and Forestry (LULUCF)	4
Waste	5

Note: Due to the unavailability of the time series data for LULUCF Sector, this sector was excluded from the national inventory.

For each sector, relevant categories (e.g., transport) and sub-categories (e.g., cars) which occur in Afghanistan, anthropogenic emissions by sources and removals by sinks were estimated.

The GHG precursors and air pollutants, namely, CO, NOx, NMVOCs, and SO_2 were prepared in line with the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2016[76].

Afghanistan's reporting obligation to the UNFCCC is administered by NEPA. With the Environmental Law (Official Gazette No. 912/2007) that entered into force on 25 January 2007, NEPA has been designated as national entity with overall responsibility for meeting the country's responsibilities under the UNFCCC, including the preparation of Afghanistan's National GHG Inventory as well as the preparation of the National Inventory Report (NIR).

Afghanistan's national GHG inventory, and its NIR were prepared by NEPA with technical support from UNEP-Afghanistan and financial assistance from the GEF in close consultation and participation of key stakeholders based on Afghanistan's capabilities and best available data

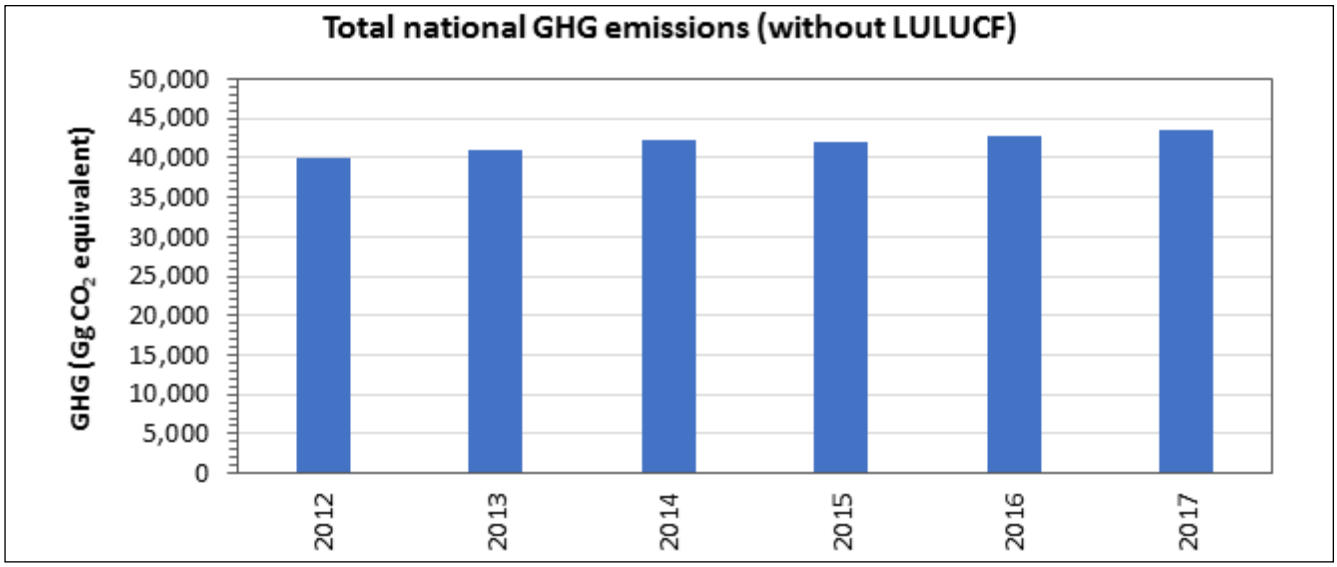


Figure 19: Total national GHG emissions (without LULUCF) in CO_2 equivalent

Afghanistan's total national GHG emissions (excluding LULUCF) amounted to 43,471.39 Gg CO_2eq in 2017. Compared to 2012, GHG emissions increased by 8.9% (see Figure 19).

2.2 INVENTORY PREPARATION AND DATA COLLECTION AND STORAGE

For estimating GHG emissions together with emissions of GHG precursors (air pollutants), Microsoft Excel™ spreadsheets were used. Activity data (AD), emissions factor (EF) and other relevant parameters for different source categories were collected and calculated in separate Excel files[a].

At the same time, the 2006 IPCC software[77] was used for QA/QC purposes and preparation of the reporting tables.

GHG Inventory Workshop - Afghanistan © UNEnvironment

All literature, statistics, and communications were archived, and the references stored on a central network server. This ensures the necessary documentation and archiving for future restoration of the inventory and for the timely response to requests during the International Consultation and Analysis (ICA) for non-Annex I Parties.

The main data supplier for the GHG inventory of Afghanistan is the NSIA providing the underlying energy source data, production data, import/export statistics, livestock data, population, GDP, etc. Additional data are requested from relevant line ministries and agencies.

[a]. *Named 'Inventory-Tool-AFG'*

2.3 METHODOLOGY

The main sources for emission factors of GHG are the 2006 IPCC Guidelines for national GHG inventories. For the emission factors of air pollutants, the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2016 was used. Country-specific (CS) emission factors were driven from the estimation of GHG emission from electricity production, cement production, as well as enteric fermentation and manure management of cattle.

For key categories, the most accurate methods for the preparation of the GHG inventory should be used. Due to lack of data and resources, it was not possible to estimate all emissions according to the sectoral decision trees. Where the methodological choice is not in line with the sectoral decision tree; actions are defined and listed in the inventory improvement plan.

Table 6 below briefly presents the AD sources, the types of EFs used, and the methods applied for estimating GHG emissions reported in this BUR.

Kabul, Afghanistan ©Zahra Khodadadi

Table 6: Summary report for methods and emission factors used and source of activity data									
Greenhouse gas source and sink categories	CO_2			CH_4			N_2O		
	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data
1. Energy									
A. Fuel Combustion									
1. Energy Industries	T1	CS	PS/Q/NSIA/UNSD	T1	D	PS/Q/NSIA/UNSD	T1	D	PS/Q/NSIA/UNSD
2. Manufacturing Industries and Construction	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD
3. Transport	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD
4. Other Sectors	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD
5. Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels									
1. Solid Fuels	T1	D	NSIA/UNSD				T1	D	NSIA/UNSD
2. Oil and Natural Gas	T1	D	NSIA/UNSD				T1	D	NSIA/UNSD
2. Industrial Processes and Product Use (IPPU)									
A. Mineral Products	T2	CS	CS/NSIA/UNSD						
B. Chemical Industry	T1	D	NSIA/UNSD	T1	D				
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production	T1	T1	NSIA/UNSD				NO	NO	NO
E. Production of Halocarbons and SF6	NO	NO	NO						
F. Consumption of Halocarbons and SF6	NE	NE	NE						
G. Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 6: Summary report for methods and emission factors used and source of activity data									
Greenhouse gas source and sink categories	CO_2			CH_4			N_2O		
	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data
3. Agriculture									
A. Enteric Fermentation				T1/T2	D/CS	NSIA/CS/FAO			
B. Manure Management				T1/T2	D/CS	NSIA/CS/FAO	T1	D	NSIA/CS/FAO
C. Rice Cultivation				T1	D	NSIA/FAO			
D. Agricultural Soils				T1	D	NSIA/FAO	T1	T1	NSIA/CS/FAO
E. Prescribed Burning of Savannahs				NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues				T1	D	NSIA/FAO	T1	D	NSIA/FAO
G. Other (Urea application)	T1	D	NSIA/FAO						
4. Land-Use, Land-Use Change and Forestry (LULUCF)									
Land-Use, Land-Use Change and Forestry (LULUCF)	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste									
A. Solid Waste Disposal on Land	T1	D		T1	D	NSIA/CS/UNSD/ALCS/EJ	T1	D	NSIA/CS/ALCS/EJ
B. Biological Treatment of Solid Waste	T1	D	NSIA/CS/UNSD/ALCS/EJ	T1	D	NSIA/CS/UNSD/ALCS/EJ			
C. Waste Incineration	T1	D	NSIA/CS/UNSD/ALCS/EJ	T1	D	NSIA/CS/UNSD/ALCS/EJ	T1	D	NSIA/CS/UNSD/ALCS/EJ
D. Waste Water Handling				T1	D	NSIA/CS/UNSD/ALCS/EJ	T1	D	NSIA/CS/UNSD/ALCS/EJ

Table 6: Summary report for methods and emission factors used and source of activity data									
Greenhouse gas source and sink categories	CO_2			CH_4			N_2O		
	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data
6. Other									
Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items									
International bunkers									
Aviation	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD	T1	D	NSIA/UNSD
Marine									
CO2 emissions from biomass									
CO2 emissions from biomass	T1	D	NSIA/CS/UNSD/FAO/ ALCS/EJ						

Notation keys		Notation keys to specify the method applied				Notation keys to specify the emission factor used		Notation keys to specify the activity data used			
NA	Not applicable	D	IPCC default	CS	Country Specific	D	IPCC default	Q	Specific Questionnaire	PS	Plant specific
NO	Not occurring	T1	IPCC Tier 1	CR	CORINAIR	CS	Country specific	NSIA	National Statistics and Information Authority (NSIA)	EJ	Expert Judgement
NE	Not estimated	T1a, T1b, T1c	IPCC Tier 1a, Tier 1b and Tier 1c, respectively	RA	Reference Approach	PS	Plant specific	ALCS	Afghanistan Living Condition survey (ALCS)		
IE	Included elsewhere	T2	IPCC Tier 2	OTH	Other	OTH	Other	UNSD	United Nations Statistics Division (UNSD)		
C	Confidential	T3	IPCC Tier 3	M	Model	M	Model	FAO	FAO Statistics Division (FAOSTAT)		

2.4. KEY CATEGORIES

The identification of key categories is prepared in accordance with the 2006 IPCC Guidelines[78]. It stipulates that a key category is one that is prioritised within the national system because its estimate has a significant influence on a country's total inventory of GHGs in terms of the absolute level of emissions or removals, the trend in emissions or removals, or both.

The key categories (excluding LULUCF) comprised 39,628 Gg CO_2eq in the year 2017, which corresponds to 95.4% of Afghanistan's total GHG emissions. For the year 2017, by level assessment, 24 key categories and by trend assessment, 21 key categories were identified.

The key category with the highest contribution (1st rank) to the total national GHG emissions (excluding LULUCF) in 2017 was '3.A.1.a Enteric Fermentation – Cattle' (CH_4) which accounted for 17.8% of total emission. This category is also the most important category in terms of emission trends; Since 1990, GHG emissions from this category have been increased by 233%.

The next most important source of GHG emissions (2nd rank) in Afghanistan was '1.A.3.b Road Transportation – Heavy-duty trucks and buses - diesel oil' (CO_2), which comprised 15.5% of the total national GHG emissions in 2017. This category is also an important category in terms of emission trends: Since 1990, GHG emissions from this category have increased by 177%.

The next most important source of GHG emissions (3rd rank) in Afghanistan was '1.A.2.m Manufacturing Industries and Construction - Others' (CO_2), with a contribution to total national emissions of 11.3% in 2017. In Manufacturing Industries and Construction - Others all fuel combustion activities are aggregated except chemical industries.

Table 7 below illustrates the results of the Key Categories Analysis Tier 1 approach for both level assessments and trend assessments for the years 1990 and 2017. Furthermore, key categories identified, including their ranking in the level and trend assessments.

Table 7: Results of the Key Categories Analysis Tier 1 Approach – Trend and Level Assessment

IPCC Category Code	IPCC Category	GHG	Rank			GHG emissions [Gg CO_2equivalent]		Share in 2017
			Level Assessment		Trend Assessment 2017-1990			
			1990	2017		1990	2017	
1.A.1.c	Manufacture of Solid Fuels and Other Energy Industries	CH_4		16		29	264	%0.6
1.A.2.c	Chemicals	CO_2	15	19	15	243	197	%0.5
1.A.2.m	Other	CO_2	11	3	6	428	5,005	%12.0
1.A.3.a.ii	Domestic Aviation	CO_2	13	21	5	397	178	%0.4
1.A.3.b.i	Cars	CO_2	7	4	4	1,120	4,707	%11.3
1.A.3.b.ii	Light-duty trucks	CO_2		17	19	122	256	%0.6
1.A.3.b.iii	Heavy-duty trucks and buses	CO_2	2	2	2	2,333	6,452	%15.5
1.A.3.b.iii	Heavy-duty trucks and buses	N_2O		24		37	101	%0.2
1.A.3.b.iv	Motorcycles	CO_2	20	13	14	142	491	%1.2
1.A.4.b	Residential	CH_4	16	15	17	195	303	%0.7
2.B.1	Ammonia Production	CO_2	17	23	21	169	119	%0.3
3.A.1.a	Cattle	CH_4	3	1	1	2,220	7,385	%17.8
3.A.1.c	Sheep	CH_4	4	7	12	1,771	1,658	%4.0

Table 7: Results of the Key Categories Analysis Tier 1 Approach – Trend and Level Assessment								
IPCC Category Code	IPCC Category	GHG	Rank			GHG emissions [Gg CO_2 equivalent]		Share in 2017
			Level Assessment		Trend Assessment 2017-1990			
			1990	2017		1990	2017	
3.A.1.d	Goats	CH_4	12	11	13	419	575	%1.4
3.A.1.e	Camels	CH_4	14	20	18	247	196	%0.5
3.A.1.f	Horses	CH_4	18		10	163	77	%0.2
3.A.1.g	Mules and Asses	CH_4	19	14	16	157	374	%0.9
3.B.2.a	Cattle	CH_4	6	8	11	1,257	1,473	%3.5
3.B.2.c	Sheep	CH_4	10	12		531	497	%1.2
3.C	Rice Cultivation	CH_4	5	6	7	1,623	2,041	%4.9
3.D.a	Direct N2O emissions from managed soils	N_2O	1	5	3	2,383	4,700	%11.3
3.D.b	Indirect N2O Emissions from managed soils	N_2O	9	9	8	638	1,212	%2.9
5.A	Solid Waste Disposal	CH_4	21	18	20	132	197	%0.5
5.D	Wastewater Treatment and Discharge	CH_4	8	10	9	675	998	%2.4
5.D	Wastewater Treatment and Discharge	N_2O		22		97	172	%0.4
TOTAL								**%95.4**

Kabul City in a dusty day © UNEnvironment/Zahra Khodadadi

2.5. GENERAL ASSESSMENT OF COMPLETENESS[b]

Sources and sinks	All sources and sinks included in the IPCC 2006 Guidelines were addressed. No additional sources and sinks specific to Afghanistan have been identified. Currently, the following GHG source and sink categories could not be estimated due to lack of data and resources: ▪ Energy - Heat Plants, Military, Multilateral Operations ▪ IPPU - Brick Production, Nitric Acid Production, Solvents, Consumption of Halocarbons and SF_6, Other Product Manufacture and Use ▪ LULUCF ▪ Waste - Industrial Wastewater, Incineration of Industrial Waste, Hazardous Waste, Clinical Waste
Gases	The GHG inventory of Afghanistan covers both direct GHGs as well as precursor gases. As mentioned above, all sources emitting fluorocarbons could not be estimated due to lack of data and resources.
Geographic coverage	National.

2.6. GLOBAL WARMING POTENTIALS (GWP)

The aggregated GHG in CO_2eq were prepared using the global warming potentials (GWP) provided by the IPCC Fourth Assessment Report (AR4)[79] based on the effects of GHGs over a 100 - year time horizon.

Table 8: Global warming potentials (GWP) provided by the IPCC Fourth Assessment Report (AR-4).

Gas Name	Chemical Formula/ abbreviation	Global Warming Potential (Time Horizon) based on the effects of GHGs over a 100-year time horizon
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298
Sulphur hexafluoride	SF_6	23,800
Hydrofluorocarbons	HFC	hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances
Perfluorocarbons	PFC	
Nitrogen Trifluoride	NFH_3	17,200

[b]. *The sources and sinks not considered in the inventory but included in the IPCC 2006 Guidelines are clearly indicated, the reasons for such exclusion are explained. Notation keys - NA, NO, NE, IE - used are in accordance with the 2006 IPCC Guidelines. Volume 1: General Guidance and Reporting, Chapter 8: Reporting Guidance and Tables, TABLE 8, page 8.7.*

2.7. NATIONAL EMISSIONS

In 2017, Afghanistan's total national GHG emissions excluding LULUCF for the three main gases (CO_2, CH_4 and N_2O) amounted to 43,471.39 Gg CO_2eq (see Figure 20). This is an 8.9% increase in the emission of GHG compared to 2012. Per capita emissions of Afghanistan in 2017, excluding LULUCF, are 1,463.68 kg, which is far below the global average.

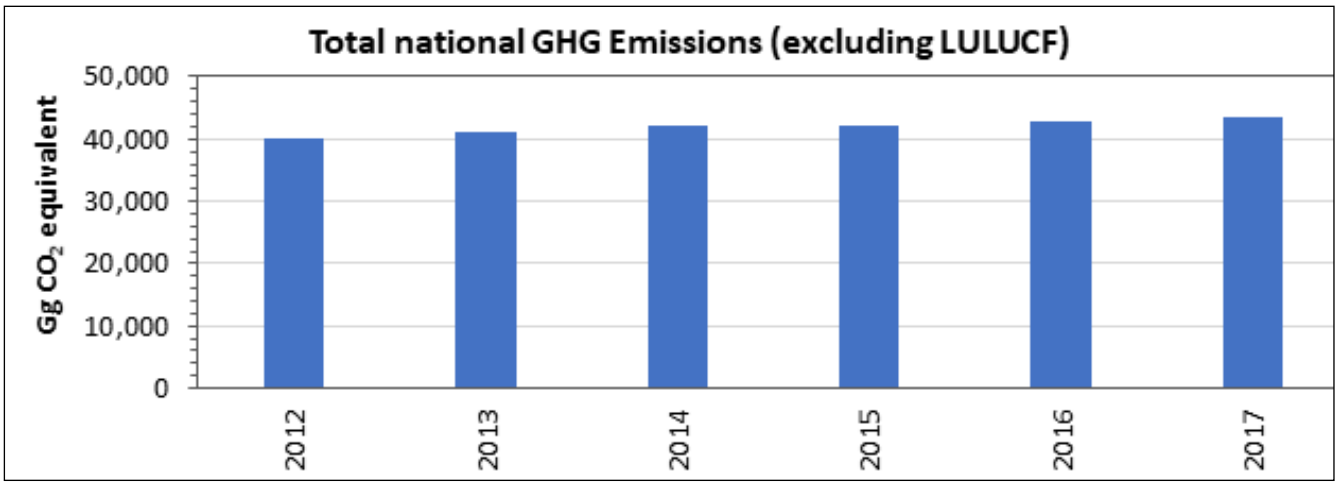


Figure 20: Total national GHG emissionsin CO_2eq

The most important GHG in Afghanistan was CO_2 comprising 48.2% of total national GHG emissions in 2017. The CO_2 emissions primarily resulted from fuel combustion activities. CH_4, which mainly arises from livestock farming, contributed to 37.8% of the national total GHG emissions, and N_2O from with agricultural soils, contributed to the remaining 14.1% in 2017 see Table 9 and Figure 21).

Table 9: Trend of GHG emissions by sources and removals by sinks for 2012 – 2017

Inventory Years	Total GHG	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	Gg CO_2 equivalent				Share in Total national GHG [%]		
2012	39,924.62	16,770.99	16,109.71	7,043.92	42.0%	40.4%	17.6%
2013	41,003.34	17,604.73	16,024.83	7,373.78	42.9%	39.1%	18.0%
2014	42,195.75	18,150.92	16,656.36	7,388.47	43.0%	39.5%	17.5%
2015	41,995.19	18,993.95	16,297.70	6,703.54	45.2%	38.8%	16.0%
2016	42,880.77	20,045.39	16,312.58	6,522.81	46.7%	38.0%	15.2%
2017	43,471.39	20,934.98	16,418.51	6,117.89	48.2%	37.8%	14.1%
Trend 2012-2017	9%	25%	2%	-13%			

Note: Due to lack of data and resources, fluorinated gases HFCs, PFCs, SF6 , NF3 are not estimated.

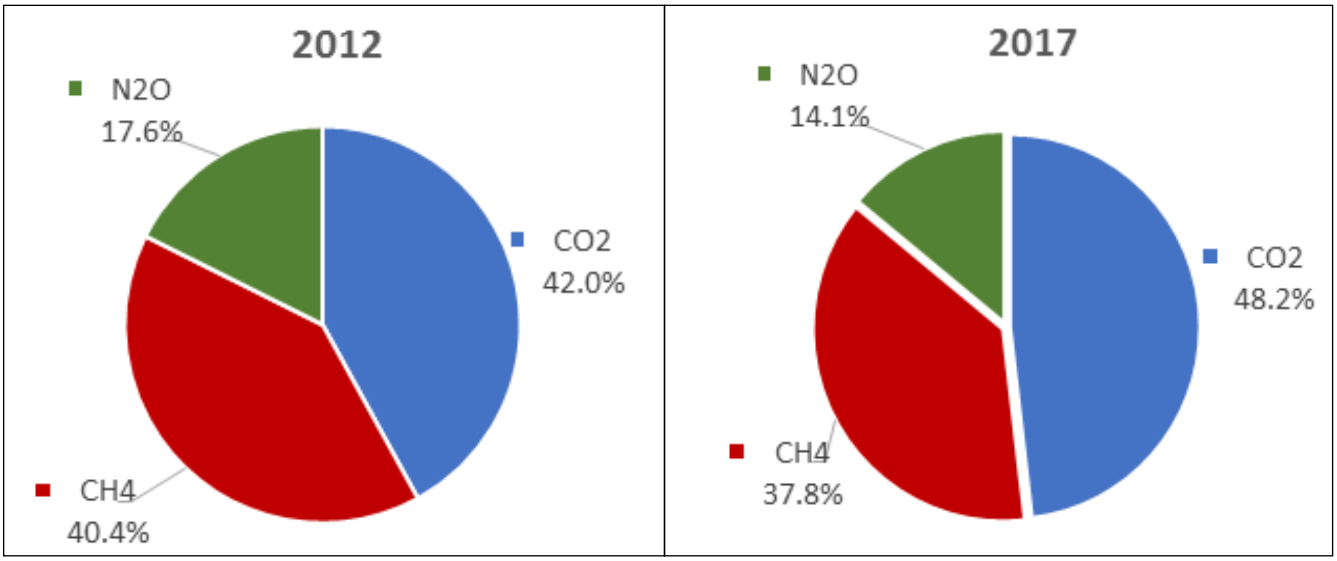


Figure 21: Share of CO_2, CH_4 and N_2O in Total national greenhouse gas emissions in 2012 and 2017

The emission trend assessment for the three main gasses are described below:

2.7.1. Carbon Dioxide (CO_2)

CO_2 emissions increased by 24.8% from 2012 to 2017 (Figure 22). In absolute figures, CO_2 emissions increased from 16,770.99 Gg to 20,934.98 Gg, mainly due to higher CO_2 emissions from transport.

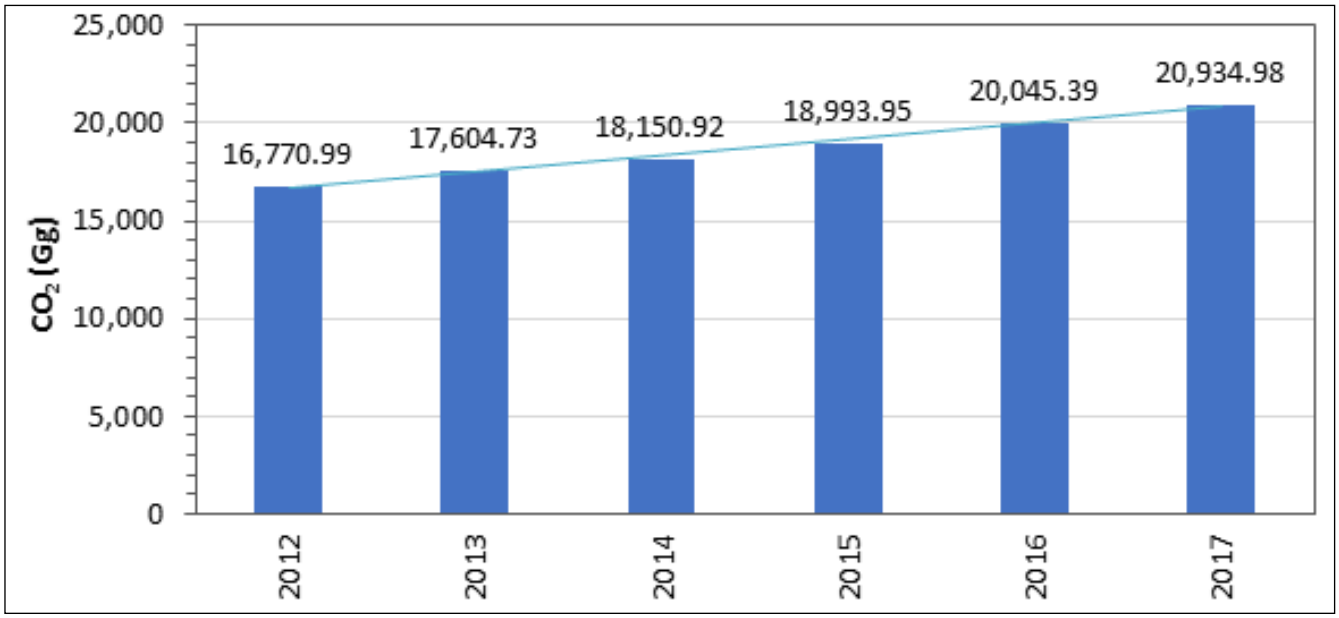


Figure 22: Total national CO_2 emissions

The primary source of CO_2 emissions in Afghanistan with a share of 98.4% is category 1. A. Fuel Combustion Activities; within this category, the subcategory 1.A.3 Transport is the most important sub-source with a share of 61.5%.

2.7.2. Methane (CH_4)

CH_4 emissions increased marginally during the period of 2012 to 2017 from 16,109.71 Gg CO_2eq to 16,418.51 Gg CO_2eq (see Figure 23). In 2017, CH_4 emissions were 1.9% above the level of 2012, mainly due to increasing emissions from categories 1.A.1.c Manufacturing of Solid Fuels (coke oven coke) and 1.A.2. Manufacturing Industries and Constructions. The main sources of CH_4 emissions in Afghanistan are the categories 3.A. Enteric Fermentation, 3.B. Manure Management and 3.C Rice Cultivation.

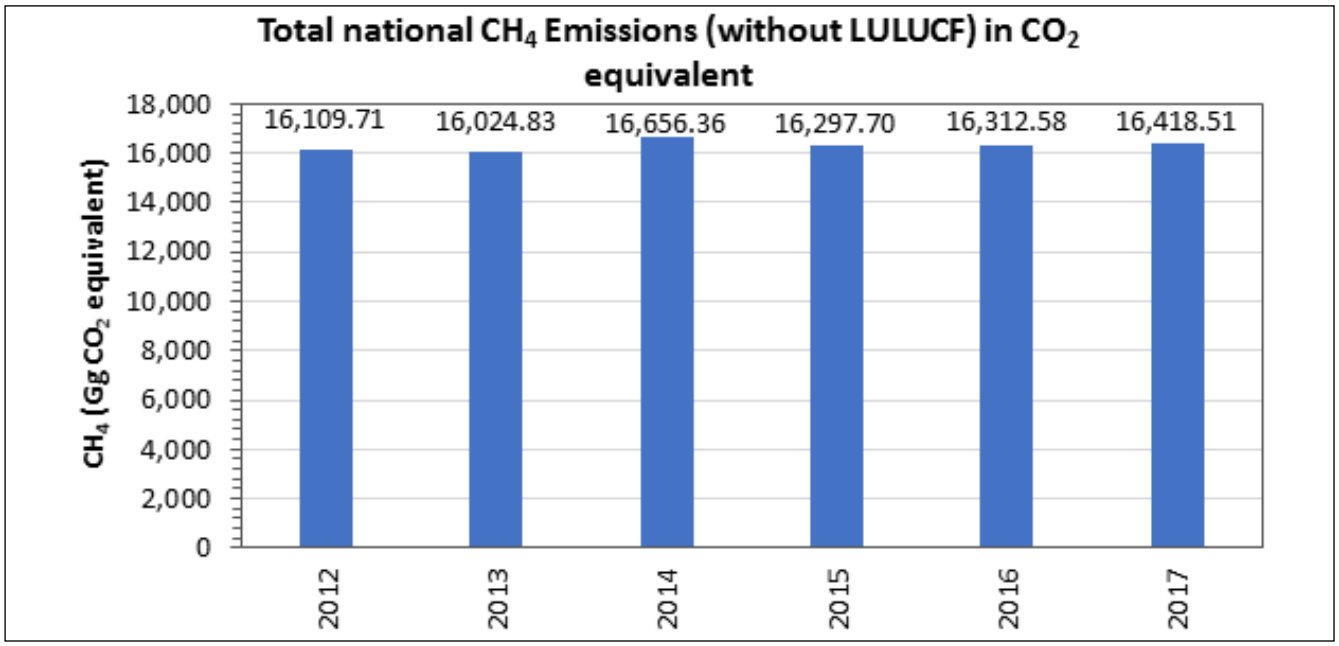


Figure 23: Total national CH_4 emissions in CO_2 equivalent

2.7.3. Nitrous Oxide (N_2O)

N_2O emissions show a decreasing trend of 13%, resulting in 6,117.89 Gg CO_2eq in 2017 compared to 7,043.92 Gg CO2eq in 2012 (see Figure 24). The decrease is mainly due to lower N_2O emissions from category 3.D Agricultural Soils.

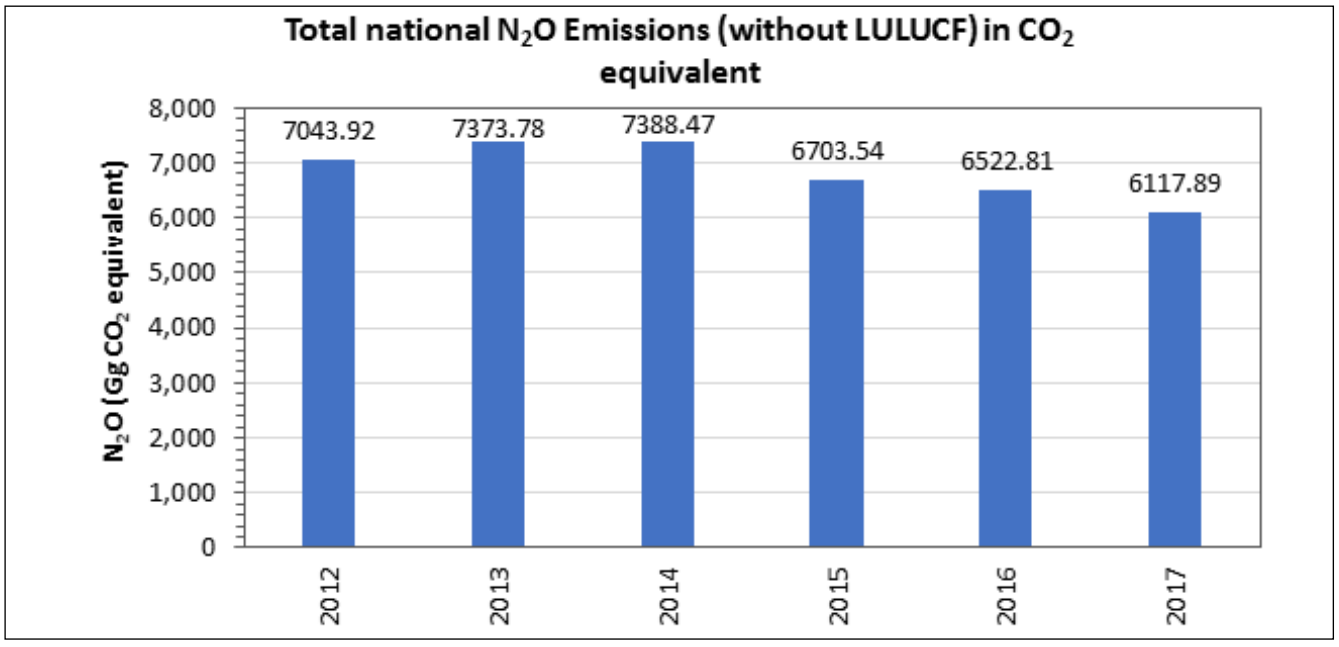


Figure 24: Total national N_2O emissions in CO_2 equivalent

The main sources of N_2O emissions in 2017 were the category 3.D Agricultural Soils with a share of 89.7% in national total N_2O emissions, the sub-category 1.A.3. Transport and the sub-category 5.B Wastewater Treatment and Discharge each with a share of 3% in total national N_2O emissions.

Apart from the GHGs, the trend assessment of the air pollutants (GHG precursors) are described as below.

2.7.4. Carbon monoxide (CO)

CO emissions increased by 11.4% from 2012 to 2017 (Figure 25). In absolute terms, CO emissions increased from 811.33 Gg to 903.96 Gg during the period 2012 to 2017, mainly due to higher CO emissions from category 1.A.2 Manufacturing Industries and Constructions as well as from 1.A.4 Other Sectors (households).

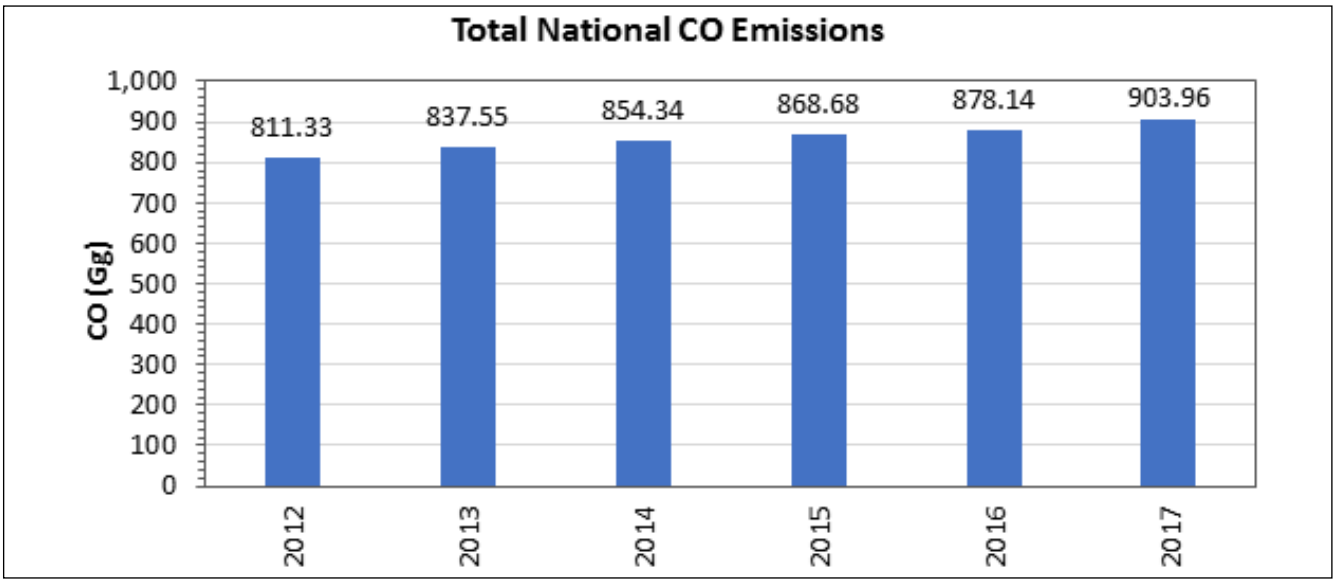


Figure 25: Total national CO emissions

2.7.5. Nitrogen Oxide (NOx)

NOx emissions increased marginally during the period 2012 to 2017 from 509.57 Gg to 634.13 Gg (Figure 26). In 2017, NOx emissions were 24% above the level of 2012, mainly due to increasing emissions from category 1.A.2 Manufacturing Industries and Construction.

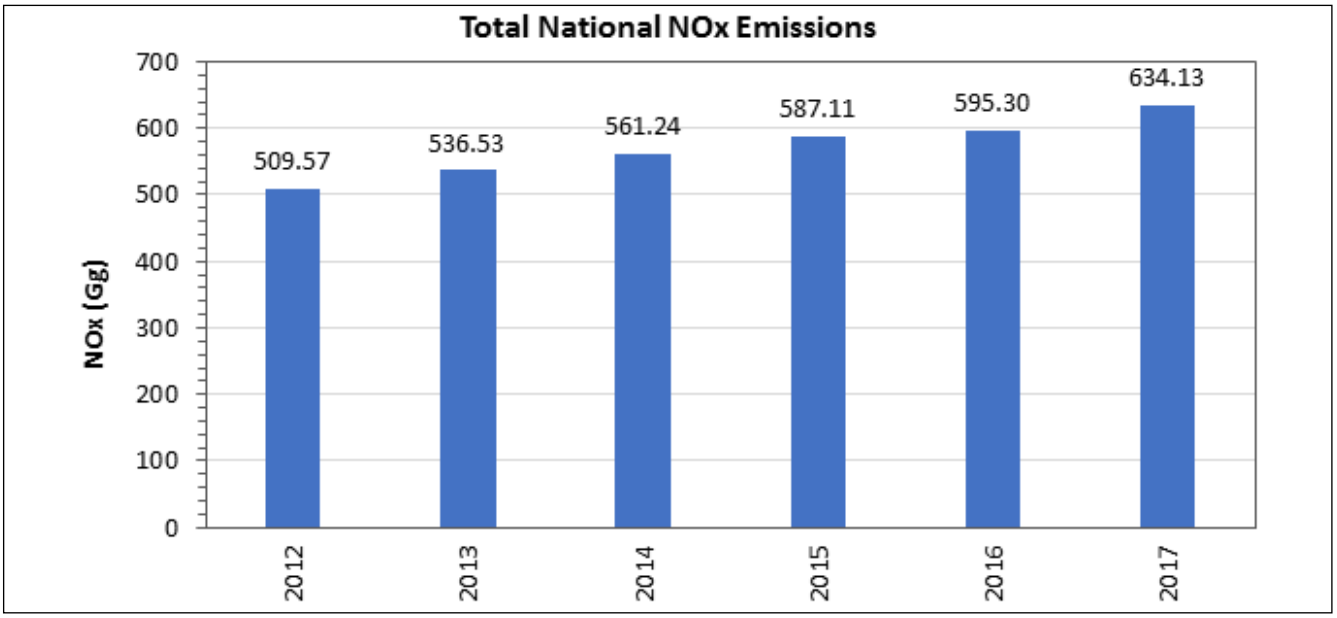


Figure 26: Total national NOx emissions

2.7.6. Sulphur Dioxide (SO_2)

SO_2 emissions increased by 128% from 2012 to 2017 (Figure 27). In absolute terms, SO_2 emissions increased from 467.23 Gg to 597.94 Gg, mainly due to higher SO_2 emissions from sub-category 1.A.3 Transport and Category 1.A.1.c Manufacturing of Solid Fuels (coke oven coke production).

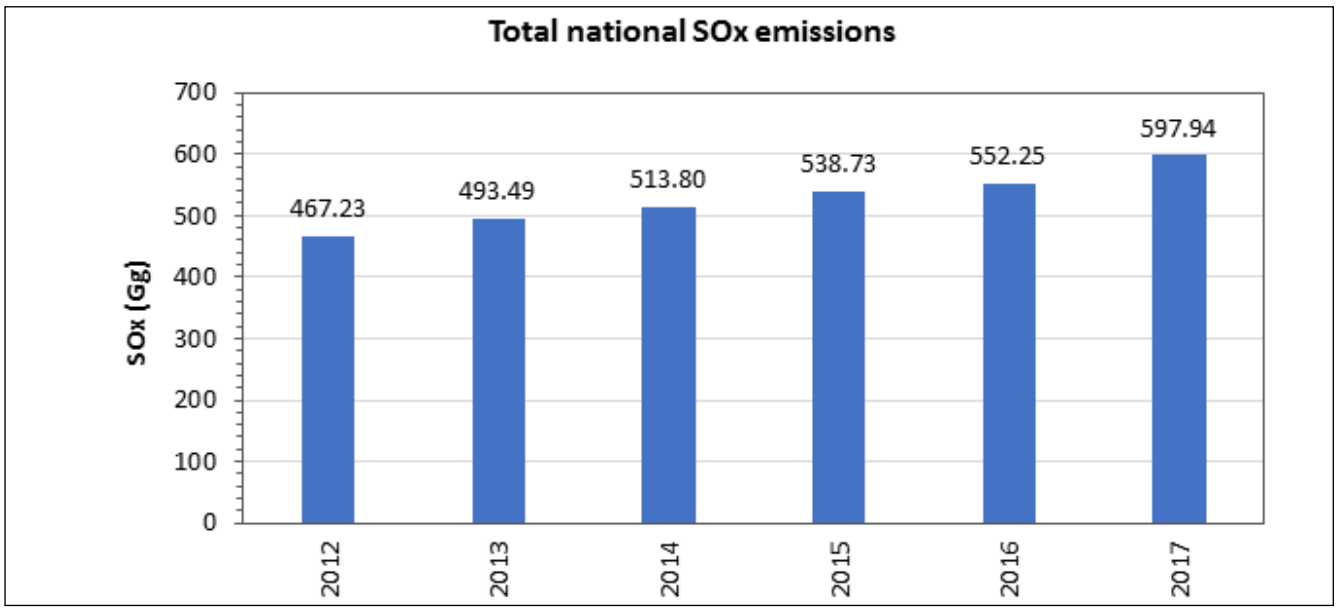


Figure 27: Total national SOx emissions

2.7.7. Non-Methane Volatile Organic Compounds (NMVOCs)

NMVOC emissions show an increasing trend of 9.0 %, resulting in 128.42 Gg in 2017 compared to 117.82 Gg in 2012 (Figure 28). The increase is mainly due to higher NMVOC emissions from Categories 1.A.2 Manufacturing Industries and Construction and 1.A.3 Transport.

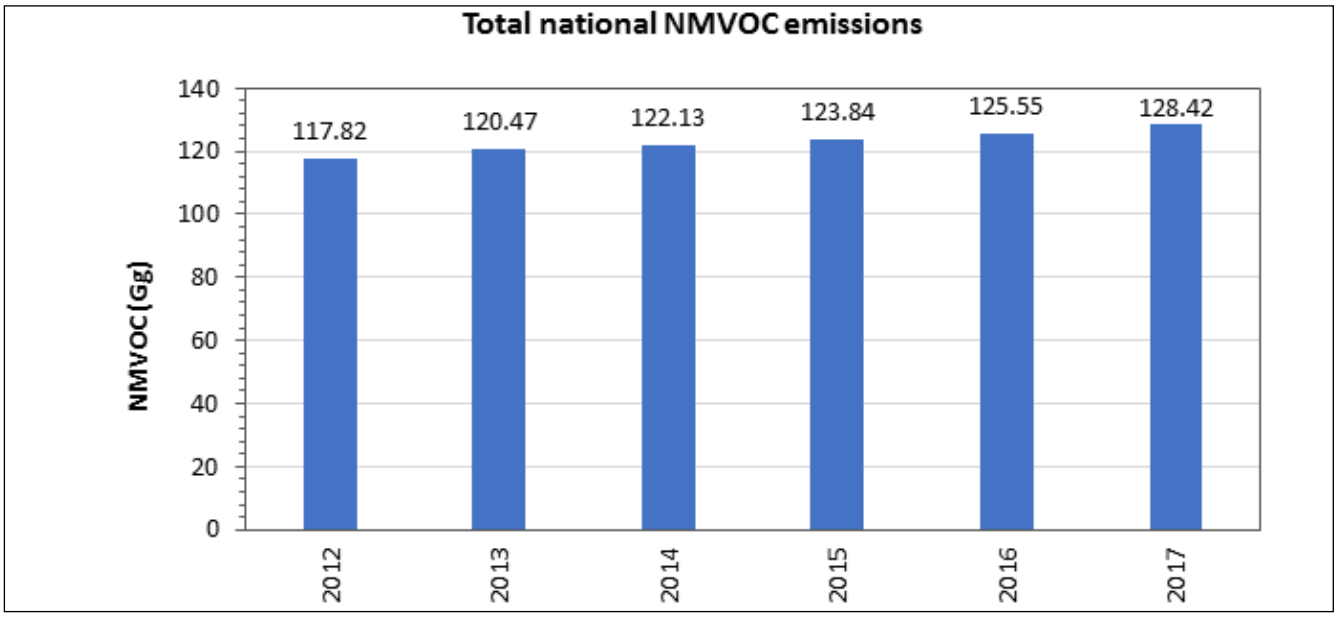


Figure 28: Total national NMVOC emissions

Table 10: National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2017									
Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SO_2
	CO_2 eq	Gg							
1. Energy	**21,649.43**	**20,615.03**	**NA**	**30.96**	**0.87**	**820.40**	**625.38**	**89.10**	**597.80**
A. Fuel combustion (sectoral approach)	21,593.37	20,603.33	NA	29.18	0.87	820.40	625.38	88.67	597.80
1. Energy Industries	408.05	93.30	NA	12.59	0.00	28.27	0.10	6.86	0.14
2. Manufacturing Industries and Construction	5,962.76	5,924.39	NA	0.55	0.08	55.95	10.62	5.40	54.00
3. Transport	13,136.61	12,881.00	NA	2.83	0.62	344.83	37.22	44.93	0.51
4. Other Sectors	2,085.95	1,704.65	NA	13.21	0.17	391.35	577.44	31.47	543.14
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	56.05	11.71	NA	1.77	0.00	NA	NA	0.43	NA
1. Solid fuels	37.27	NA	NA	1.49	NA	NA	NA	NA	NA
2. Oil and Natural Gas	18.78	11.71	NA	0.28	0.00	NA	NA	0.43	NA
2. Industrial Processes and Product Use	**245.78**	**245.78**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.08**	**NE**
A. Mineral Products	81.68	81.68	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	130.67	130.67	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.08	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**20,073.90**	**67.92**	**NA**	**575.05**	**18.89**	**14.13**	**4.78**	**35.20**	**NA**
A. Enteric Fermentation	10,273.23	NA	NA	410.93	NA	NA	NA	NA	NA
B. Manure Management	2,183.59	NA	NA	81.83	0.46	NA	1.03	NA	NA
C. Rice Cultivation	2,040.57	NA	NA	81.62	NO	NA	NA	NA	NA
D. Agricultural Soils	5,487.00	0.00	NA	0.00	18.41	0.00	2.13	35.20	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NA
F. Field Burning of Agricultural Residues	21.60	NA	NA	0.67	0.02	14.13	0.58	NA	NA
G. Other (urea application)	67.92	67.92	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land Use, Land Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,502.27**	**6.25**	**NA**	**50.73**	**0.76**	**69.43**	**3.95**	**4.04**	**0.14**
A. Solid Waste Disposal on Land	216.36	0.00	NA	8.65	0.00	NA	NA	2.51	NA
B. Other - Composting	54.13	NA	NA	1.26	0.08	NE	NE	NE	NE
C. Waste Incineration	28.87	6.25	NA	0.07	0.07	69.43	3.95	1.53	0.14
D. Waste Water Handling	1,202.92	NA	NA	40.74	0.62	NA	NA	NA	NA
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**43,471.39**	**20,934.98**	**NE**	**656.74**	**20.53**	**903.96**	**634.13**	**128.42**	**597.94**
Memo items									
International bunkers	**31.69**	**31.53**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.69	31.53	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,230.35**	**4,230.35**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Table 11: National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2012									
Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SO_2
	CO_2 Gg eq	Gg							
1. Energy	**17,324.81**	**16,443.91**	**NA**	**25.81**	**0.79**	**723.04**	**500.83**	**81.42**	**467.08**
A. Fuel combustion (sectoral approach)	17,270.70	16,432.20	NA	24.12	0.79	723.04	500.83	81.02	467.08
1. Energy Industries	301.92	93.97	NA	8.31	0.00	24.58	0.10	5.97	0.06
2. Manufacturing Industries and Construction	4,040.54	4,016.52	NA	0.35	0.05	36.87	7.13	3.59	35.54
3. Transport	12,156.56	11,919.48	NA	2.65	0.57	319.18	34.49	41.64	0.47
4. Other Sectors	771.67	402.23	NA	12.81	0.17	342.40	459.13	29.82	431.01
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	54.11	11.70	NA	1.70	0.00	NA	NA	0.40	NA
1. Solid Fuels	35.43	NA	NA	1.42	NA	NA	NA	NA	NA
2. Oil and Natural Gas	18.68	11.70	NA	0.28	0.00	NA	NA	0.40	NA
2. Industrial Processes and Product Use	**260.30**	**260.30**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.09**	**NE**
A. Mineral Products	126.82	126.82	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	100.04	100.04	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.09	0.00
E. Production of Halocarbons and SF6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**21,006.13**	**60.22**	**NA**	**573.48**	**22.18**	**15.34**	**4.56**	**33.82**	**NA**
A. Enteric Fermentation	10,194.85	NA	NA	407.79	NA	NA	NA	NA	NA
B. Manure Management	2,360.80	NA	NA	88.90	0.46	NA	1.08	NA	NA
C. Rice Cultivation	1,901.44	NA	NA	76.06	NO	NA	NA	NA	NA
D. Agricultural Soils	6,466.34	0.00	NA	0.00	21.70	0.00	1.89	33.82	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	22.48	NA	NA	0.73	0.01	15.34	0.51	NA	NA
G. Other (urea application)	60.22	60.22	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land Use, Land Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,333.39**	**6.56**	**NA**	**45.09**	**0.67**	**72.95**	**4.16**	**2.48**	**0.14**
A. Solid Waste Disposal on Land	147.49	0.00	NA	5.90	0.00	NA	NA	0.87	NA
B. Other - Composting	46.70	NA	NA	1.09	0.07	NE	NE	NE	NE
C. Waste Incineration	30.33	6.56	NA	0.08	0.07	72.95	4.16	1.61	0.14
D. Waste Water Handling	1,108.86	NA	NA	38.03	0.53	NA	NA	NA	NA
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**39,924.62**	**16,770.99**	**NE**	**644.39**	**23.64**	**811.33**	**509.57**	**117.82**	**467.23**
Memo items									
International bunkers	**31.69**	**31.53**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.69	31.53	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,168.42**	**4,168.42**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

2.8. SECTORAL EMISSIONS

Description and Interpretation of Emission Trends by Sectors

The important sectors for GHG emissions in Afghanistan (excluding LULUCF) are IPCC sector 1 Energy comprising 49.8% of total national GHG emissions in 2017 (43.4% in 2012), followed by IPCC sector 3 Agriculture with 46.2% of total national GHG emissions in 2017 (52.6% in 2012). Figure 29 and Table 13 below present a summary of Afghanistan's anthropogenic GHG emissions by sector.

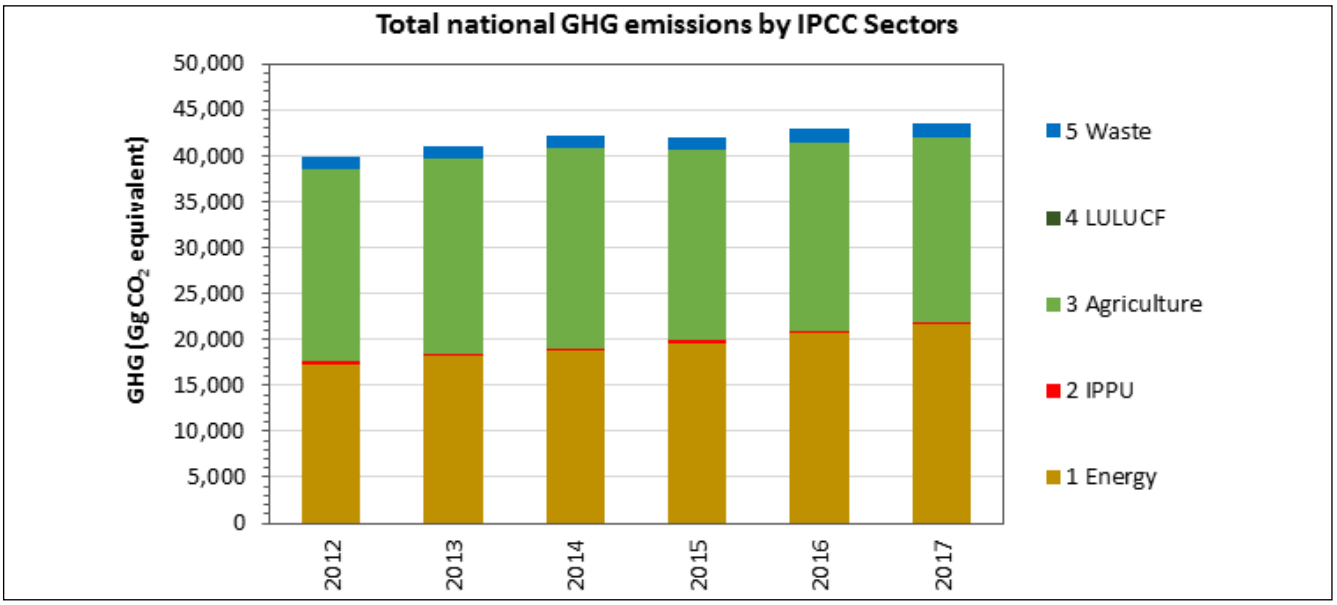


Figure 29: Total national GHG emissions in CO_2 equivalent by IPCC Sectors

In 2017, GHG emissions from IPCC sector Energy amounted to 21,649.43 Gg CO_2eq which corresponds to about 50% of the total national emissions. Some 99% of the emissions from this sector originate from IPCC category 1.A. Fossil Fuel Combustion. IPCC category 1.B Fugitive Emissions from Fuels are of minor importance. From 2012 to 2017, emissions from this sector increased by 25%. The main increase occurred in the Transport and Manufacturing Industries and Construction sectors due to higher consumption of fossil fuels.

In 2017, GHG emissions from IPCC sector IPPU amounted to 245.78 Gg CO_2eq, which corresponds to 0.6% of the total national emissions. From 2012 to 2017, emissions from this sector decreased by 5.6%, mainly due to a decrease in lime production.

In 2017, GHG emissions from IPCC sector Agriculture amounted to 20,073.90 Gg CO_2eq, which corresponds to about 46.2% of total national emissions. From 2012 to 2017, emissions from this sector decreased by 4.4%, mainly due to decreasing GHG emissions from manure management.

In 2017, GHG emissions from IPCC sector Waste amounted to 1,502.27 Gg CO_2eq, which corresponds to 3.5% of total national emissions. From 2012 to 2017, emissions from this sector increased by 13%, mainly due to an increase in the solid waste disposal and increased population.

Table 13 provides an overview of the trend in overall GHG emissions between 2012 to 2017 for each sector. Figure 30 shows the contribution of each sector to each of the primary GHGs estimated. Table 14 provides a summary of Afghanistan's anthropogenic GHG emissions by sector for the period 2012–2017.

Table 12: Trend of GHG emissions by sources and removals by sinks for 2012 – 2017									
Greenhouse Gas Source and Sink Categories	2012	2013	2014	2015	2016	2017	Trend 2012–2017	2012	2017
	Gg CO_2 equivalent							Share [%]	
1. Energy	17,324.81	18,155.72	18,784.66	19,614.68	20,664.69	21,649.43	25.0%	43.4%	49.8%
2. Industrial Processes and Product Use	260.30	261.31	223.77	233.87	278.59	245.78	-5.6%	0.7%	0.6%
3. Agriculture	21,006.13	21,227.59	21,800.63	20,729.34	20,490.89	20,073.90	-4.4%	52.6%	46.2%
4. Land-Use, Land-Use Change and Forestry (LULUCF)	NE	NE	NE	NE	NE	NE	NE	_	_
5. Waste	1,333.39	1,358.72	1,386.69	1,417.30	1,446.59	1,502.27	12.7%	3.3%	3.5%
6. Other	NO	NO	NO	NO	NO	NO	NO	0.0%	0.0%
Total national emissions and removals	**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**	**8.9%**	**100.0%**	**100.0%**

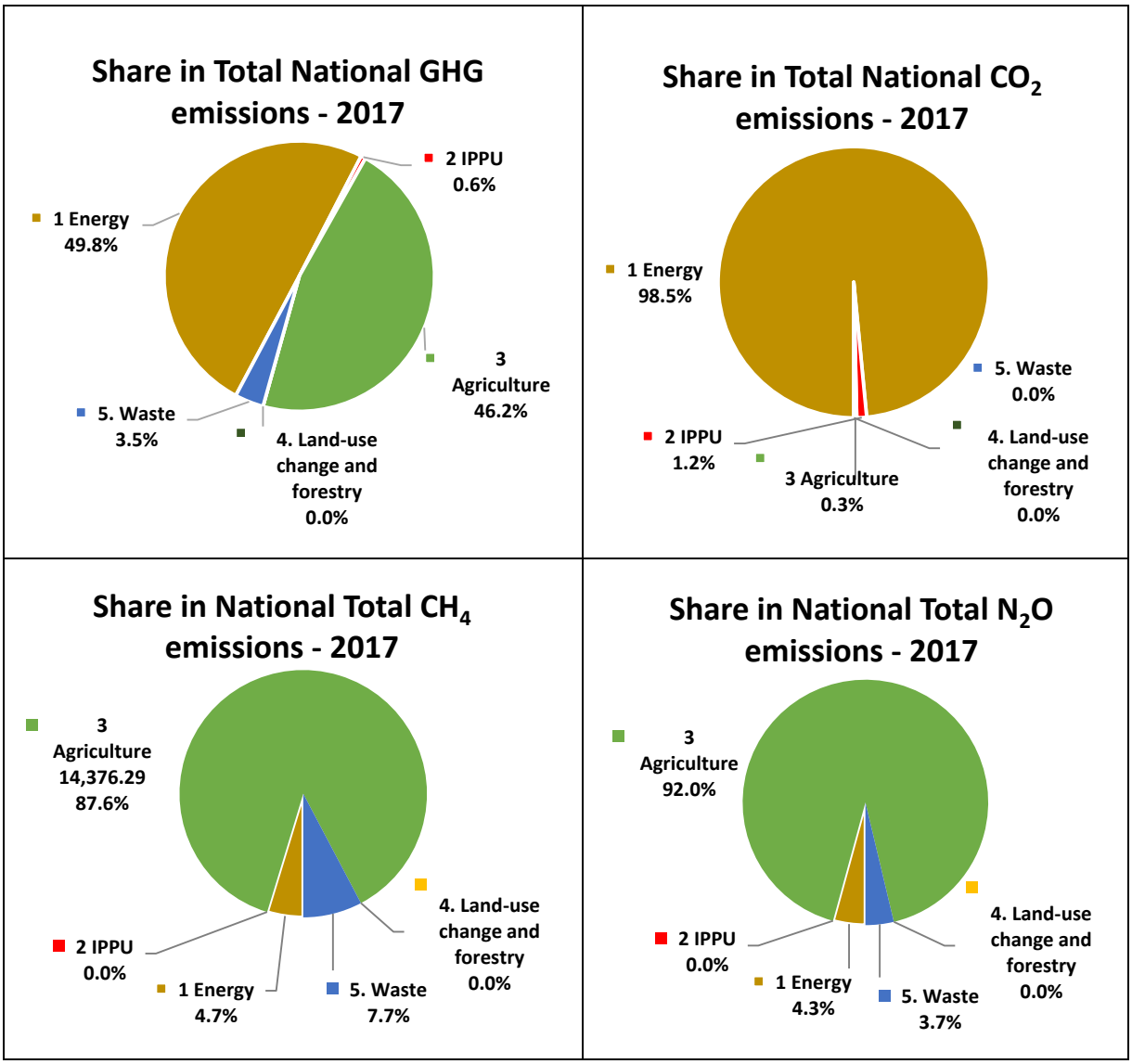


Figure 30: Total national GHG emissions by IPCC sectors

Table 13: Summary of Afghanistan's anthropogenic greenhouse gas emissions by sector from 2012 – 2017						
Greenhouse gas source and sink categories	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Greenhouse gases (GHG)	**Gg CO_2 equivalent**					
1. Energy	**17,324.81**	**18,155.72**	**18,784.66**	**19,614.68**	**20,664.69**	**21,649.43**
A. Fuel combustion (sectoral approach)	17,270.70	18,101.34	18,732.09	19,561.77	20,609.17	21,593.37
1. Energy Industries	301.92	334.93	341.15	292.41	336.20	408.05
2. Manufacturing Industries and Construction	4,040.54	4,405.10	3,979.55	4,040.48	4,816.94	5,962.76
3. Transport	12,156.56	12,649.52	12,880.92	13,015.30	13,136.61	13,136.61
4. Other Sectors	771.67	711.79	1,530.47	2,213.58	2,319.42	2,085.95
5. Other	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	54.11	54.39	52.56	52.91	55.52	56.05
1. Solid Fuels	35.43	35.80	35.47	35.51	36.20	37.27
2. Oil and Natural Gas	18.68	18.58	17.09	17.40	19.33	18.78
2. Industrial Processes and Product Use	**260.30**	**261.31**	**223.77**	**233.87**	**278.59**	**245.78**
A. Mineral Products	126.82	131.18	95.66	99.92	125.82	81.68
B. Chemical Industry	100.04	96.70	94.67	100.51	119.33	130.67
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	33.43	33.43	33.43	33.43
E. Production of Halocarbons and SF6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF6	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NO	NO	NO	NO	NO	NO
3. Agriculture	**21,006.13**	**21,227.59**	**21,800.63**	**20,729.34**	**20,490.89**	**20,073.90**
A. Enteric Fermentation	10,194.85	10,084.85	10,505.79	10,309.18	10,265.21	10,273.23
B. Manure Management	2,360.80	2,346.65	2,369.36	2,188.64	2,182.39	2,183.59
C. Rice Cultivation	1,901.44	1,901.44	2,040.57	2,040.57	2,040.57	2,040.57
D. Agricultural Soils	6,466.34	6,785.64	6,790.57	6,099.17	5,911.65	5,487.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	22.48	25.19	26.43	23.87	23.16	21.60
G. Other	60.22	83.82	67.92	67.92	67.92	67.92
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,333.39**	**1,358.72**	**1,386.69**	**1,417.30**	**1,446.59**	**1,502.27**
A. Solid Waste Disposal on Land	147.49	155.76	166.71	180.36	197.11	216.36
B. Waste Water Handling	1,108.86	1,124.05	1,139.43	1,154.99	1,169.23	1,202.92
C. Waste Incineration	30.33	30.46	30.41	30.19	28.76	28.87
D. Other - Composting	46.70	48.45	50.14	51.76	51.49	54.13
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**
Memo items						
International bunkers	31.69	31.69	32.01	31.38	31.69	31.69
Aviation	31.69	31.69	32.01	31.38	31.69	31.69
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	4,168.42	4,111.53	4,185.72	4,234.56	4,218.94	4,230.35

2.8.1 Energy (IPCC Sector 1)

Emissions from the Energy sector are the main source of GHGs in Afghanistan; in 2017, about 49.8% of the total national GHG emissions and 95.2% of total CO_2 emissions arose from the energy sector.

In the Energy sector, emissions originating from fuel combustion activities in road traffic, in the energy and manufacturing industry and the commercial, agricultural and residential sector (Category 1.A), as well as Fugitive Emissions from Fuels (Category 1.B), were considered. However, fugitive emissions make up less than 1% of the total emissions from this sector.

The most important sources of GHGs in the Energy Sector is Transport and Manufacturing Industries and Construction. With regards to CO_2 emission, the source Transport was the primary source.

Emissions from energy mainly consist of CO_2, N_2O and CH_4 emissions only make up about 1.2% and 3.6%, respectively.

During the period of 2012 to 2017, GHG emissions from the Energy Sector increased by 25% from 17,324.81 Gg CO_2eq in 2012 to 21,649.43 Gg CO_2eq in 2017 (see Figures 31-37 and Table 15), which is mainly caused by increasing emissions from fuel combustion in Transport (IPCC subcategory 1.A.3) and in the Manufacturing Industries and Construction (IPCC subcategory 1.A.2).

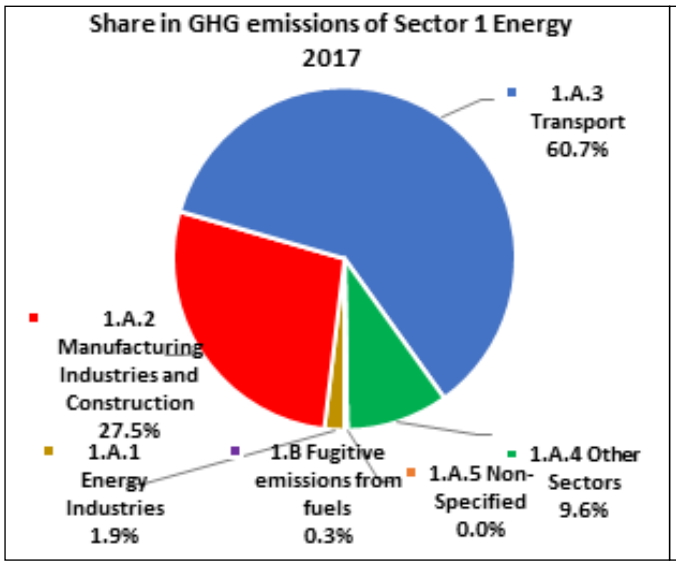


Figure 31: Share in GHG emissions of sector 1 Energy in 2017

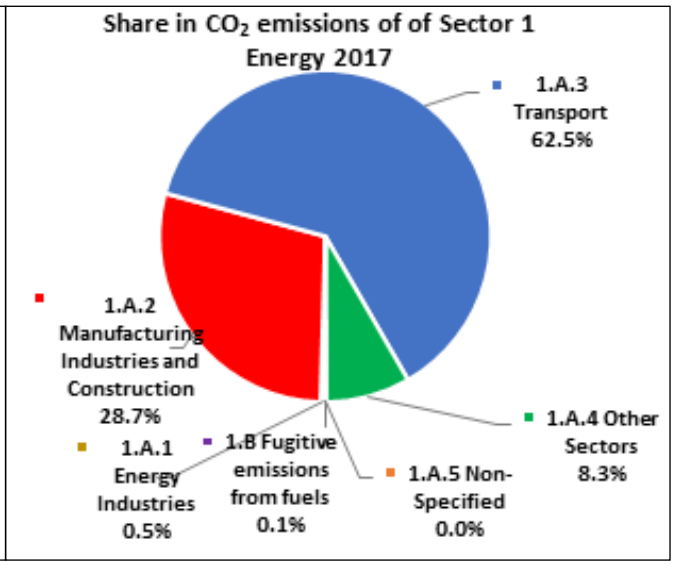


Figure 32: Share in CO_2 emissions of sector 1 Energy in 2017

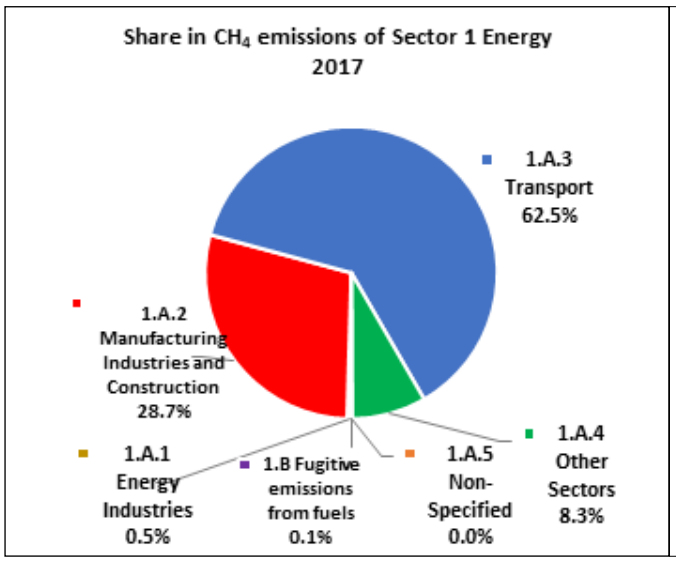


Figure 33. Share in CH_4 emissions of sector 1 Energy in 2017

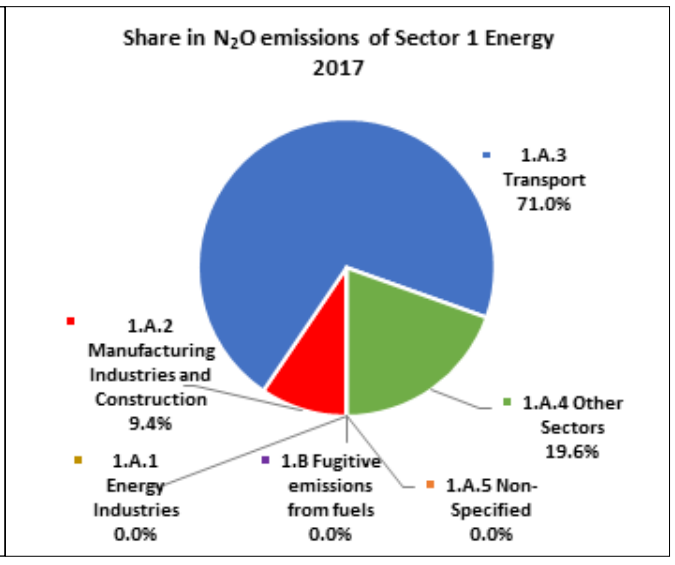


Figure 34. Share in N_2O emissions of sector 1 Energy in 2017

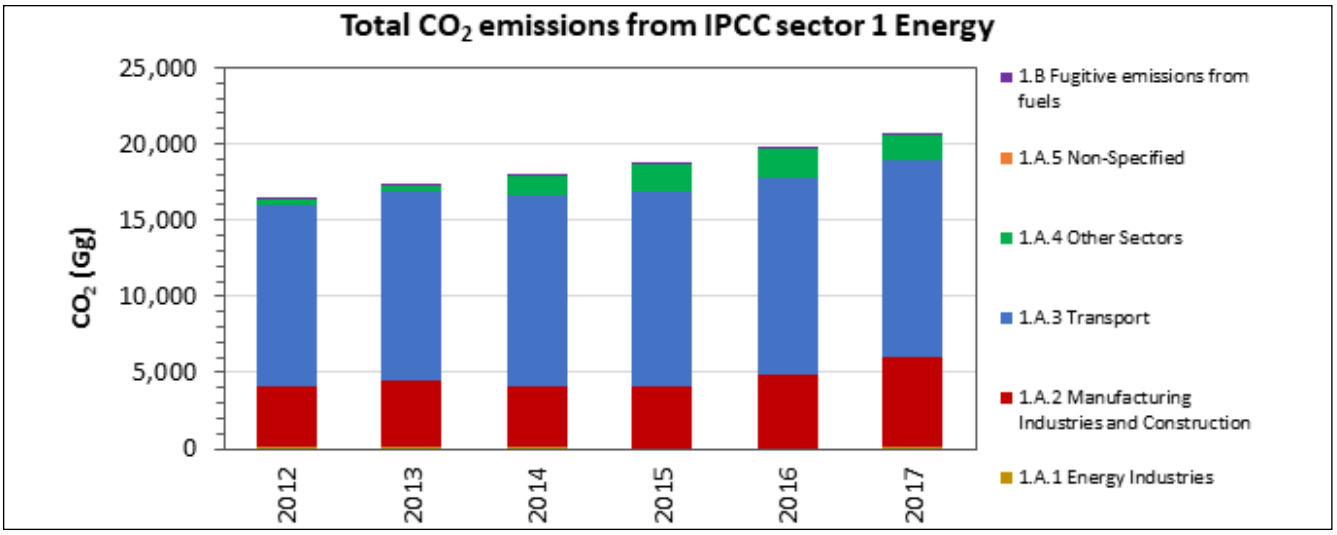


Figure 35. Total national CO_2 emissions by category of sector Energy

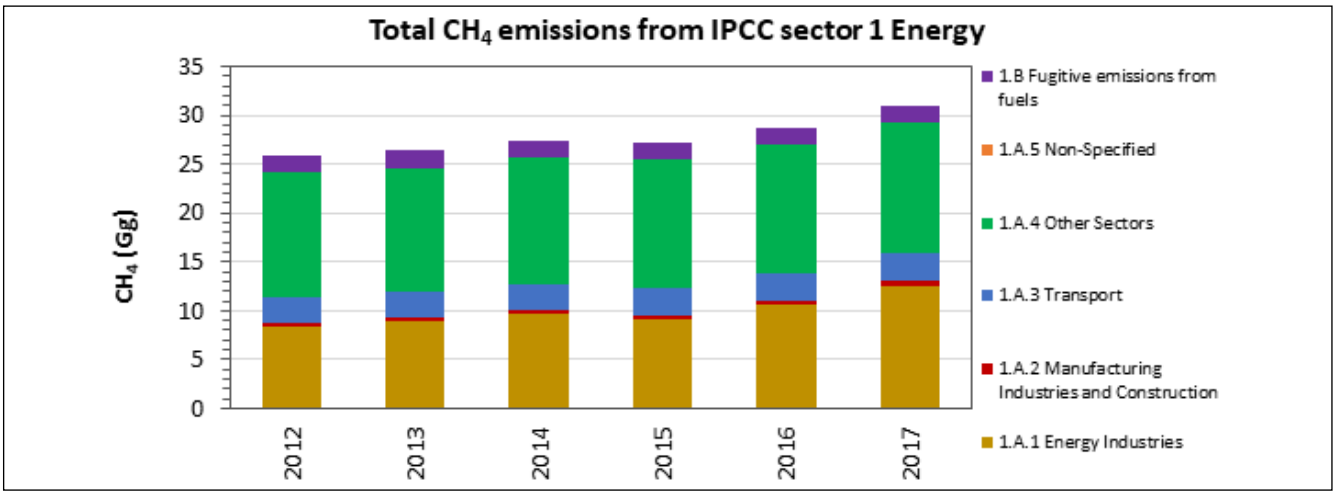


Figure 36. Total national CH_4 emissions by category of sector Energy

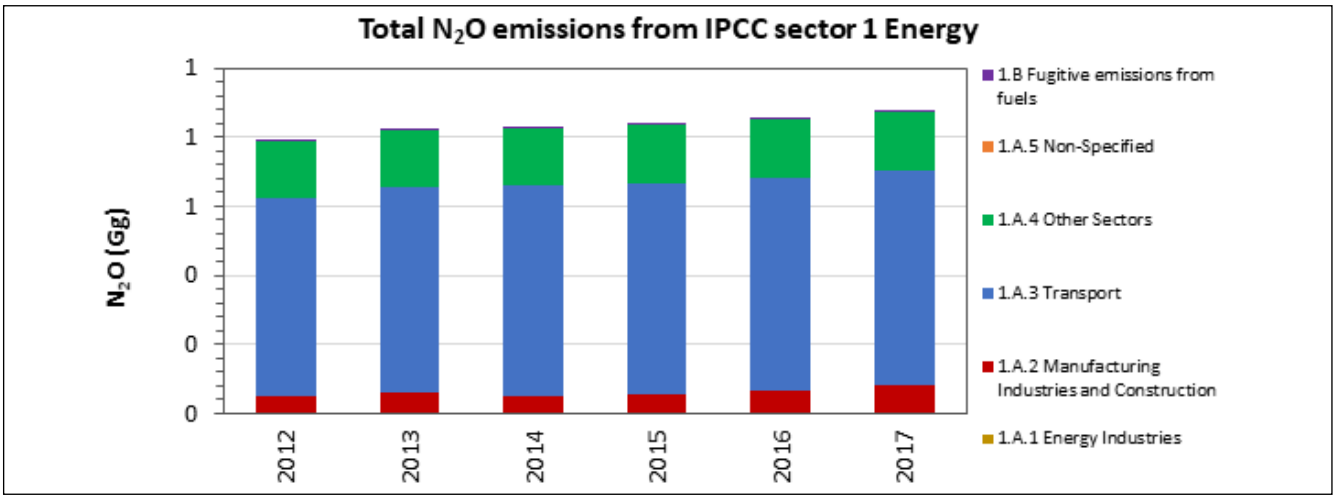


Figure 37.Total national N_2O emissions by category of sector Energy

Table 14: Emissions of GHG, CO_2, CH4 and N_2O from IPCC sector 1 Energy for the period of 2012 – 2017							
Greenhouse gas source and sink categories		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Greenhouse gas emissions (GHG)		GHG (Gg CO_2 equivalent)					
1	Energy	17,324.81	18,155.72	18,784.66	19,614.68	20,664.69	21,649.43
1.A	Fuel Combustion Activities	17,270.70	18,101.34	18,732.09	19,561.77	20,609.17	21,593.37
1.A.1	Energy Industries	301.92	334.93	341.15	292.41	336.20	408.05
1.A.2	Manufacturing Industries & Construction	4,040.54	4,405.10	3,979.55	4,040.48	4,816.94	5,962.76
1.A.3	Transport	12,156.56	12,649.52	12,880.92	13,015.30	13,136.61	13,136.61
1.A.4	Other Sectors	771.67	711.79	1,530.47	2,213.58	2,319.42	2,085.95
1.A.5	Non-Specified	NE	NE	NE	NE	NE	NE
1.B	Fugitive Emissions from Fuels	54.11	54.39	52.56	52.91	55.52	56.05
1.B.1	Solid Fuels	35.43	35.80	35.47	35.51	36.20	37.27
1.B.2	Oil and Natural Gas	18.68	18.58	17.09	17.40	19.33	18.78
Total national GHG emissions (without LULUCF)		**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**
CO_2 emissions		CO_2 (Gg)					
1	Energy	16,443.91	17,253.01	17,852.65	18,685.63	19,692.65	20,615.03
1.A	Fuel Combustion Activities	16,432.20	17,241.72	17,842.29	18,674.95	19,680.58	20,603.33
1.A.1	Energy Industries	93.97	113.65	100.08	63.78	72.41	93.30
1.A.2	Manufacturing Industries & Construction	4,016.52	4,378.36	3,955.79	4,016.18	4,787.07	5,924.39
1.A.3	Transport	11,919.48	12,402.97	12,630.02	12,761.96	12,881.00	12,881.00
1.A.4	Other Sectors	402.23	346.74	1,156.39	1,833.02	1,940.11	1,704.65
1.A.5	Non-Specified	NE	NE	NE	NE	NE	NE
1.B	Fugitive Emissions from Fuels	11.70	11.29	10.37	10.68	12.07	11.71
1.B.1	Solid Fuels	NA	NA	NA	NA	NA	NA
1.B.2	Oil and Natural Gas	11.70	11.29	10.37	10.68	12.07	11.71
Total national CO_2 emissions (without LULUCF)		**16,770.99**	**17,604.73**	**18,150.92**	**18,993.95**	**20,045.39**	**20,934.98**
CH_4 emissions		CH_4 (Gg)					
1	Energy	25.81	26.36	27.42	27.18	28.70	30.96
1.A	Fuel Combustion Activities	24.12	24.63	25.73	25.49	26.96	29.18
1.A.1	Energy Industries	8.31	8.84	9.64	9.14	10.55	12.59
1.A.2	Manufacturing Industries &Construction	0.35	0.39	0.34	0.35	0.43	0.55
1.A.3	Transport	2.65	2.75	2.79	2.81	2.83	2.83
1.A.4	Other Sectors	12.81	12.66	12.97	13.19	13.15	13.21
1.A.5	Non-Specified	NE	NE	NE	NE	NE	NE
1.B	Fugitive Emissions from Fuels	1.70	1.72	1.69	1.69	1.74	1.77
1.B.1	Solid Fuels	1.42	1.43	1.42	1.42	1.45	1.49
1.B.2	Oil and Natural Gas	0.28	0.29	0.27	0.27	0.29	0.28
Total national CH_4 emissions (without LULUCF)		**644.39**	**640.99**	**666.25**	**651.91**	**652.50**	**656.74**
N_2O emissions		N_2O (Gg)					
1	Energy	0.79	0.82	0.83	0.84	0.85	0.87
1.A	Fuel Combustion Activities	0.79	0.82	0.83	0.84	0.85	0.87
1.A.1	Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2	Manufacturing Industries & Construction	0.05	0.06	0.05	0.05	0.06	0.08
1.A.3	Transport	0.57	0.60	0.61	0.61	0.62	0.62
1.A.4	Other Sectors	0.17	0.16	0.17	0.17	0.17	0.17
1.A.5	Non-Specified	NE	NE	NE	NE	NE	NE
1.B	Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1	Solid Fuels	NA	NA	NA	NA	NA	NA
1.B.2	Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00
Total national CH_4 emissions (without LULUCF)		**23.64**	**24.74**	**24.79**	**22.50**	**21.89**	**20.53**

2.8.1.1 Energy Industries (IPCC subcategory 1.A.1)

GHG emissions occur from fuel combustion for producing heat and electricity for the public, in refineries, and for manufacturing of solid fuels.

1.A.1.A. ELECTRICITY PRODUCTION

Overview: GHG emissions occur from fuel combustion for producing heat and electricity for the public (sold to industry, commercial, households, etc.). Nearly all of the thermal generation comes from reciprocating engines except the northeast Kabul power plant, which consists of two diesel-fired gas turbines. No solid fuels are used for electricity production.

Method	2006 IPCC GL Tier 1	EF	Default	AD	Plant specific - DABS

Trend

1A.1.a is a small source of GHG emissions as hydropower and imports of electricity are the main source for heat and electricity production in Afghanistan. The fluctuation of fuel consumption and emissions is due to:

- increased electricity consumption for heating coupled with non-availability of hydropower in winter and during droughts;
- the ongoing fonflict and insecurity.

1.A.1.B. PETROLEUM REFINING

Overview: GHG emissions occur from fuel combustion activities for heat and electricity production used in compressors, pumps and cracker furnaces within the refineries. A few small petroleum refineries exist in Afghanistan. Natural gas liquids were explored and refined for many years; a small amount of crude oil was explored and refined in the last years.

Method	2006 IPCC GL Tier 1	EF	Default	AD	UNDS & NSIA

Trend

Increased in fuel consumption and emissions are due to:

- increasing demand for oil products;
- rising capacities of the refineries;
- constructing new refineries.

1.A.1.C. MANUFACTURE OF SOLID FUELS

Overv iew: GHG emissions occur from fuel combustion activities in coke oven manufacturing facilities. Additionally, a significant amount of CH4 emissions occur during the pyrolysis of hard coal at temperatures of about 1,000°C. In Afghanistan, the production of coke oven coke is not integrated into iron and steel industry plants. Coke oven coke is produced from national hard coal and is mainly exported.

Another significant amount of GHG emissions occurs from charcoal production via slow pyrolysis: heating of wood or other organic materials in the absence of oxygen.

Method	2006 IPCC GL Tier 1	EF	Default	AD	UNDS & NSIA

Trend

- Start of coke oven coke production in 2008 with strongly rising production.
- Coke oven coke is wholly exported.
- Increasing production and consumption of charcoal due to the rising demand for fuel, especially by households for heating and cooking.

2.8.1.2 Manufacturing Industries and Construction (IPCC subcategory 1.A.2)

GHG emissions occur from fuel combustion for producing heat and electricity in Manufacturing Industries and Construction activities. The national energy statistics did not provide information regarding the use of fuels in the different IPCC subcategories of IPCC category 1.A.2. Therefore, all emissions except those for IPCC subcategory 1.A.2.c Chemicals where natural gas is combusted are reported under IPCC subcategory 1.A.2.m Other.

1.A.2.c CHEMICALS

Overview: GHG emissions occur from fuel combustion for producing heat and electricity in the chemical industry. The power plant at Kod-e-Barq was built at the same time as the fertiliser plant primarily to provide power to the large number of compressors and pumps that the fertiliser plant employs. A small amount of electricity and heat is also provided to neighboring villages. It has a rated capacity of 48 MW, from four turbine generators of 12 MW each. The steam for the turbines is supplied by five water tube boilers run on natural gas. Not all turbines and boilers are working at all times.

Method	2006 IPCC GL Tier 1	EF	Default	AD	NSIA

Trend

The fluctuation of fuel consumption and emissions due to:

- shortage of natural gas because of damaged and/or destroyed pipelines;
- start-ups and shut-downs as well as maintenance periods of the fertilizer plant.

1.A.2.m OTHER

Overview: GHG emissions occur from fuel combustion for producing heat and electricity through construction activities (1.A.2.k) as well as by the following manufacturing industries:

- Iron and Steel (1.A.2.a)
- Non-Ferrous Metals (1.A.2.b)
- Pulp, Paper and Print (1.A.2.d)
- Food Processing, Beverages & Tobacco (1.A.2.e)
- Non-Metallic Minerals (1.A.2.f)
- Mining (excluding fuels) and Quarrying (1.A.2.i)
- Wood and wood products (1.A.2.j)
- Textile and Leather (1.A.2.l)

In the energy-intensive cement and lime industry (1.A.2.f) mainly hard coal (coking coal, other bituminous coal) was combusted. Other industries combust a significant amount of liquid fuels as well.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA

Trend

Increasing and fluctuating fuel consumption and emissions are due to:

- various industries of different configuration (boiler size, pumps, etc.);
- maintenance periods of big plants (e.g. cement and lime plant);
- availability of fuels and/or (imported) electricity;
- availability of raw material (e.g. iron scrap);
- growing diversification of the manufacturing industries;
- stabilization of industrial activities;
- the war in Afghanistan.

2.8.1.3 Transport (IPCC subcategory 1.A.3)

1.A.3.a NATIONAL AND INTERNATIONAL AVIATION

Overview: GHG emissions occur from international and domestic civil aviation, including take-offs and landings, and combustion of Aviation and Jet Gasoline as well as Jet Kerosene.

The split between international and domestic aviation (Figure 38) is based on departure and landing locations for each flight stage and not by the nationality of the airline. The energy statistics from UNSD provided fuel consumption for domestic and international aviation.

The GHG emissions of domestic civil aviation are included in 'Total national GHG emissions', whereas the GHG emissions of international civil aviation are reported under International Bunkers and therefore excluded from 'Total national GHG emissions'.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	UNSD & NSIA

Trend

Increasing and fluctuating fuel consumption and emissions are due to:

- an increase in the number of air passengers carried;
- the growing air freight volume (tonne-kilometres) as a result of growing imports of goods;
- the ongoing conflict and insecurity.

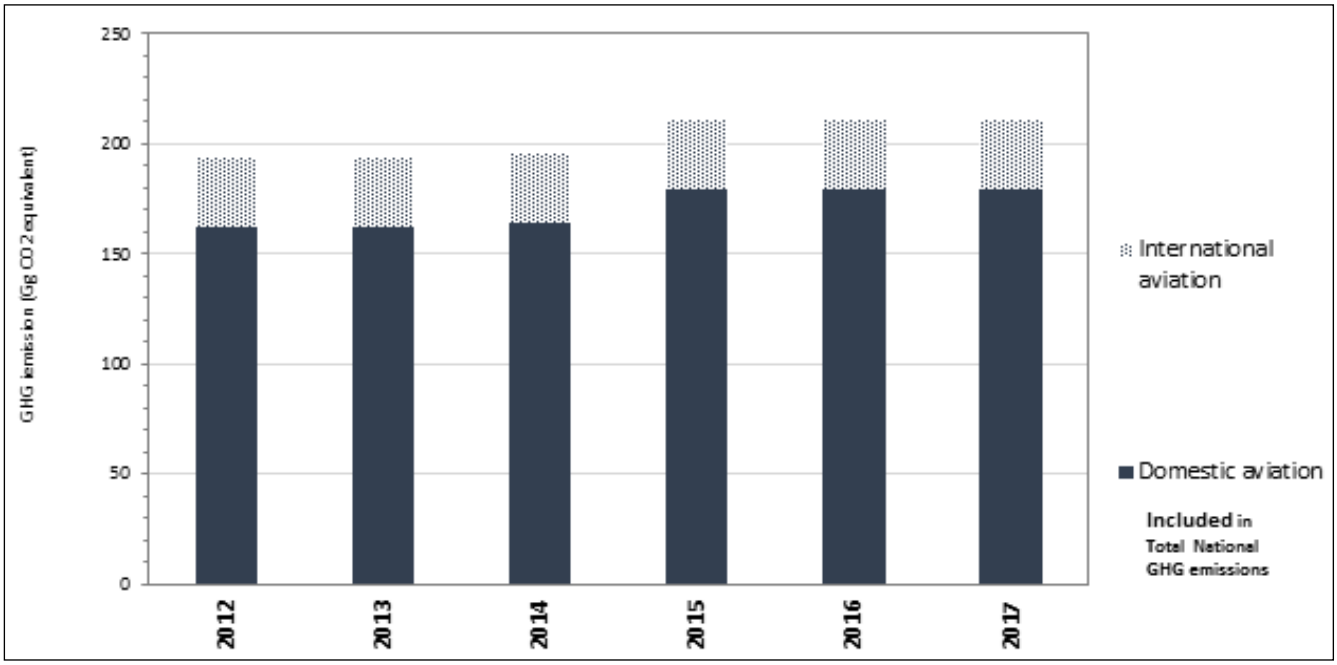


Figure 38. GHG emission from Domestic and International Aviation

1.A.3.B ROAD TRANSPORT

Overview: All combustion and evaporative emissions arise from fuel use (diesel, gasoline, liquid petroleum gas) in road vehicles, including the use of agricultural vehicles on paved roads.

The GHG emissions were calculated by a combination of top-down and bottom-up approaches:

- Top-down: the amount of fuel sold provided in energy statistics and import statistics.
- Bottom-up: number of vehicles (motorbikes, passenger cars, vans, buses and coaches, trucks) from national statistics, annual mileage, and average fuel consumption.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA, UNSD, expert judgement

Trend

Increasing and fluctuating fuel consumption and emissions are due to:

- an increase of passenger kilometres (annual length of a journey by passengers who are travelling by motorbikes, passenger cars, vans, buses);
- an increase of freight kilometres (length of a journey of freight) with light- and heavy-duty trucks;
- the growing number of private vehicles and rising mobility;
- the ongoing conflict and insecurity.

1.A.3.c RAILWAY

Overview: GHG emissions occur from fuel combustion during railway transport for both freight and passenger traffic routes. In 2017, the total length of the railway in Afghanistan was 123 km.

1.A.3.d NAVIGATION

Overview: As the energy statistic does not provide the data to split the fuel consumed in various transport modes (road, off-road, railway, navigation), all GHG emissions are estimated in Road Transport. (1.A.3.b)

Landlocked Afghanistan has cargo transport to Hairatan river port at Amu Darya River (boarder – Hairatan river port: 18 km). All other rivers are not navigable.

2.8.1.4 Other Sectors and Not Specified (IPCC subcategory 1.A.4 and 1.A.5)

1.A.4 OTHER

Overview: GHG emissions occur from fuel combustion for heating and cooking purpose in

- Commercial and institutional buildings (1.A.4.a)
- Residential buildings and households (1.A.4.b)
- Agriculture/Forestry/Fishing/Fish Farms (1.A.4.c)

Stationary combustions are boilers (< 50 MW), pumps, stoves, fireplaces, cooking, etc. Mobile combustions are gardening equipment and vehicles, fire trucks, sewage trucks, snowmobiles, etc.

The national energy statistics do not provide a split of fuel used in this sector. UNDS and Food and Agriculture Organisation (FAO) provided the statistics of the amount of fuel used in the energy sector. All solid biomass fuels such as wood, charcoal, crop residues or animal dung are allocated to this sector.

Furthermore, GHG emissions from waste burned in households for cooking and heating was estimated based on expert judgment.

CO_2 from the combustion of biomass for energy production (heat and electricity) is not included in the 'Total national GHG emissions' and reported as a memo item (Figure 39).

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA, UNSD, FAO, expert ajudgement

Trend

Increasing and fluctuating fuel consumption and emissions are due to:

- The wide variety of boilers, pumps, stoves, fireplaces;
- annual heating degree days: energy demand needed to heat building due to weather conditions;
- availability of electricity;
- increasing population.

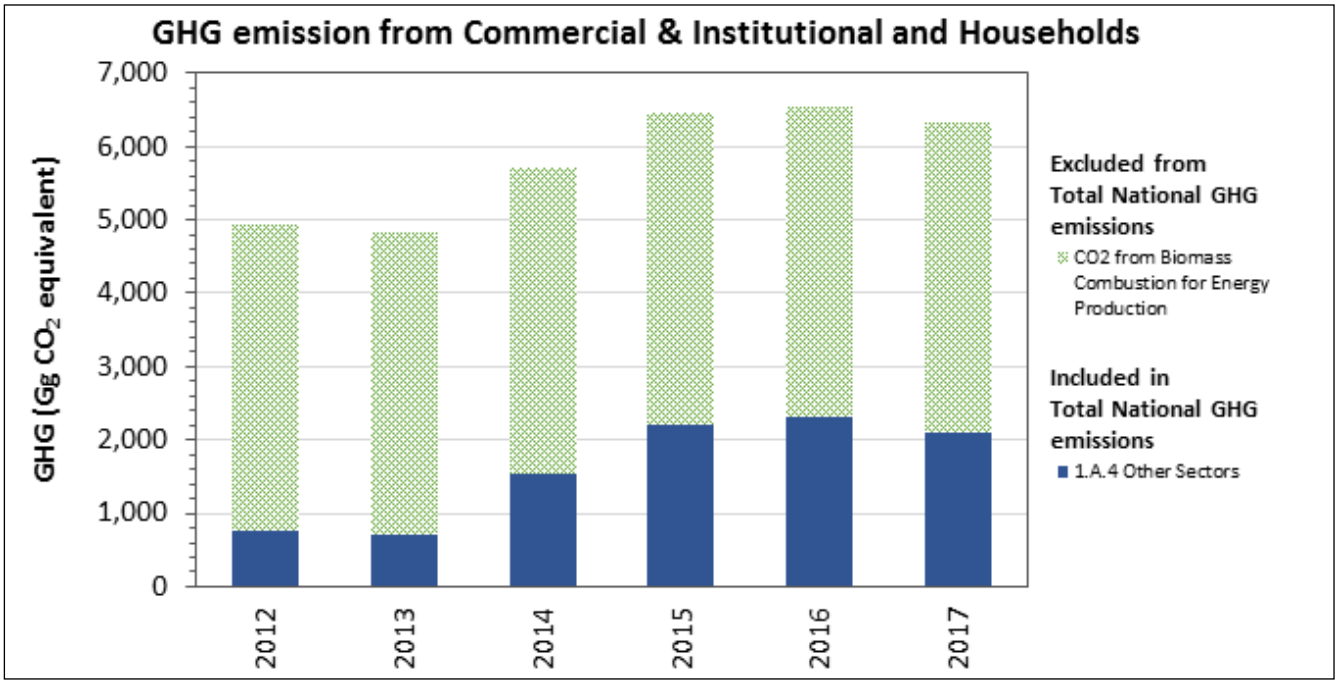


Figure 39. CO_2 from Biomass Combustion for Energy Production

2.8.1.5. Fugitive Emissions from Fuels (IPCC subcategory 1.B)

1.B. FUGITIVE EMISSIONS FROM FUELS	Overview: Fugitive Emissions from Fuels include all intentional and unintentional emissions from the extraction, processing, storage and transport of fuel to the point of final use.					
	Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA and UNDS
	Trend	The fluctuation of fuel consumption and emissions due to: • increased exploration and processing also for export (e.g. coke oven coke) • old and/or damaged natural gas pipelines (180 km) • increased imports of liquid fuels.				

2.8.2 Industrial Processes and Product Use (IPPU) (IPCC Sector 2)

Emissions from IPPU are minor sources of GHGs in Afghanistan; in the years 2012 and 2017, GHG emissions from this sector amounted to less than 1% of national total GHG emissions. In the period 2012 and 2017, CO_2 emissions of sector IPPU decreased by 5.6% mainly due to lower lime production.

Afghanistan is endowed with a wealth of natural resources like coal, petroleum oil and natural gas as well as iron, gold, copper, lead, etc., but currently, only a small amount of some of these resources is extracted. Refining and upgrading of the extracted resources like the (primary) iron and steel industries do not take place at present.

Afghanistan has one fertiliser plant and four cement plants and lime production plant. For these industries, emissions were estimated.

Figures 40–43 and Table 16 show the GHG emissions from the IPPU sector for the period 2012 to 2017.

Brick production takes place in small factories which produce the bricks in the traditional way. CO_2 emissions from brick production were not estimated as the amount of limestone used, and the annual limestone input was not available. Combustion-related emissions are estimated in the energy sector and allocated to IPCC subcategory 1.A.2.m Other. GHG Emissions from consumption of halocarbons and SF6 are not estimated due to the following obstacles:

Import and export	• Import and export statistics provide only overall data of imported refrigerator and air conditions. No specifications, as well as type and amount of gases, were available. • Lack of data and completeness is not ensured regarding F-gas content and F-gas composition.
The stock of products containing F-gases	• Lack of data and/or completeness is not ensured • The assumption for the identification of relevant f-gases and/or blends at this stage not reliable.

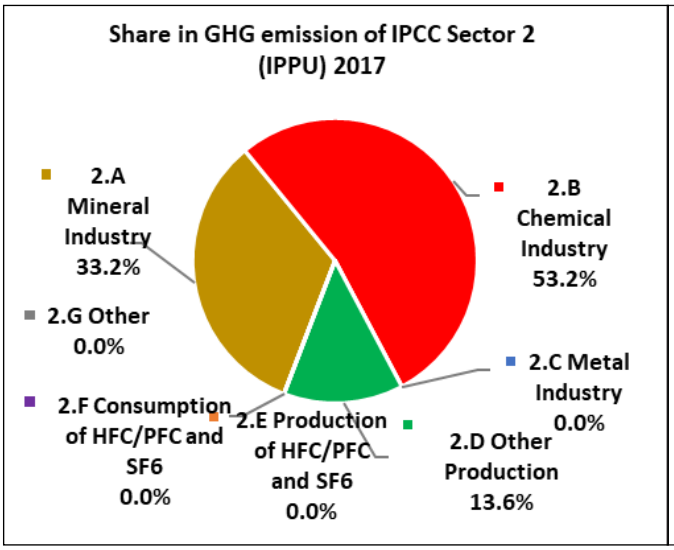
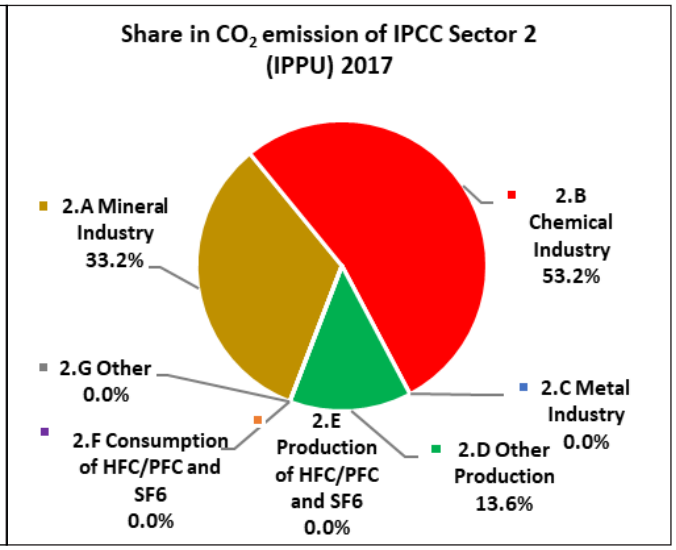


Figure 40: Share in GHG emissions of sector 2 Industrial Processes and Product Use (IPPU) in 2017



41: Share in CO_2 emissions of sector 2 Industrial Processes and Product Use (IPPU) in 2017

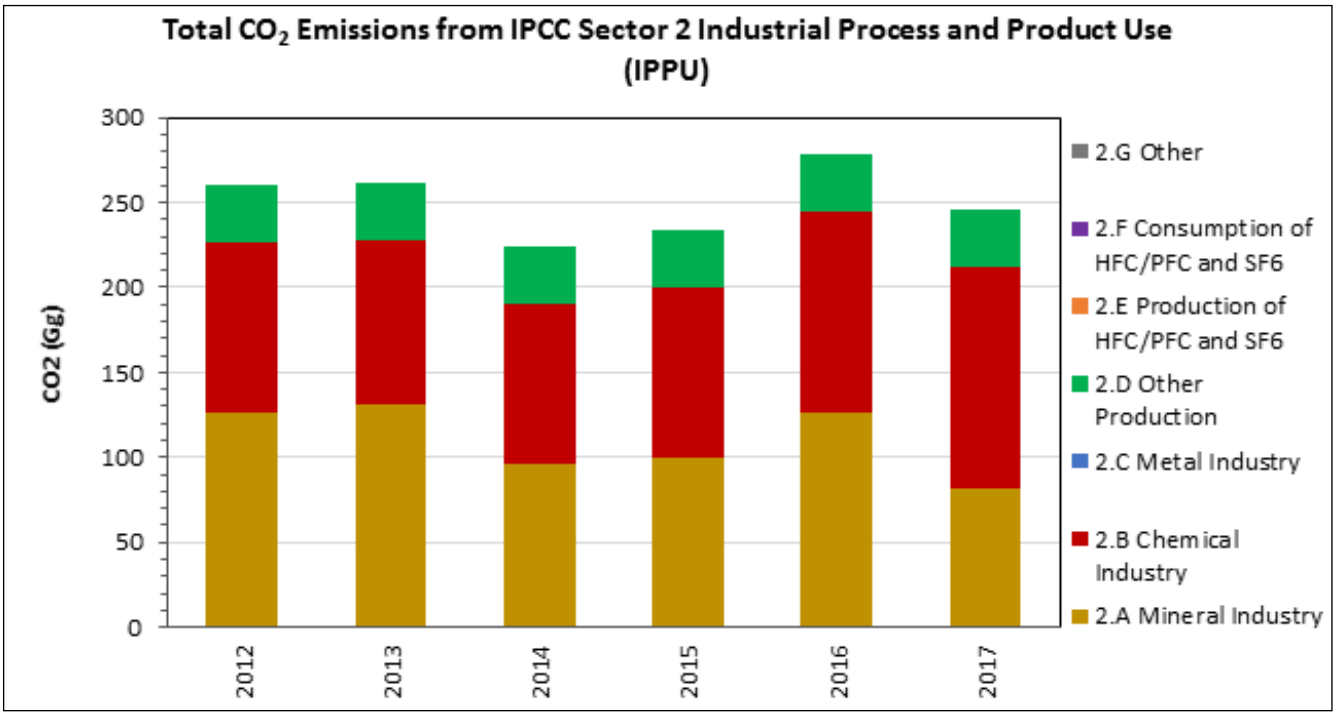


Figure 42. Total CO_2 emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU)

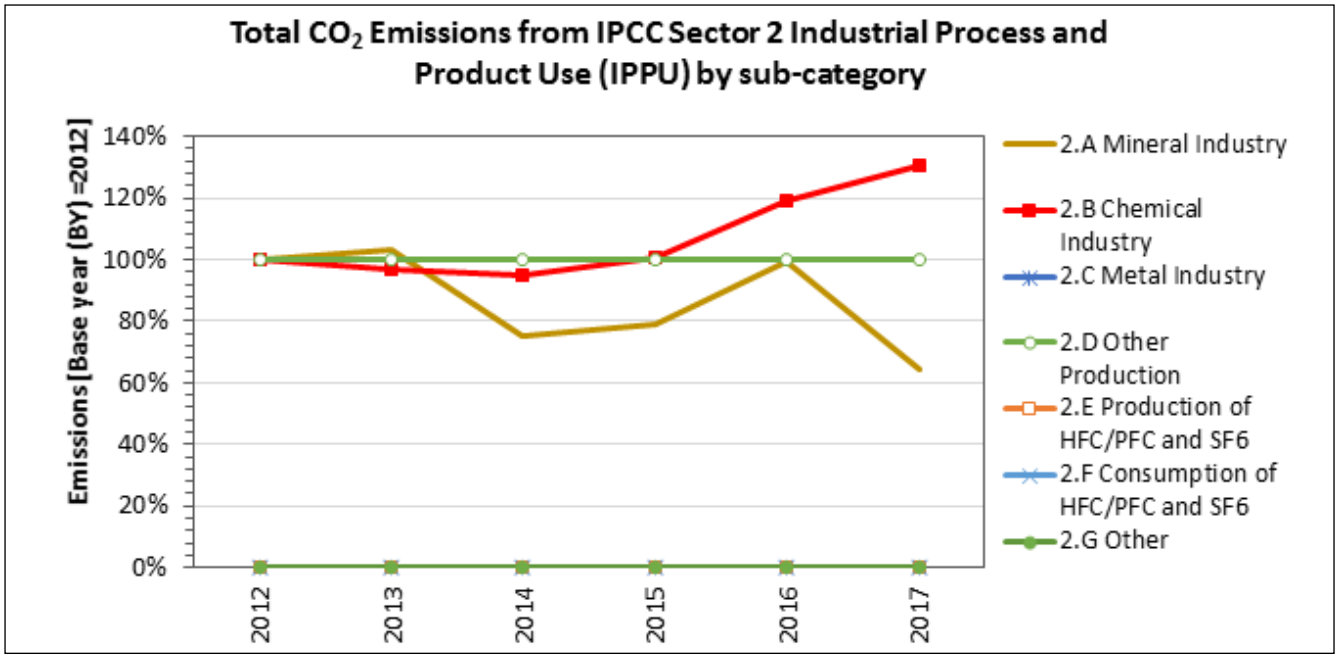


Figure 43. The trend in CO_2 emissions 2012–2017 in index form (base year = 100) of sector 2 Industrial Processes and Product Use (IPPU)

Brick Kilns, Daikundi 2017 © UNEnvironment

Table 15: Emissions of GHG of IPCC Sector 2 Industrial Processes and Product Use (IPPU) for the period 2012 - 2017							
Greenhouse gas source and sink categories		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Greenhouse gas emissions (GHG)		**GHG (Gg CO_2 equivalent)**					
2	IPPU	260.30	261.31	223.77	233.87	278.59	245.78
2.A	Mineral Industry	126.82	131.18	95.66	99.92	125.82	81.68
2.B	Chemical Industry	100.04	96.70	94.67	100.51	119.33	130.67
2.C	Metal Industry	NO	NO	NO	NO	NO	NO
2.D	Non-Energy Products f. Fuels & Solvent Use	33.43	33.43	33.43	33.43	33.43	33.43
2.E	Electronics Industry	NO	NO	NO	NO	NO	NO
2.F	Production of HFC/PFC and SF_6	NE	NE	NE	NE	NE	NE
2.G	Consumption of HFC/PFC and SF_6	NE	NE	NE	NE	NE	NE
Total national GHG emissions (without LULUCF)		**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**
CO_2 emissions		**CO_2 (Gg)**					
2	IPPU	260.30	261.31	223.77	233.87	278.59	245.78
2.A	Mineral Industry	126.82	131.18	95.66	99.92	125.82	81.68
2.B	Chemical Industry	100.04	96.70	94.67	100.51	119.33	130.67
2.C	Metal Industry	NO	NO	NO	NO	NO	NO
2.D	Non-Energy Products f. Fuels & Solvent Use	33.43	33.43	33.43	33.43	33.43	33.43
2.E	Electronics Industry	NO	NO	NO	NO	NO	NO
2.F	Production of HFC/PFC and SF_6	NE	NE	NE	NE	NE	NE
2.G	Consumption of HFC/PFC and SF_6	NE	NE	NE	NE	NE	NE
Total national CO_2 emissions (without LULUCF)		**16,770.99**	**17,604.73**	**18,150.92**	**18,993.95**	**20,045.39**	**20,934.98**
CH_4 emissions		**CH_4 (Gg)**					
2	IPPU	NO	NO	NO	NO	NO	NO
2.A	Mineral Industry	NO	NO	NO	NO	NO	NO
2.B	Chemical Industry	NO	NO	NO	NO	NO	NO
2.C	Metal Industry	NO	NO	NO	NO	NO	NO
2.D	Non-Energy Products f. Fuels & Solvent Use	NA	NA	NA	NA	NA	NA
2.E	Electronics Industry	NA	NA	NA	NA	NA	NA
2.F	Production of HFC/PFC and SF_6	NA	NA	NA	NA	NA	NA
2.G	Consumption of HFC/PFC and SF_6	NA	NA	NA	NA	NA	NA
Total national CH_4 emissions (without LULUCF)		**644.39**	**640.99**	**666.25**	**651.91**	**652.50**	**656.74**
N_2O emissions		**N_2O (Gg)**					
2	IPPU	NO	NO	NO	NO	NO	NO
2.A	Mineral Industry	NO	NO	NO	NO	NO	NO
2.B	Chemical Industry	NO	NO	NO	NO	NO	NO
2.C	Metal Industry	NO	NO	NO	NO	NO	NO
2.D	Non-Energy Products f. Fuels & Solvent Use	NA	NA	NA	NA	NA	NA
2.E	Electronics Industry	NA	NA	NA	NA	NA	NA
2.F	Production of HFC/PFC and SF_6	NA	NA	NA	NA	NA	NA
2.G	Consumption of HFC/PFC and SF_6	NA	NA	NA	NA	NA	NA
Total national CH_4 emissions (without LULUCF)		**23.64**	**24.74**	**24.79**	**22.50**	**21.89**	**20.53**

Following is the overview of the relevant categories, the method, source of emissions factor and activity data as well the key drivers for the trend.

2.8.2.1 Cement Production (IPCC Subcategory 2.A.1)

2.A.1 CEMENT PRODUCTION	Overview: CO_2 emission originates from the production of clinker, where the raw material limestone, which is mainly calcium carbonate ($CaCO_3$), is heated, or calcined, to produce lime (CaO) and CO_2 as a by-product. The CaO then reacts with silica (SiO_2), alumina (Al_2O_3), and iron oxide (Fe_2O_3) in the raw materials to make the clinker minerals (chiefly calcium silicates). The clinker is finally cooled down, grained and mixed.					
	Method	2006 IPCC GL Tier 2	**EF**	Country specific	**AD**	NSIA, MEW, MoPM
	Trend	Increasing CO_2 emissions were due to increased cement production. At the same time, fluctuation, which was due to the bad conditions of the cement plants, could be observed.				

2.8.2.2 Lime Production (IPCC Subcategory 2.A.2)

2.A.2 LIME PRODUCTION	Overview: CO_2 emission originates from the production of quicklime, using limestone and dolomite as raw material.					
	Method	2006 IPCC GL Tier 1	**EF**	default	**AD**	BGS & USGS
	Trend	Increasing CO_2 emissions were due to increased lime production, which started in 2008.				

2.8.2.3 Ammonia and Urea Production (IPCC Subcategory 2.B.1)

2.B.1 AMMONIA PRODUCTION - UREA PRODUCTION	Overview: CO_2 emissions originate from the production of urea as a downstream process in the ammonia plant. The process of ammonia production is based on the ammonia synthesis loop (also referred to as the Haber-Bosch process) reaction of nitrogen (derived from process air) with hydrogen to form anhydrous liquid ammonia. The hydrogen is derived from feedstock as natural gas (conventional steam reforming route). CO_2 is recovered for the production of Urea.					
	Method	2006 IPCC GL Tier 1	**EF**	default	**AD**	NSIA and UN
	Trend	Increasing CO_2 emissions were due to the rising amount of urea. Observed fluctuations were due to start-up and maintenance period and lack of natural gas.				

2.8.2.4 Non-Energy Products (IPCC Subcategory 2.D.1)

2.D.1 NON-ENERGY PRODUCTS FROM FUELS AND SOLVENT USE	Overview: CO_2 emission originates from the first use (combustion) of fossil fuels as a product (Lubricant Use, Paraffin Wax Use) used in small engines.					
	Method	2006 IPCC GL Tier 1	**EF**	default	**AD**	NSIA and UN
	Trend	Constant emissions over the years were observed.				

2.8.3 Agriculture (IPCC Sector 3)

In the year 2017, agriculture excluding LULUCF sector accounted for 20,073.90 Gg CO_2eq, which is equal to 46.2% of Afghanistan's national total greenhouse gas emissions in CO_2eq. The trend of GHG emissions from 2012 to 2017 shows a decrease of about 4.4% for this sector due to a decrease in livestock numbers and lower amounts of N-fertilizers applied to agricultural soils.

GHG emissions of the Agriculture sector originate from:

- Enteric Fermentation (Livestock husbandry) (IPCC category 3.A) with 23.6% of total National GHG emissions,
- Agricultural Soils (IPCC category 3.D) with 12.6% of total National GHG emissions,
- Manure Management (IPCC category 3.B) with 5.0% of total National GHG emissions,
- Rice Cultivation (IPCC category 3.C) with 4.7% of total National GHG emissions,
- CO_2 Emissions from Urea Application (IPCC category 3.G) with 0.2% of total National GHG emissions, and,
- Agricultural Residue Burning (IPCC category 3.F) with less than 0.1% of total National GHG emissions.

The agriculture sector, with 71.6% of the total National CH_4 emissions and 28.0% of the total National N_2O emissions is an important source in 2017. The most important sources of GHGs in Agriculture sector were Enteric fermentation and Agricultural Soils.

From 2012 to 2017, CH_4 emissions from the Agriculture sector (excluding LULUCF) stayed constant at the level of about 575 Gg with some annual fluctuations. During the same period, N_2O emissions from the Agriculture sector decreased from 22.18 Gg to 18.89 Gg (excluding LULUCF). CO_2 emissions arose with a share of less than 1 % of national total CO_2 emissions from the Agriculture sector.

Figures 44 to 48 and Table 17 show the GHG emissions from the Agriculture sector for 2012 to 2017.

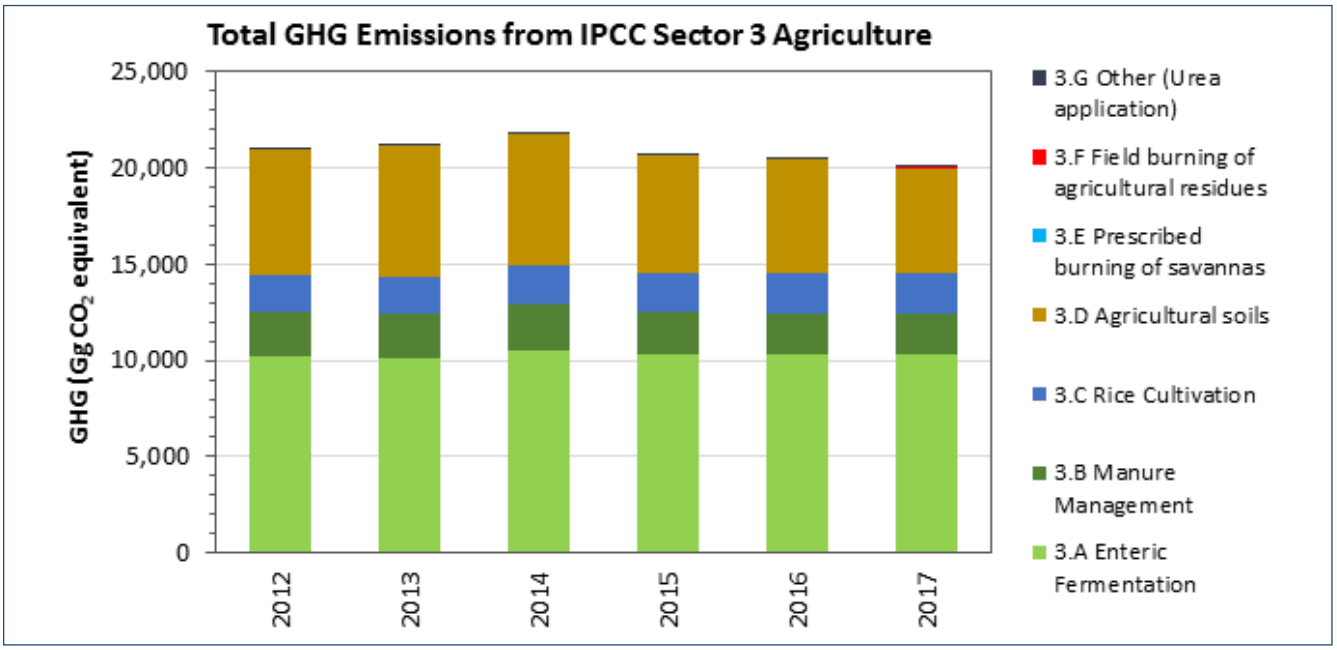


Figure 44. Total GHG Emissions from IPCC sector 3 Agriculture

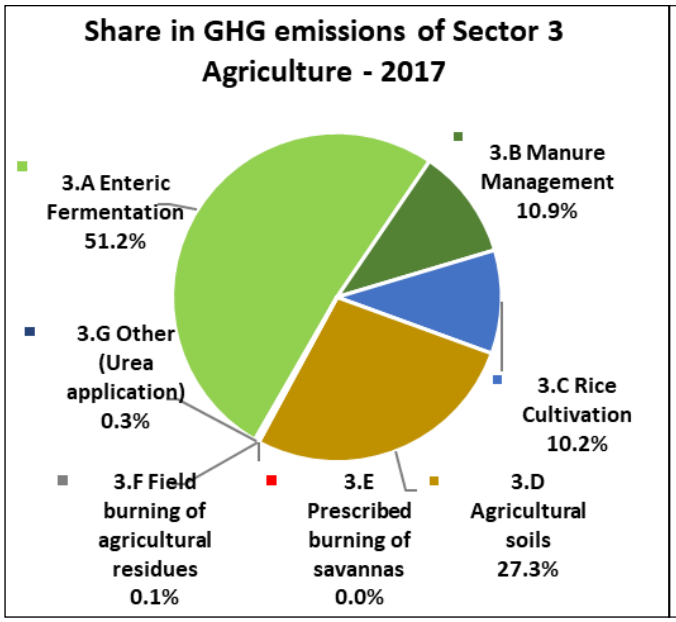


Figure 45. Share in GHG emissions of IPCC sector 3 Agriculture in 2017

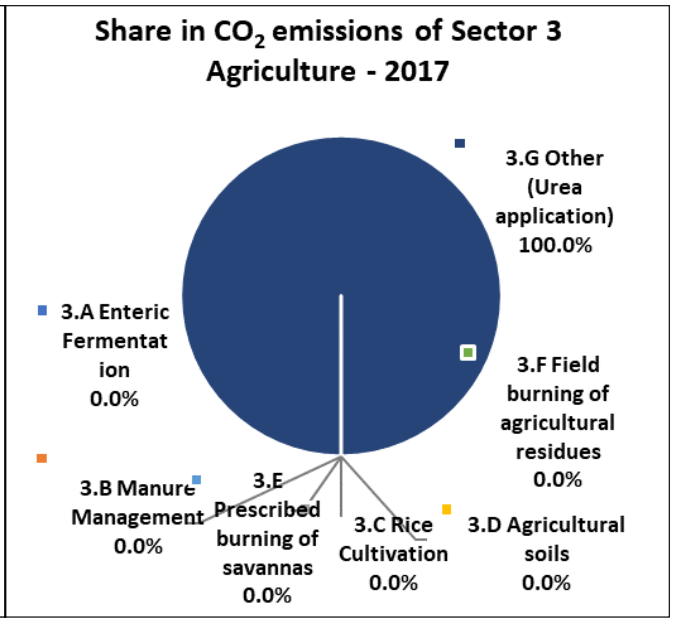


Figure 46. Share in CO_2 emissions of IPCC sector 3 Agriculture in 2017

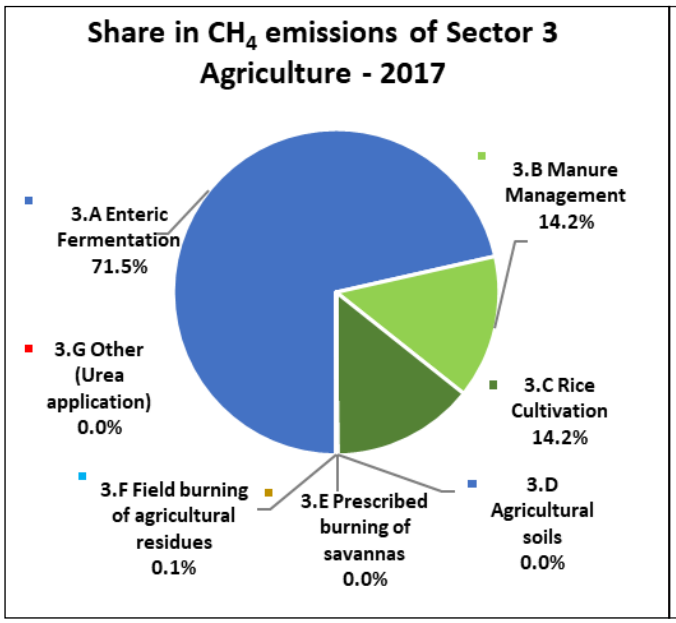


Figure 47. Share in CH_4 emissions of IPCC sector 3 Agriculture in 2017

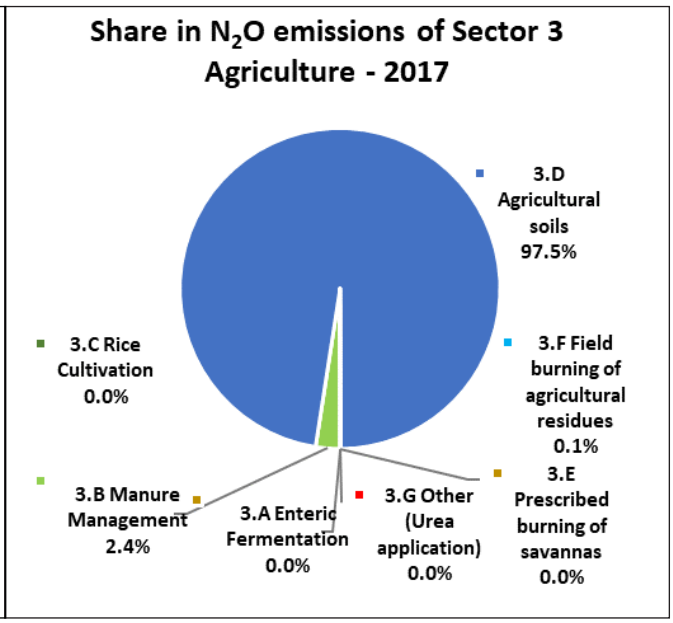


Figure 48. Share in N_2O emissions of IPCC sector 3 Agriculture in 2017

Table 16: Emissions of GHG of IPCC Sector 3 Agriculture for the Period of 2012 - 2017							
Greenhouse gas source and sink categories		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Greenhouse gas emissions (GHG)		**GHG (Gg CO_2 equivalent)**					
3	Agriculture	21,006.13	21,227.59	21,800.63	20,729.34	20,490.89	20,073.90
3.A	Enteric Fermentation	10,194.85	10,084.85	10,505.79	10,309.18	10,265.21	10,273.23
3.B	Manure Management	2,360.80	2,346.65	2,369.36	2,188.64	2,182.39	2,183.59
3.C	Rice Cultivation	1,901.44	1,901.44	2,040.57	2,040.57	2,040.57	2,040.57
3.D	Agricultural Soils	6,466.34	6,785.64	6,790.57	6,099.17	5,911.65	5,487.00
3.E	Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA
3.F	Field Burning of Agricultural Residues	22.48	25.19	26.43	23.87	23.16	21.60
3.G	Other (Urea Application)	60.22	83.82	67.92	67.92	67.92	67.92
Total national GHG emissions (without LULUCF)		**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**
CO_2 emissions		**CO_2 (Gg)**					
3	Agriculture	60.22	83.82	67.92	67.92	67.92	67.92
3.A	Enteric Fermentation	NA	NA	NA	NA	NA	NA
3.B	Manure Management	NA	NA	NA	NA	NA	NA
3.C	Rice Cultivation	NA	NA	NA	NA	NA	NA
3.D	Agricultural Soils	0.00	0.00	0.00	0.00	0.00	0.00
3.E	Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA
3.F	Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA
3.G	Other (Urea Application)	60.22	83.82	67.92	67.92	67.92	67.92
Total national CO_2 emissions (without LULUCF)		**16,770.99**	**17,604.73**	**18,150.92**	**18,993.95**	**20,045.39**	**20,934.98**
CH_4 emissions		**CH_4 (Gg)**					
3	Agriculture	573.48	568.69	591.93	576.75	574.74	575.05
3.A	Enteric Fermentation	407.79	403.39	420.23	412.37	410.61	410.93
3.B	Manure Management	88.90	88.44	89.24	82.01	81.79	81.83
3.C	Rice Cultivation	76.06	76.06	81.62	81.62	81.62	81.62
3.D	Agricultural Soils	0.00	0.00	0.00	0.00	0.00	0.00
3.E	Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO
3.F	Field Burning of Agricultural Residues	0.73	0.80	0.84	0.75	0.73	0.67
3.G	Other (Urea Application)	0.00	0.00	0.00	0.00	0.00	0.00
Total national CH_4 emissions (without LULUCF)		**644.39**	**640.99**	**666.25**	**651.91**	**652.50**	**656.74**
N_2O emissions		**N_2O (Gg)**					
3	Agriculture	22.18	23.24	23.27	20.95	20.32	18.89
3.A	Enteric Fermentation	NA	NA	NA	NA	NA	NA
3.B	Manure Management	0.46	0.46	0.46	0.46	0.46	0.46
3.C	Rice Cultivation	NO	NO	NO	NO	NO	NO
3.D	Agricultural Soils	21.70	22.77	22.79	20.47	19.84	18.41
3.E	Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO
3.F	Field Burning of Agricultural Residues	0.01	0.02	0.02	0.02	0.02	0.02
3.G	Other (Urea Application)	NA	NA	NA	NA	NA	NA
Total national N_2O emissions (without LULUCF)		**23.64**	**24.74**	**24.79**	**22.50**	**21.89**	**20.53**

The following is an overview of the relevant categories, the methods, source of EFs and AD as well the key drivers for the trends.

2.8.3.1 Enteric Fermentation (IPCC Subcategory 3.A)

3.A ENTERIC FERMENTATION

Overview: CH_4 is produced in herbivorous animals (plant eater) as a by-product of enteric fermentation, a digestive process by which carbohydrates are broken down by micro-organisms into simple molecules for absorption into the bloodstream. The amount of CH_4 that is released depends on the type of digestive tract, age, and weight of the animal, and the quality and quantity of the feed consumed. Ruminant livestock (e.g., cattle, sheep) are major sources of methane with moderate amounts produced from non-ruminant livestock (e.g., horses, mules and asses). CH_4 emission from the following animals was estimated:

- cattle (dairy cows, other cattle)
- sheep (dairy and non-dairy);
- goats (dairy and non-dairy)
- camels;
- horses
- mules and asses;
- poultry.

Method	2006 IPCC GL Tier 1/2	EF	Default / Country-specific	AD	NSIA & FAO
Trend	The fluctuation of CH_4 emissions was due to: • decreased number of dairy cattle but increased number of non-dairy cattle, • decreased number of sheep and goats				

2.8.3.2 Manure Management (IPCC Subcategory 3B)

3.B MANURE MANAGEMENT

Overview: CH_4 is produced during the storage and treatment of manure, and from manure deposited on pasture. The decomposition of manure under anaerobic conditions (i.e. in the absence of oxygen), during storage and treatment, produces CH_4. The main factors affecting CH_4 emissions are the amount of manure produced and the portion of the manure that decomposes anaerobically.
Direct N_2O emissions occur via combined nitrification and denitrification of nitrogen contained in the manure. The emission of N_2O from manure during storage and treatment depends on the nitrogen and carbon content of manure, and the duration of the storage and type of treatment.
Indirect emissions result from volatile nitrogen losses that occur primarily in the forms of ammonia and NOx. The fraction of excreted organic nitrogen that is mineralized to ammonia nitrogen during manure collection and storage depends primarily on time and a lower degree temperature.
CH_4 and N_2O emission were estimated from the livestock mentioned above and poultry.

Method	2006 IPCC GL Tier 1	EF	Default	AD	NSIA & FAO
Trend	The fluctuation of CH_4 emissions was due to: • decreased number of dairy cattle but increased number of non-dairy cattle, • decreased number of sheep and goats; • increased number of poultries.				

2.8.3.3 Rice Cultivation (IPCC Subcategory 3.C)

3.C RICE CULTIVATION

Overview: CH_4 is produced by anaerobic decomposition of organic material in flooded rice fields. The CH_4 is emits to the atmosphere primarily by transport through the rice plants.

Method	2006 IPCC GL Tier 1	EF	Default	AD	NSIA & FAO
Trend	Increasing CH_4 emissions were due to the increased area under rice cultivation during the last decade.				

2.8.3.4 Agricultural Soils (IPCC Subcategory 3.D)

3.D AGRICULTURAL SOILS

Overview: Direct N_2O emissions: In most soils, an increase in available nitrogen (N) enhances nitrification and denitrification rates, which then increase the production of N_2O. Increases in available N can occur through human-induced N additions:

- synthetic N fertilisers;
- organic N applied as fertiliser (e.g., animal manure, compost, sewage sludge, etc.);
- urine and dung N deposited on pasture, range and paddock by grazing animals;
- N in crop residues (above-ground and below-ground), including from N-fixing crops and from forages during pasture renewal;
- N mineralisation associated with loss of soil organic matter resulting from the change of land use or management of mineral soils; and
- drainage/management of organic soils.

Indirect N_2O emissions: in addition to the direct emissions of N_2O from managed soils that occur through a direct pathway (i.e., directly from the soils to which N is applied), emissions of N_2O also take place through two indirect pathways:

1. volatilisation of N as NH_3 and oxides of N (NOx) and the deposition of these gases and their products NH_4^+ and NO_3^- onto soils and the surface of lakes and other waters;
2. leaching and runoff from the land of N from synthetic and organic fertiliser additions, crop residues, mineralisation of N associated with loss of soil C in mineral and drained/managed organic soils through land-use change or management practices, and urine and dung deposition from grazing animals.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA & FAO
Trend	Decreasing and fluctuation of emissions were due to: • increased consumption of synthetic fertiliser (urea), • fluctuating amount of manure applied to soils, • decreased amount of crop residues because of decreased crop production: e.g. wheat and barley, maize, rice, and, • increasing amount of crop residues because of increased crop production (peas, potatoes, sunflower).				

2.8.3.5 Field Burning of Agricultural Residue (IPCC Subcategory 3.F)

3.F FIELD BURNING OF AGRICULTURAL RESIDUES

Overview: GHG emissions occur from burning of agricultural residues in the field. This practice is not common in Afghanistan, as residues are more used as fuel for cooking and heating.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA & FAO
Trend	Decreasing and fluctuation of emissions were due to: • decreased amount of crop residues because of decreased crop production (e.g. wheat and barley, maize, rice), and • increasing amount of crop residues because of increased crop production (peas, potatoes, sunflower).				

2.8.3.6 Others (IPCC Subcategory 3.G)

3.G OTHER (UREA APPLICATION)

Overview: Adding urea to soils during fertilisation leads to a loss of CO_2 that was fixed in the industrial production process. Urea ($CO(NH_2)_2$) is converted into ammonium (NH_4+), hydroxyl ion (OH-), and bicarbonate (HCO_3-), in the presence of water and urease enzymes. Similar to the soil reaction following addition of lime, bicarbonate that is formed evolves into CO_2 and water.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA & FAO
Trend	CO_2 emissions were fluctuating due to the needs of the soil and availability of urea.				

2.8.4 Waste (IPCC Sector 5)

In 2017, GHG emissions from IPCC sector Waste amounted to 1,502.27 Gg CO_2eq, which corresponds to 3.5% of the total national emissions. From 2012 to 2017, emissions from this sector increased by 13% mainly due to an increase in solid waste disposal and the increased population.

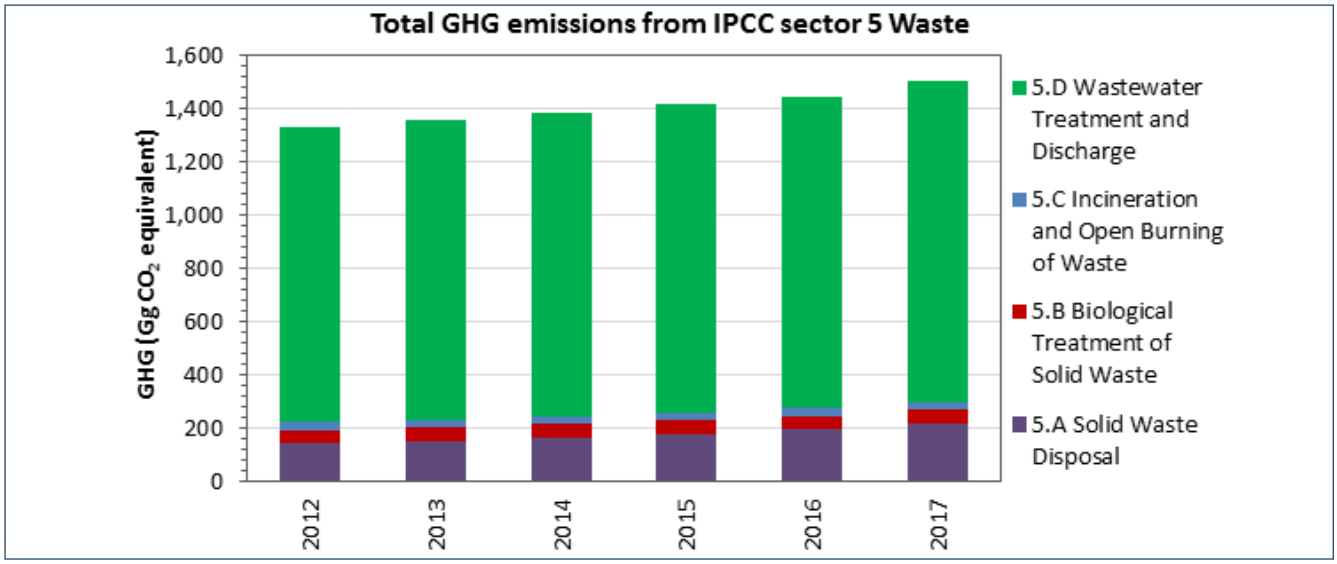


Figure 49. Total GHG emissions from IPCC sector 5 Waste

The GHG emissions of Waste Sector originate from (see Figure 49):

- Wastewater Treatment and Discharge (IPCC category 5.D), about 2.8% of total national GHG emissions,
- Solid Waste Disposal (IPCC category 5.A), about 0.5% of total national GHG emissions,
- Biological Treatment of Solid Waste (Composting) (IPCC category 5.B), about 0.1% of total national GHG emissions,
- Incineration and Open Burning of Waste (IPCC category 5.C) with about 0.1% of total national GHG emissions.

In 2017, the most important GHG from the Waste sector was CH_4 with a share of 84.4% in total GHG emissions from this sector, followed by N_2O with 15.2% and CO_2 with 0.4% of the total emissions from Waste sector. Figures 50 to 56 and Table 18 show the GHG emissions from the Waste sector for 2012 to 2017.

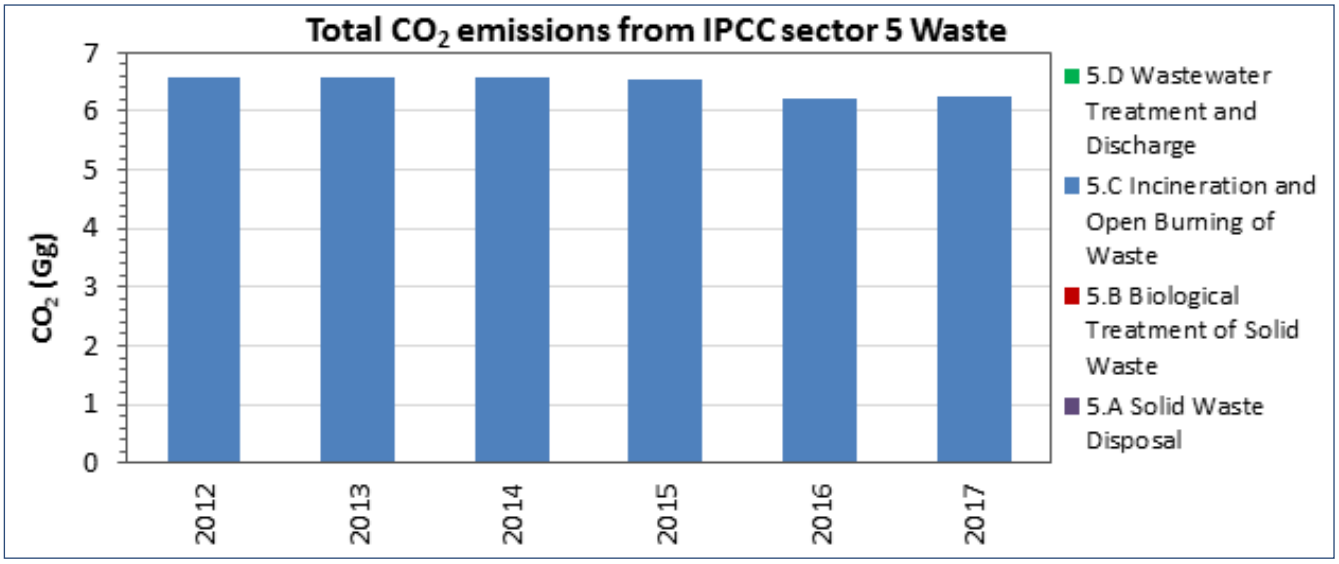


Figure 50. Total CO_2 emissions from IPCC sector 5 Waste

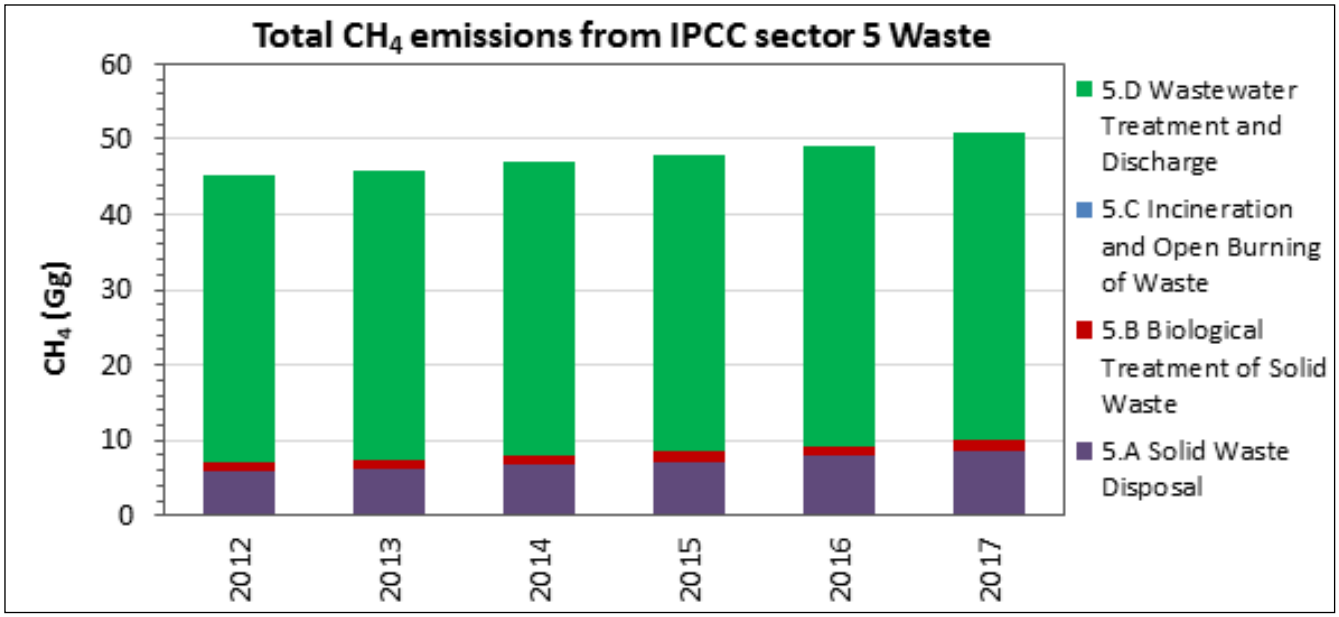


Figure 51. Total CH_4 emissions from IPCC sector 5 Waste

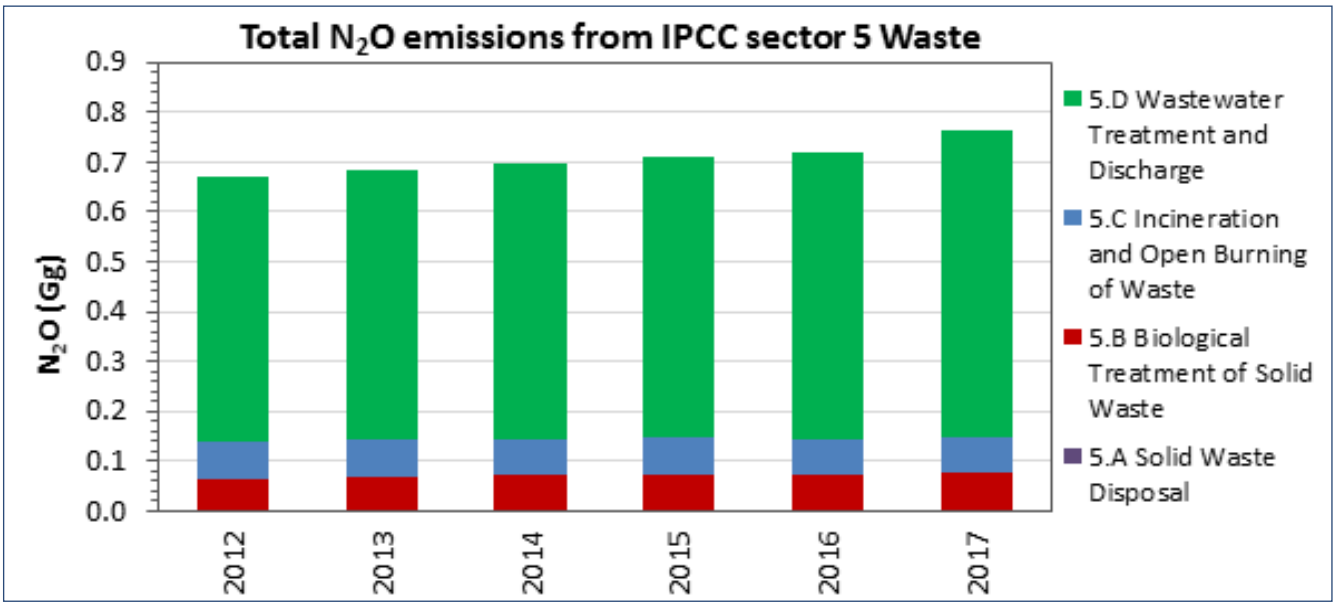


Figure 52. Total N_2O emissions from IPCC sector 5 Waste

Table 17: Emissions of GHG from the Waste Sector for the period of 2012 - 2017							
Greenhouse gas source and sink categories		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Greenhouse gas emissions (GHG)		**GHG (Gg CO_2 equivalent)**					
5	Waste	1,333.39	1,358.72	1,386.69	1,417.30	1,446.59	1,502.27
5.A	Solid Waste Disposal	147.49	155.76	166.71	180.36	197.11	216.36
5.B	Biological Treatment of Solid Waste	46.70	48.45	50.14	51.76	51.49	54.13
5.C	Incineration and Open Burning of Waste	30.33	30.46	30.41	30.19	28.76	28.87
5.D	Wastewater Treatment and Discharge	1,108.86	1,124.05	1,139.43	1,154.99	1,169.23	1,202.92
Total national GHG emissions (without LULUCF)		**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**
CO_2 emissions		**CO_2 (Gg)**					
5	Waste	6.56	6.59	6.58	6.53	6.22	6.25
5.A	Solid Waste Disposal	0.00	0.00	0.00	0.00	0.00	0.00
5.B	Biological Treatment of Solid Waste	NA	NA	NA	NA	NA	NA
5.C	Incineration and Open Burning of Waste	6.56	6.59	6.58	6.53	6.22	6.25
5.D	Wastewater Treatment and Discharge	NA	NA	NA	NA	NA	NA
Total national CO_2 emissions (without LULUCF)		**16,770.99**	**17,604.73**	**18,150.92**	**18,993.95**	**20,045.39**	**20,934.98**
CH_4 emissions		**CH_4 (Gg)**					
5	Waste	45.09	45.94	46.90	47.97	49.06	50.73
5.A	Solid Waste Disposal	5.90	6.23	6.67	7.21	7.88	8.65
5.B	Biological Treatment of Solid Waste	38.03	38.50	38.99	39.47	39.91	1.26
5.C	Incineration and Open Burning of Waste	0.08	0.08	0.08	0.08	0.07	0.07
5.D	Wastewater Treatment and Discharge	1.09	1.13	1.17	1.21	1.20	40.74
Total national CH_4 emissions (without LULUCF)		**644.39**	**640.99**	**666.25**	**651.91**	**652.50**	**656.74**
N_2O emissions		**N_2O (Gg)**					
5	Waste	0.67	0.68	0.70	0.71	0.72	0.76
5.A	Solid Waste Disposal	0.00	0.00	0.00	0.00	0.00	0.00
5.B	Biological Treatment of Solid Waste	0.53	0.54	0.55	0.56	0.58	0.08
5.C	Incineration and Open Burning of Waste	0.07	0.07	0.07	0.07	0.07	0.07
5.D	Wastewater Treatment and Discharge	0.07	0.07	0.07	0.07	0.07	0.62
Total national N_2O emissions (without LULUCF)		**23.64**	**24.74**	**24.79**	**22.50**	**21.89**	**20.53**

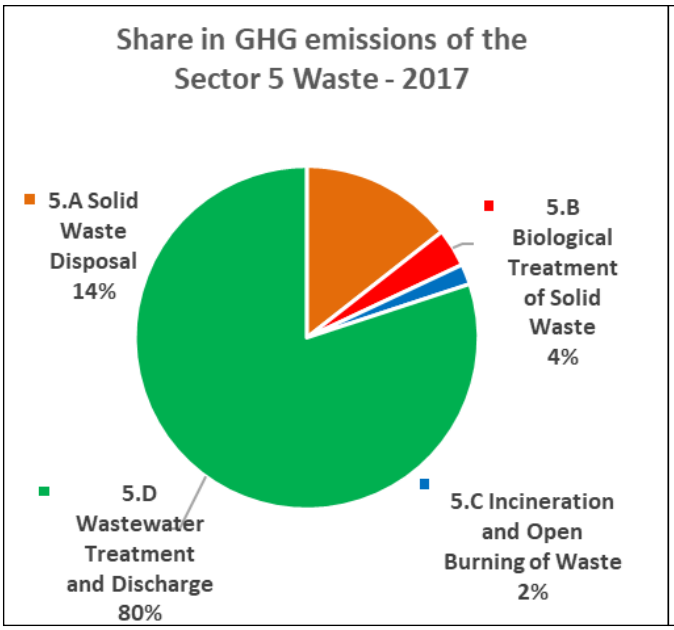


Figure 53. Total GHG emissions from IPCC sector 5 Waste in 2017

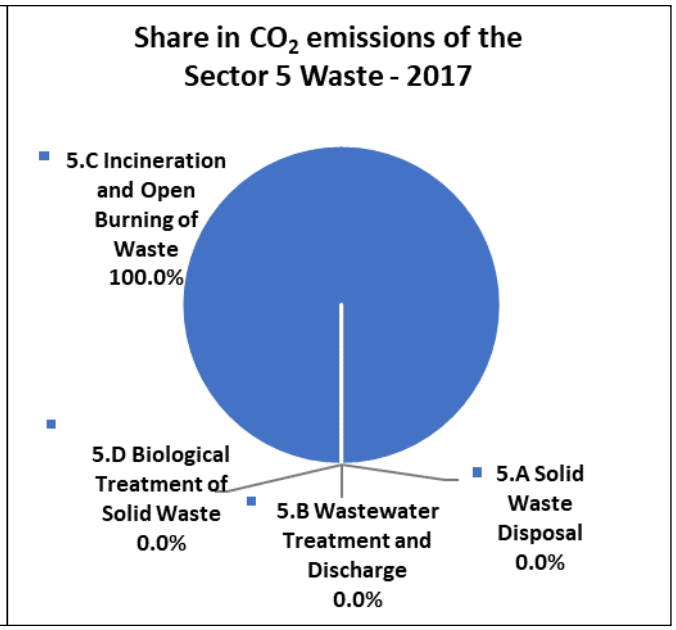


Figure 54. Share in CO_2 emissions of sector 5 Waste in 2017

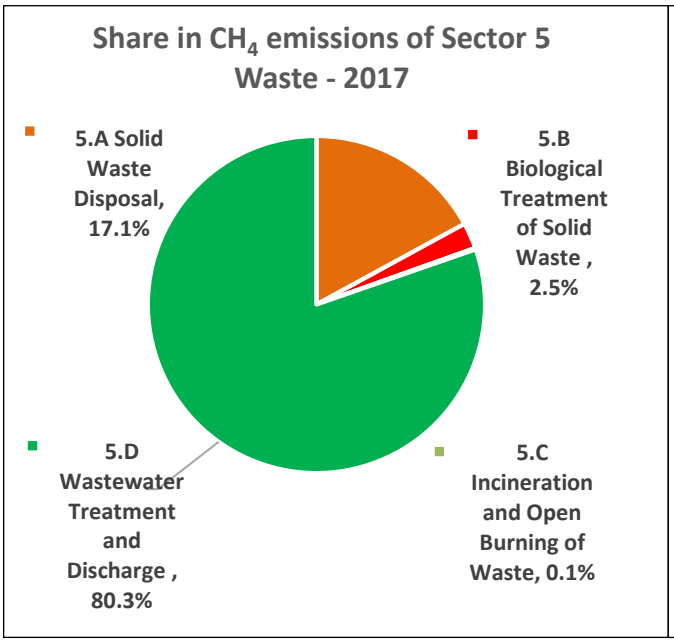


Figure 55. Share of CH_4 emissions from IPCC sector 5 Waste in 2017

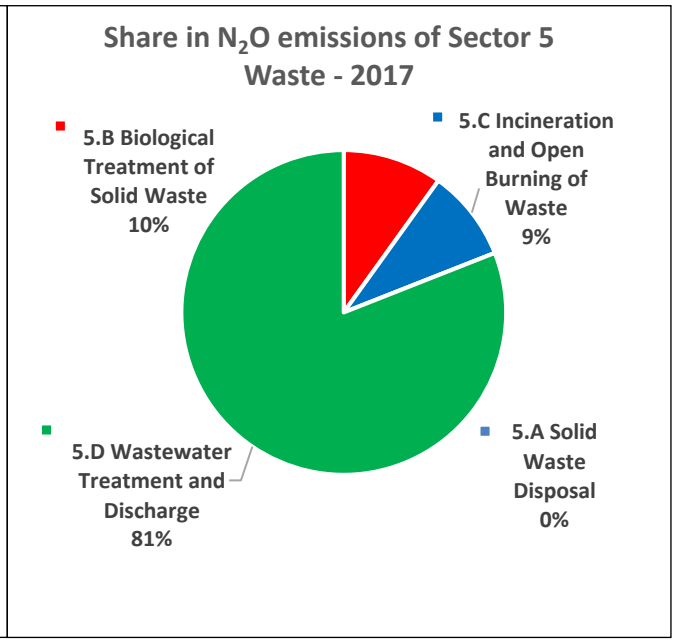


Figure 56. Share of N_2O emissions from IPCC sector 5 Waste in 2017

Solid waste is generated from households, offices, shops, markets, restaurants, public institutions, industrial installations, waterworks and sewage facilities, construction and demolition sites, and agricultural activities.

The availability and quality of data on solid waste generation as well as subsequent treatment vary significantly from country to country. In Afghanistan, statistics on waste generation and treatment have improved substantially during the last 10 years, but there is still a gap in comprehensive waste data covering all waste types and treatment techniques. Therefore, an overall analysis was made of the collection process, disposal routes and various treatments techniques. The following steps were done

1. Definition of solid waste;
2. Waste collection and waste disposal routes: Identification of waste treatments and allocation the waste to the waste treatments;
3. Compilation of activity data on waste generation per year starting from 1950;
4. Estimation of GHG emission from the different waste treatments techniques.

For estimating CH_4 emission from solid waste disposal (landfilling) requires data on

- waste generation of municipal solid waste (MSW) starting in 1950;
- waste generation of sludge starting in 1950;
- waste generation of industrial waste starting in 1950;
- recycling rate, starting in 1950.

For all other treatment techniques - open burning and/or incineration, composting, anaerobic treatment, mechanical and/or mechanical-biological treatment, data is required for the first inventory year, which was 1990.

In Figure 57, the collection process and the different disposal routes and treatments techniques are illustratively presented.

Kabul, MSW disposal site © UNEnvironment

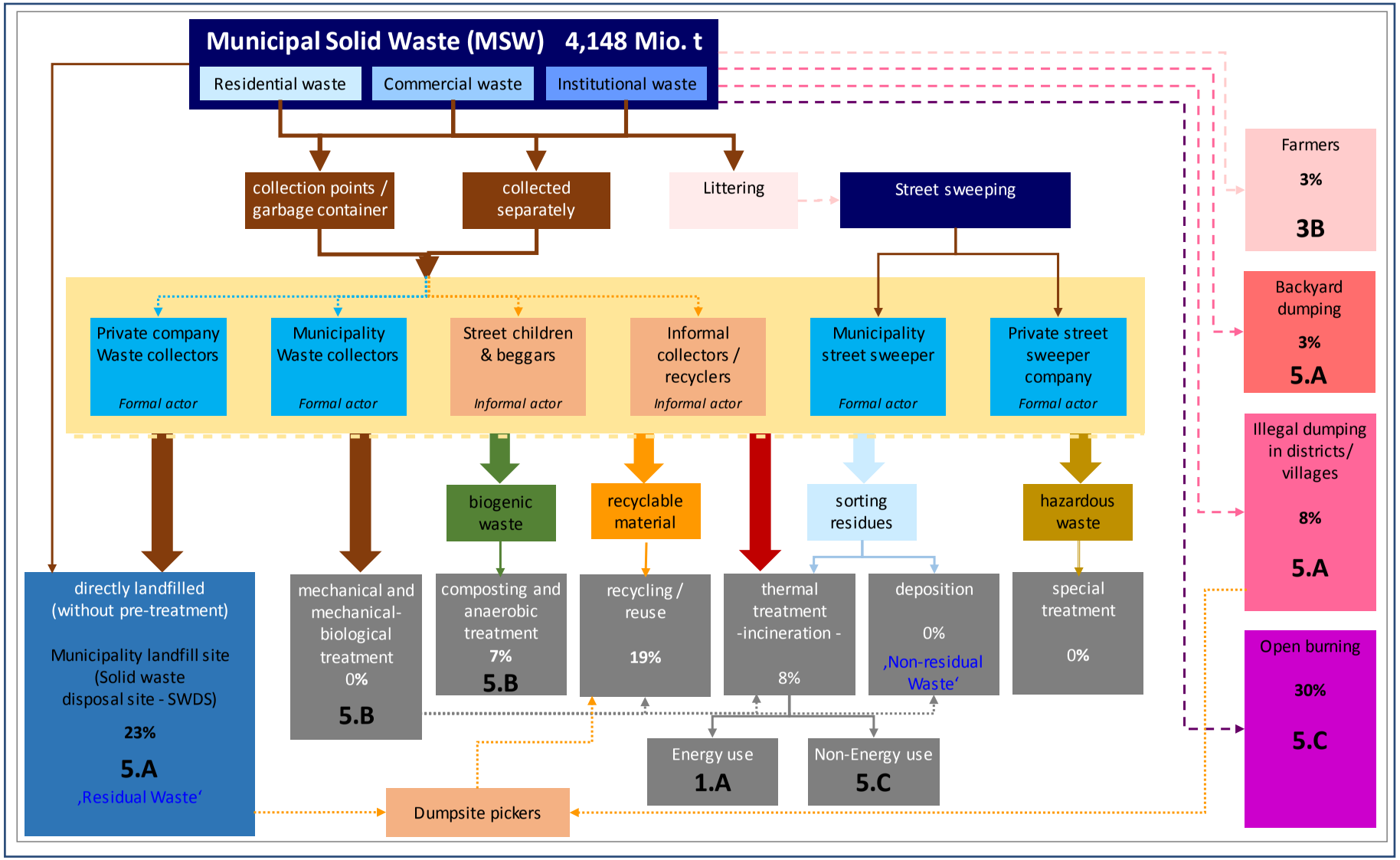


Figure 57: Waste from households and similar sources: collection process, disposal routes and treatments 2017.

Please note: This illustration only covers data from households and similar sources. Waste from industrial and similar sources (e.g. wastewater treatment plants) are also included in the inventory, but not considered in this Figure

2.8.4.1 Solid Waste Disposal (IPCC Subcategory 5.A)

5.A SOLID WASTE DISPOSAL

Overview: CH_4 emissions occur from the treatment and disposal of municipal, industrial, and other solid waste disposals. Gas generation usually begins two months after the burial of the wastes and continues up to 100 years. The quantity of CH_4 emitted during the decomposition process is directly proportional to the fraction of degradable organic carbon (DOC), which is defined as the carbon content of different types of organic biodegradable wastes such as paper and textiles, garden and park waste, food waste, wood and straw waste. Depending on the waste management practices in the countries, the Municipal Solid Waste Disposal Sites (SWDS) can be divided into Managed SWDS, Unmanaged SWDS, and Uncategorised SWDS.

All landfill sites of Afghanistan were allocated to 'uncategorised waste disposal sites' as the status was not well known. CH_4 emission from 'illegal (wild) landfill sites' were allocated to composting (IPCC category 5.B) as the waste is decomposed mainly aerobically (with oxygen) due to less weight and compactions.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA & expert judgment
Trend	CH_4 emissions increased due to: • growing landfilling activities which was a result of increasing population and growing waste generation rates. • reduction of illegal disposal (sites) and open burning.				

2.8.4.2 Biological Treatment of Solid Waste (IPCC Subcategory 5.B)

5.B BIOLOGICAL TREATMENT OF SOLID WASTE

Overview: CH_4 and N_2O emissions occur from 'Biological Treatment of Solid Waste' which is either 'composting', 'anaerobic digestion of organic waste' or 'mechanical-biological (MB) treatment'. GHG emissions were estimated only from composting as biogas generation (anaerobic digestion of organic waste) is still not common in Afghanistan.

Composting is an aerobic process and a large fraction of the DOC in the waste material is converted into CO_2. CH_4 is formed in anaerobic sections of the compost, but it is oxidised to a large extent in the aerobic sections of the compost.

Wild landfill sites were allocated to composting (IPCC category 5.B) as the waste decomposition is more comparable to composting (aerobically - with oxygen) then to landfilling (aerobically - without oxygen).

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	Plant specific - DABS
Trend	Constantly rising GHG emissions are due to increasing waste generation rate because of the growing population, composting activities but also still due to backyard dumping and illegal dumping in districts/villages and garbage pit.				

2.8.4.3 Open Burning of Waste (IPCC Subcategory 5.C)

5.C INCINERATION AND OPEN BURNING OF WASTE

Overview: GHG emissions occur from the combustion of waste either in Waste Incineration plants or in the form of open burning of waste.

- 5.C.1 Waste Incineration (with or without energy recovery)
- 5.C.2 Open Burning of Waste

Consistent information about the operation of waste incinerators was not available; therefore, this source is not estimated. GHG emission from open burning of waste is estimated.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA & Expert judgement
Trend	Fluctuation of fuel consumption and emissions are due to • Increasing population and increased waste generation rate • Increasing needs of getting rid of the waste • missing adequate waste management practice.				

2.8.4.4 Wastewater Treatment (IPCC Subcategory 5.D)

5.D WASTEWATER TREATMENT AND DISCHARGE

Overview: CH_4 emissions from wastewater occur when wastewater is treated or disposed of anaerobically. Wastewater is also a source of N_2O emissions. CO_2 emissions from wastewater are not considered because these are of biogenic origin. Wastewater originates from a variety of domestic, commercial and industrial sources and is treated on site (uncollected), sewerage to a centralised plant (collected) or disposed of untreated nearby. Domestic wastewater is defined as wastewater from household water use, while industrial wastewater is from industrial practices only.

Migration from rural to urban areas, industrial sector and increasing population growth have considerable affection creating wastewater production. In low-income countries like Afghanistan, Organisation, industrialisation, rapid population growth, unplanned urbanisation and informal activities are significant issues regarding wastewater and water pollution. Due to the high CH_4 generation potential of wastewater from latrines, this category is an important GHG source in Afghanistan.

Method	2006 IPCC GL Tier 1	**EF**	Default	**AD**	NSIA & expert judgment
Trend	The reason for the steadily rising GHG emissions is the growing population. However, the improved sanitation facilities in urban areas did not counterbalance the rising trend.				

Pamir © NRC/Ayub Alavi

3 MITIGATION ACTIONs

kandahar, 2019 ©Asghar Normohammadi

3.1 INTRODUCTION

The ACCSAP is a long-term strategy document and action plan that outlines the climate change priorities, strategies and actions covering both adaptation and mitigation. In addition, it seeks to fill key gaps and to identify strategic financial and operational linkages to support the activities included under the ACCSAP.

In the context of national-level planning processes, centred on the Afghanistan National Peace and Development Framework (ANPDF) with strategic direction provided by the National Priority Programmes (NPPs) to this end, the international climate change establishment can provide valuable opportunities to achieve the National Development Goals (NDG) while at the same time mitigating emissions and adapting to climate change adverse effects.

Recognising that GHG mitigation and adaptation to climate change require a broad-based, multi-sectoral approach, which involves measures specific to each sector, GIRoA developed several NAMAs along with the NAPAs, (see Table 19 below); these programmes represent a series of policies and measures the country conditionally commits to implement up to 2030 in the energy, industrial, agriculture and waste sectors with an estimated mitigation impact of 13.6% reduction in total national GHG emissions excluding LULUCF compared to a BAU scenario[80].

The NAMAs are expected to fulfil the conditional goals of Afghanistan's NDC. The ACCSAP clearly states that implementing the communicated NAMAs is conditional depending on the level of international support received.

3.2 PREVIOUS MITIGATION ACTIVITIES

Over the past two decades, Afghanistan has implemented a large number of mini and small-scale projects in the Renewable Energy (RE) and Energy Efficiency (EE) domains. A total of 450 Mini HPPs are reported totalling 6.9 MW of installed capacity.

Afghanistan's first-ever power generating wind farm was built in Panjshir in 2008 with a total installed capacity of 100 kW. In total, six wind projects have been completed with a combined installed capacity of 230 kW. Concerning solar energy, 0.55 MW of solar photovoltaic (PV) mini units were implemented in the same period. An estimated 200 small biogas digesters have been installed in Kandahar province,[81] and about 100 plants have been installed in Jalalabad province. The projects were scattered over the national territory, and several implementing partners were involved in the activities, which make the follow up very difficult.

GIRoA has developed its EEP in 2016. As a consequence of the implementation of the EEP, MEW executed an EE project of replacing inefficient lighting devices with light-emitting diode (LED) devices in 39 government institutions. This project resulted in reducing the demand by 4.22 MW. The project cost was USD 3.8 Million. A second phase of the project is planned to be implemented in 2019–2020.

One of the initiatives that the GIRoA has identified is to capitalise on its wealth of RE resources with a view to both increasing access to the electricity services and developing domestic business opportunities. Specifically, the GIRoA has set a target to supply 10% of forecast electricity demand (350–500 MW) through RE by 2032.

The following large-scale hydropower options were identified for future development in the Afghanistan Power Sector Master Plan (APSMP)[82]. It is well known that large power projects in the case of Afghanistan are difficult to realise due to the prevailing security conditions and their reflection on financing possibilities. For large hydropower schemes, some political barriers also exist in relations with neighbouring countries.

Table 18. Proposed Hydro Power Plants Additions				
The First Year of Operation	HPP	Installed Capacity (MW)	Capital Cost ($ million)	Annual Energy (GWh)
Finalising expected soon	Salma	40	200	197
Finalising expected soon	Kajaki Extension	18.5	90	91
2024	Kunar B	300	600	1,485
2026	Kunar A	789	2,000	4,772
2028	Kajaki Addition	100	300	493
2029	Olambagh	90	400	444
2032	Baghdara	210	600	968

Moreover, under the Afghanistan Sustainable Energy for Rural Development (ASERD) programme of the Ministry of Rural Rehabilitation and Development (MRRD)[83], several small-scale projects were implemented countrywide. The following is a summary of the achievements:

1. Distribution of 4,400 efficient cookstoves in four provinces of the country (Kabul, Nangarhar, Herat and Parwan provinces)
2. The first hybrid mini-grid project with a capacity of 340 kW in Dara-e-Noor district of Nangarhar province that will cover seven villages with more than 2,000 households (HH) along with small and medium enterprises (SMEs)
3. Installation of demonstration models (micro-hydropower, wind turbines, solar street lighting) in MRRD's Rural Technology Park.[84]

The main conclusion from investigating the Afghan context is that the development of small to mini renewable energy options is of the highest priority in the short term. These options are abundant, easy to access and finance, existing know-how is adequate, have flexibility in implementation (primary grid or isolated mini-grid) and have no significant political and financial barriers.

Herat, Salma Dam, 2016 © ARG_AFG Twitter

3.3 AFGHANISTAN NAMAs

Following the submission of the INDC in 2015, Afghanistan prepared its NAMAs to achieve a 13.6% reduction of GHG emissions by 2030. Table 19 below provides a list and description of Afghanistan's NAMAs.

Table 19: List of Afghanistan's NAMAs to achieve the 13.6% conditional reduction by 2030[85]

NAMA Category	Scope	Intervention Title	Institutional Stakeholder	NAMA Description
Policy	Support for National Policy and Guideline Development	Supporting EE Policymaking for Afghanistan	Lead: MEW Other: NEPA	Currently, there is no focus on EE. Proposed NAMA would set up policy goals and framework. Focus on efficient mining, SMEs and other sectors. Especially, household appliance, EE awareness and policy needs to be developed. The baseline needs to be established
Policy/ Programme/ Project	Sustainable Urban Infrastructure Development	Guidelines on sustainable urban habitat, covering waste management, efficient building design and programmes.	Lead: MUDL, Kabul Municipality Other: NEPA, MEW	Sustainable urban living could reduce both GHG emissions and local pollutants. Policy directives could be aimed at the use of SWH for hot water supply, use of efficient (star rated) appliances and devices. Interventions for sustainable housing guidelines in terms of choice of building materials.
Policy/ Programme/ Project	Sustainable Urban Transportation	Policy and Regulation covering sustainable Urban Transportation	Lead: MOTCA Other: NEPA	Establish standards for vehicular, regulate movement of non-passenger traffic, policies and measures for phasing out older vehicles — measures for traffic management Institutional framework and creation of government body responsible for sustainable urban transportation.
Project	Introduce solar PV, biomass and other RE for enhanced energy access in rural areas	Promotion of Decentralized Renewable Energy Systems for economic development	MRRD, MEW	Explore options for enterprise development in rural areas using renewable energy, complement the national and / or regional grid with decentralized energy generation

Aside from the communicated NAMAs, there is a wealth of policies and plans specifically designed to tackle both the adaptation and mitigation aspects of climate change. Table 20 below summarises these policies and plans.

Table 20. Existing Climate Change Policies and Plans

Number	Name of the Existing Policies and Plans
1	Strategic Policy Framework for the Water Sector
2	Range Land Management Plan
3	National Forestry Management Plan
4	Energy Sector Strategy
5	National Environment Strategy
6	National Agricultural Development Framework
7	National Biodiversity Strategy and Action Plan
8	Energy for Rural Development
9	National Environmental Action Plan
10	Strategic National Action Plan for Disaster Risk Reduction
11	National Water and Natural Resources Management Priority Programme

12	National Renewable Energy Policy
13	National Adaptation Plan
14	National Climate Change Strategy and Action Plan
15	National Capacity Needs Self-Assessment for Global Environmental Management
16	National Adaptation Programme of Action for Climate Change
17	Afghanistan National Peace and Development Framework
18	Initial National Communication
19	Second National Communication
20	Rural Water Supply, Sanitation and Hygiene Promotion Policy 2016-2020
21	Afghanistan Power Sector Master Plan

Note: Please refer to the SNC report to see the complete list of legislation.

As is evident from Table 19, NAMAs were determined in broad terms that need to be translated into more specific coherent activities that are readily Measurable, Reportable and Verifiable.

NEPA, with technical support from UNEP, recently conducted a case study to identify programmes and projects that are intended to fulfil the goals stated in the communicated NAMAs. As a result of this study, four soft programmes relevant to all NAMAs were identified, and eight hard projects based on CDM approved methodologies were appraised[86].

Table 21: List of mitigation actions identified

Number	Mitigation Action	Category
1	Climate Change National Information System (CCNIS)	Soft Programme
2	Renewable Energy and Energy Efficiency Fund Proposal	Soft Programme
3	Energy Codes in the Building Sector	Soft Programme
4	Labelling and Standards for Household Appliances (LSHA)	Soft Programme
5	Solar Water Heaters in Households	CDM-PoA Eligible actions (hard projects)
6	Electrification of Rural Communities Using Renewable Energy	CDM-PoA Eligible actions (hard projects)
7	Grid-connected PV	CDM-PoA Eligible actions (hard projects)
8	Mini Hydropower Plants	CDM-PoA Eligible actions (hard projects)
9	Improved Cookstove Programme	CDM-PoA Eligible actions (hard projects)
10	Methane Gas Recovery from MSWDs	CDM-PoA Eligible actions (hard projects)
11	Natural Gas Combined Cycle	CDM-PoA Eligible actions (hard projects)
12	Bus Rapid Transit	CDM-PoA Eligible actions (hard projects)

Adopting CDM approved methodologies is not only intended for generating certified emission reductions (CERs), but also to increase the transparency and credibility of reported estimations and to build trust among potential supporting entities. The overall mitigation plan for the mentioned projects and programmes was based on a top-down approach targeting the achievement of the intended NDC, starting from overall NDG and LEDS through sectoral goals to the last level of individual mitigation actions. The target year was shifted to 2035.

Figure 58 illustrates the approaches to implement the actions summarised in Table 21.

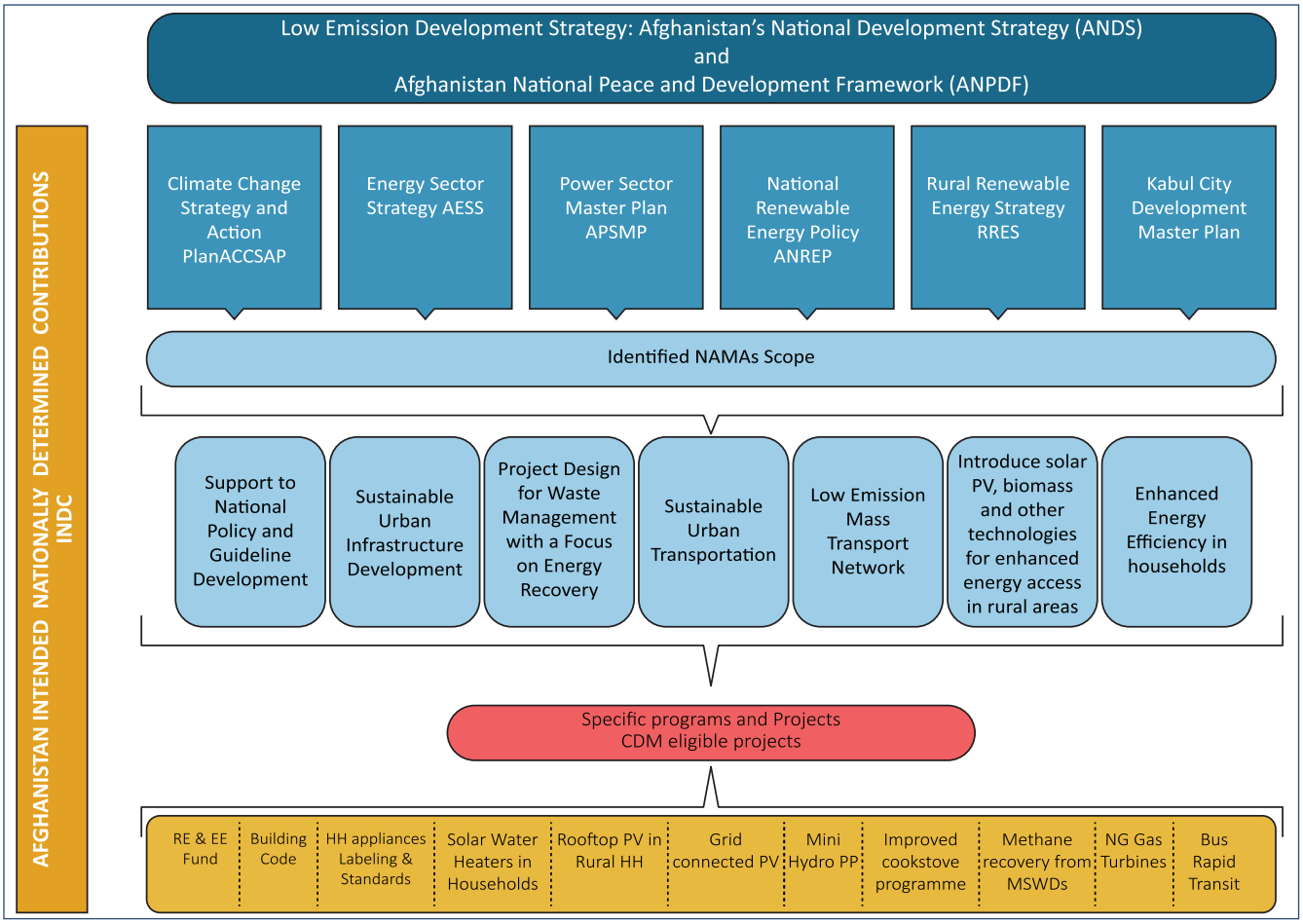


Figure 58: The logical sequence of determining GHG mitigation activities starting from LEDs

3.4 BASELINE SCENARIO

The baseline scenario or BAU scenario in UNFCCC literature signifies future developments in the absence of specific GHG mitigation actions. The BAU scenario doesn't reflect simple extrapolation of existing conditions and trends. Rather it should incorporate programmes and projects identified in sectoral development plans that are approved and committed.

Specific development goals and objectives are based on conditional programmes and projects i.e. will be persued only if specific conditions are fulfilled. For example, getting foreign financing assistance in the form of grants, soft loans and direct foreign investment for GHG adaptation and mitigation activities falls under this category. Other activities are foreseen to be implemented by the national private sector, which in their turn are subject to conditions that may not be fulfilled. Such activities were carefully evaluated before inclusion in the BAU scenario. Only "must do", committed and highly probable activities are considered in the BAU scenario. Based on these prerequisites, the baseline scenario is also called the Most Probable Scenario (MPS).

In the medium and long term, Afghanistan's economy will undergo significant structural changes to meet the ambitious development goals (including a double-digit growth rate). The guidelines for such changes are detailed in national and sectoral policies and strategies; any baseline scenario, therefore, should observe these guidelines.

To identify mitigation actions, the adopted baseline considered only key category sectors that will host mitigation actions. Other categories are deemed irrelevant to the targets of the NDC. Sector-specific

baseline assumptions were made based on discussions and analysis carried out in collaboration with government line ministries and agencies. Baseline GHG emissions estimates were based on these assumptions.

Sectors considered in the baseline scenario are the Power, Household and Commercial, Manufacturing Industries and Construction, and Domestic Solid Waste sectors.

3.5 BASELINE DEVELOPMENT METHODOLOGY

In most countries, analytical models are used to generate the BAU based on adopted assumptions. Examples of such models are the Energy and Power Evaluation Programme (ENPEP), an integrated energy modelling system developed by Argonne National Laboratories and Long-range Energy Alternatives Planning System (LEAP) developed and supported by the Stockholm Environment Institute.

In the case of Afghanistan, and until such model is adopted by the relevant entities, BAU and mitigation scenarios will be developed and analysed in a bottom-up approach where activities are first developed at the sector/sub-sector level and then bundled in a national scenario.

Constructing a BAU scenario is a collaborative effort; therefore, representatives of all key sectors participated in this endeavor to obtain the best insights.

3.6 BASELINE EMISSIONS CALCULATION SPREADSHEET

For the short term, and until a more comprehensive tool is adopted, national experts will use the spreadsheet explicitly developed for the case of Afghanistan to help in constructing the baseline scenario. The spreadsheet calculates baseline scenario emissions based on planned/committed and must-do projects. These projects are identified based on the above-mentioned sectoral assumptions and introduced in the spreadsheet.

3.7 MITIGATION

The ANDS reflects Afghanistan's long-term goals to tackle climate change issues under pillar (iii) Economic and Social Development where energy, water, transport, urban development, agriculture and rural development are the major components[87].

Afghanistan has prepared a list of conditional NAMAs (Table 20) designed to achieve the communicated NDC of a 13.6% reduction in GHG emissions to achieve the NDC conditional target. GIRoA conducted a case study in 2018 to explore the mitigation options for Afghanistan which shows that Afghanistan has a potential of 17.4% GHG emission reduction by 2035 compared to the BAU scenario.

Table 22 below summarises the expected GHG reductions as a result of implementing the identified individual mitigation projects and programmes.

Table 22: Summary of GHG emission reduction from the Identified mitigation programmes and projects under the communicated NAMAs

Year	Baseline emissions CO_2e Gg	Mitigation Scenario emissions CO_2e Gg	GHG Emission Reductions CO_2e Gg	GHG Emission Reductions %
2015	19903.30	19903.30	0.00	0
2016	20304.08	20304.08	0.00	0.00%
2017	20718.76	20718.76	0.00	0.00%
2018	21429.18	21429.18	0.00	0.00%
2019	22200.40	22200.40	0.00	0.00%
2020	23184.91	21300.08	1884.83	8.13%

2021	23948.04	21890.24	2057.80	8.59%
2022	25223.72	22982.70	2241.02	8.88%
2023	25778.51	23367.69	2410.83	9.35%
2024	26352.40	23772.39	2580.01	9.79%
2025	28284.16	24429.38	3854.78	13.63%
2026	28956.61	24929.67	4026.94	13.91%
2027	29652.31	25453.75	4198.56	14.16%
2028	30372.15	26001.49	4370.66	14.39%
2029	31117.08	26573.81	4543.27	14.60%
2030	33611.79	27782.49	5829.30	17.34%
2031	34444.31	28439.65	6004.66	17.43%
2032	35305.63	29147.64	6157.99	17.44%
2033	36196.87	29884.95	6311.92	17.44%
2034	37119.20	30651.72	6467.48	17.42%
2035	38073.82	31450.14	6623.68	17.40%

The mitigation opportunities were selected based on a set of evaluation criteria derived from the need to complement and enhance national efforts towards LEDS achievement. The mitigation actions evaluation criteria are listed below:

- NAMA scope
- CDM eligibility
- Alignment with national developmental priorities and strategies
- ANDS
- Afghanistan SDGs & NPPs
- Energy Sector Strategy
- Rural Renewable Energy Strategy
- Mitigation potential (in Gg CO_2eq)
- Direct cost (in USD per t CO_2eq)
- Indirect cost employment
- Environment goals (e.g. pollution benefits)
- Data availability

To achieve the 13.6% reduction in GHG emission by 2030, the NDC estimated that USD 6.62 billion would be required for mitigation actions and a further USD 10.79 billion for adaptation actions. GIRoA did receive support for NDC implementation; this support only contributed to the policy and planning levels of action; no support has been received to stimulate the next step of implementation of the identified actions.

3.8 INFORMATION ON MITIGATION ACTIONS

3.8.1 Mitigation Goal Assessment

The mitigation target period considered is 2016 – 2035; the mitigation activities are expected to be started in the first few years and continue over the whole period depending on the multiplicity of activity components. For example, activities executed under CDM Programme of Activities (PoAs) would witness additions of new component project activities (CPAs) over different periods of years depending on the programme.

No specific target emission reduction is considered by the GIRoA aside from the 13.6% reduction at the national level compared to the BAU scenario. i.e. no specific year emission level nor specific emission intensity is targeted.

A new study on climate change mitigation options for Afghanistan was conducted in 2018, which provides detailed information regarding the mitigation actions identified and listed in Table 21. This study shows that Afghanistan has the potential for emission reductions of 17.4% by 2035 (17.34% in 2030)[88], which is in conformity with the announced target of 13.6% reduction by 2030 (see Figure 59).

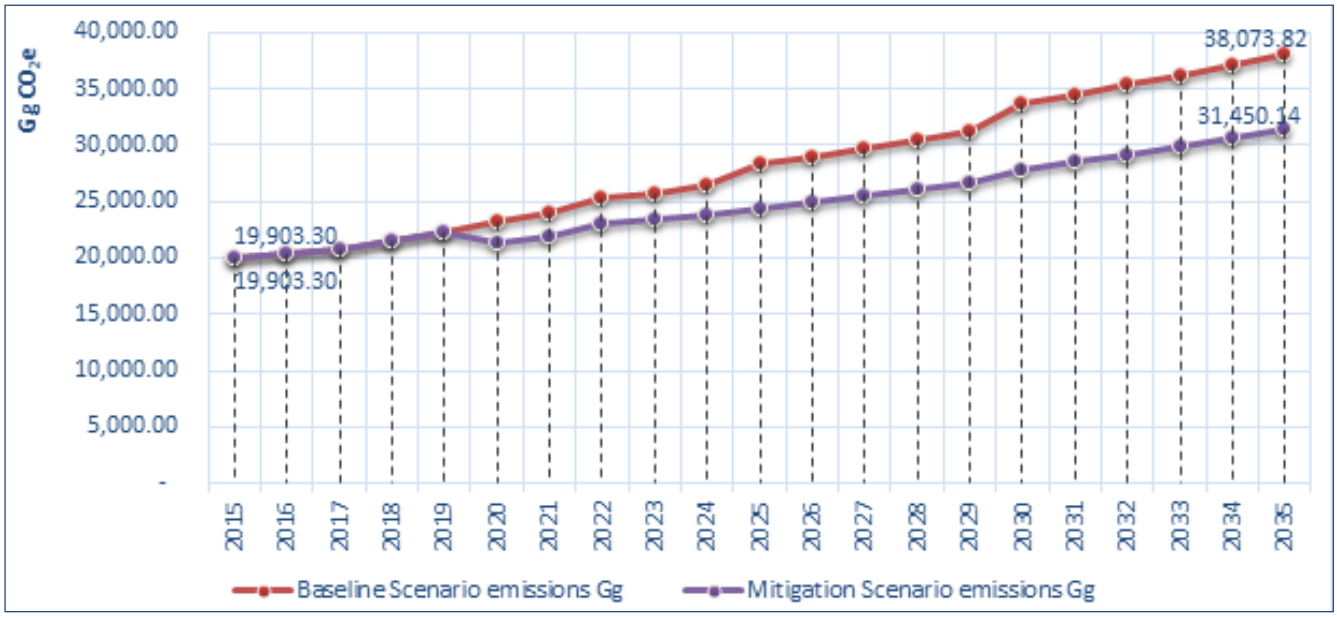


Figure 59: Comparison of the GHG emissions baseline and mitigation scenarios

Mitigation opportunities formulated below are presented in two parts, the first part represents opportunities not eligible for development under CDM (soft programmes), while the second one represents opportunities that are eligible for development under CDM.

Part 1: Mitigation Actions Not Eligible for Development Under CDM and PoA

The following four soft programmes were identified as mitigation actions

Mitigation Programme 1: Climate Change National Information System

Objective:

The objectives of the CCNIS are to generate transparent, consistent, comparable, complete and accurate inventories and standard quality results. The CCNIS will also facilitate MRV report issuance needed for NAMAs and related mitigation activities. It should cover all data required from all sectors contributing to the anthropogenic GHG emissions in Afghanistan and all data required for appraising, implementing and operating mitigation actions and reporting on such actions.

Information on the nature of the action

The CCNIS is designed to incorporate all the elements necessary to estimate GHG emissions and removals based on approved calculation tools and methodologies. The system is comprised of three main parts (Figure 60). The first part contains the data bank covering information on national circumstances, information required for 2006 IPCC Inventory Software and information required to appraise, monitor and report on mitigation actions.

The second part consists of adopted software, models and spreadsheets required for reporting on climate change activities. This part represents the electronic core of CCNIS and readily defines the type of information needed to be included in the data bank.

The third part of the CCNIS is the formal reporting formats and templates determined by UNFCCC for international reporting, and the MRV Protocols developed explicitly for the mitigation actions.

The CCNIS represents the necessary and basic infrastructure capable of meeting the short-term requirements of GIRoA for its climate change related activities. In the short term, it will depend on human intervention to a large degree; in the long term, the system could be fully computerised.

Constructing and maintaining the CCNIS is a multi-disciplinary activity, especially in the case of GHG inventory data. In addition to the national inventory core team, the NSIA should also take active participation in creating and maintaining the inventory data bank. To make the system functional, data request templates as per the requirements of the 2006 IPCC Software have been designed. Moreover, various protocols have been developed for MRV for each mitigation action.

The mitigation assessment data bank should include the necessary information to:

- Define the time frame (typically long term);
- Define the scope (energy demand and supply, agriculture, land use, forestry, solid waste management);
- Define participants and key stakeholders (policymakers, the scientific community, NGOs);
- Define the desired results;
- Select methodologies consistent with data and expertise availability;
- Standardise key parameters (base year, end year, discount rate, etc.);
- Define project boundaries (consistent with the approach used to develop emissions inventories);
- Define scenarios, typically at least baseline and mitigation scenarios.

The information will cover all phases of any mitigation activity, namely Conceptualisation and Appraisal, Implementation, and Operation. Similarly, it will include time and the data and variables requested under the relevant CDM methodologies for each CDM project.

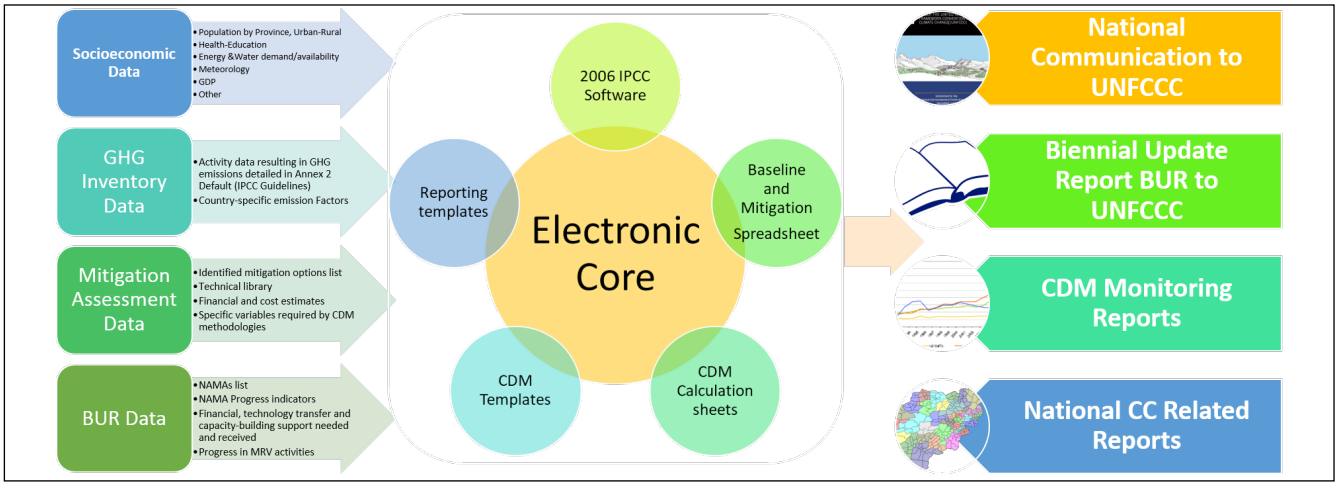


Figure 60: Basic Structure of the CCNIS

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

- GIRoA prepared its INC and SNC, so the national team is familiar with this part of the system,
- The NST on GHG inventory was recently trained on using the 2006 IPCC Inventory Software and associated spreadsheets to calculate baseline and mitigation scenarios emissions,
- National experts were briefly acquainted with CDM-PoA and relevant methodologies, guidelines and procedures,
- NEPA has developed the required data request templates and protocols,
- No quantitative estimates are possible, but the programme is providing the necessary infrastructure to the CCNIS.

Mitigation Programme 2: Renewable Energy and Energy Efficiency Fund Proposal

Objective:

The Renewable Energy and Energy Efficiency Fund's (REEEF) primary goal is to support the implementation of projects and other activities that lead to maximising the share of renewable energy production and energy efficiency savings in the national energy balance.

The REEEF will finance activities implemented by the private sector and other entities that promote sustainable use of Afghanistan's natural resources and help achieve environmental objectives, including GHG mitigation goals. The Fund is expected to promote projects in solar and wind energy, small hydropower and energy efficiency in industries and commercial buildings.

Information on the nature of the action

Afghanistan is embarking on a rapid growth rate path where securing energy supply is a crucial requirement. To achieve the required levels of energy security, Afghanistan needs to secure significant investments across both the public and private sectors.

The proposed REEEF formulates a sound systematic approach to the identification, preparation, appraisal, selection, implementation and subsequent evaluation of projects receiving its support. This series of steps constitute the Project Cycle, management of which will be the REEEF most critical process.

The Fund will operate through several windows, some of which are listed below:

- RE Subsidy Window
- RE and EE Interest Subsidy Window
- RE and EE Loan Guarantee Window
- Studies and Technical Cooperation Window
- Equity Financing Window

Expected sources of revenues include:

- General budget allocation by the government
- Donations from international donors
- Fees and penalties raised on violations to environmental law
- CDM revenues and interest on loans

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The concept has been shared with the government line ministries and agencies for further analysis and development.

Mitigation Programme 3: Energy Codes for Buildings

Objective:

Adopting building energy codes ensures the use of energy efficiently over the lifetime of the building and provides for society's minimum requirements for public health, safety and general welfare. In line with the primary objectives of the programme, a building energy code serves as:

- A regulatory document by which to specify and judge compliance with occupant's requirements.
- An official document which has a mechanism to describe compatibility achievements. It belongs to the building code organisations in the country; its main functions include issuing permits, reviewing plans, and conducting inspections.
- A technical document that provides information to build practitioners' capacity on what should be done by experts.
- A social document that specifies the society's minimum requirements for public health, safety and general welfare.

Information on the nature of the action

Building codes are sets of regulations governing the design, construction, alteration and maintenance of structures. They specify the minimum requirements to adequately safeguard the health, safety and welfare of building occupants.

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was shared with the relevant governmental institutions for further appraisal and development.

Mitigation Programme 4: Household Appliances Labelling and Standards

Objective:

Potential users of equipment, faced with a choice of designs, may not have the skills and information to understand the consequences of their choices. Labelling and standardisation provide the necessary information to help users make an educated choice, which improves the standard of living in the household sector. The primary objectives of proposing this programme are to:

- Improve energy consumption efficiency in households,
- Provide income savings for households,
- Phase-out inefficient appliances from the local market.

Information on the nature of the action

The obligation on manufacturers and importers of equipment to label goods or to meet specified standards is a policy measure introduced to overcome market failure caused by asymmetric information regarding the efficiency in the performance of different equipment (initial cost vs operating cost).

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored for each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development.

Part 2. Mitigation Actions Eligible for Development Under CDM and PoA

The following eight hard projects were identified as mitigation actions eligible for development under the CDM.

Mitigation Project 1: Solar Water Heaters in Households-PoA

Objective:

In Afghanistan, there is considerable pressure on using trees and other sources of fuelwood for heating and cooking. The project is proposed to minimise demand for commercial and traditional (wood, dung) fuels and improve the quality of living in households. In addition, the following outcomes are expected from the project:

- Reduce fossil fuel and wood-fuel consumption by using renewable energy to meet water heating requirements,
- Reduce CO_2 emissions and deforestation,
- Improve indoor air quality through the replacement of inefficient water heating appliances,
- Provide income savings for households.

Information on the nature of the action

Sector: Energy

Install solar water heaters in individual dwellings to provide hot water in different regions of Afghanistan using a CDM-PoA approach.

Methodology to be applied: AMS-I.J. (Small-scale Methodology: Solar Water Heating System).

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 2: Electrification of Rural Communities Using Renewable Energy (Roof-top PV Units-PoA)

Objective:

The primary goal of this PoA is to boost the use of renewable energy through the installation of roof-top PV systems by domestic consumers and private companies, improving, the socio-economic well-being of the citizens. The following are the key objectives of this project:

- Reduce fossil fuel and wood-fuel consumption (depending on the mix used to heat water) by using renewable energy to meet lighting and other energy needs,
- Reduce CO_2 emissions and deforestation,
- Improve indoor air quality through the replacement of inefficient lighting and energy-consuming appliances,
- Provide income savings for households.

Information on the nature of the action

Sector: Energy

Install roof-top PV units for domestic consumers and private companies. A typical CPA under this PoA is either:

Type 1: A group of independent activities in a predetermined province of Afghanistan, each of which is no larger than 0.15 MW installed capacity or,

Type 2: An identified independent activity or a group of identified independent activities of any capacity which together do not exceed 15 MW.

CDM Methodology to be applied: Each CPA will apply: either (1) only AMS-I.F, (2) only AMD-I.D or (3) a combination of both methodologies.

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 3: Grid-Connected PV Power Plant-PoA

Objective:

Afghanistan relies heavily on import of energy from the neighboring countries while having huge potential for generating energy. This project is proposed to boost the use of PV solar energy in Afghanistan, improving, the wellbeing of the population by providing needed energy at reasonable prices and reducing electricity imports. The key objectives of this project are:

- Reducing dependence on imported electricity,
- Improving self-sufficiency in electricity generation and security of supply,
- Supplying a larger segment of the population with electricity.

Information on the nature of the action

Sector: Energy/IPPU

The electricity generated from grid-connected solar power plants in each of the small-scale CDM CPAs under this PoA shall be supplied to the regional grid or to an identified consumer facility via the national/ regional grid. The generated electricity thereby contributes towards the reduction of GHG emission and increases access to electricity.

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 4: Mini Hydropower Plants-PoA

Objective:

Afghanistan's abundant water resources mean that there is considerable potential for hydropower development estimated at 23,310MW.[89] However, the country imports most of its electricity from neighboring countries or uses small generators for electricity production. This project is proposed to boost the use of renewable energy from hydropower plants in Afghanistan, improving, the well-being of its residents by providing needed energy at reasonable prices and reducing electricity imports. The key objectives of the project are:

- Reducing dependence on imported electricity,
- Improving self-sufficiency in electricity generation and security of supply,
- Supplying a larger segment of the population with electricity.

Information on the nature of the action

Sector: Energy/IPPU

Afghanistan has substantial hydropower resources providing excellent opportunities for mini, small, and large HPP installation. Exploiting these resources will replace imported energy and improve energy supply security.

Applied CDM Methodology: AMS-I.D. (grid-connected renewable electricity generation)

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 5: Improved Cookstoves-PoA

Objective:

More than three-quarters of Afghan households use solid fuels such as firewood, charcoal, animal dung and bushes for cooking[90]. This project is proposed to minimise the demand for solid fuels and improve the indoor air quality of households. The project has the following key objectives:

- Reducing the time consumed for collecting traditional fuel,
- Improving indoor air quality,
- Improving the socio-economic status of rural areas.

Information on the nature of the action

Sector: Energy

The majority of Afghan households depend on wood and other biomass fuels for cooking using traditional stoves that have very low energy efficiency and high emissions of GHGs. A survey in 2014 showed that only 1% of Afghans have access to clean fuels and technologies for cooking[91].This action consists of distributing more efficient locally manufactured stoves to reduce the emission of GHGs and the workload on women who are primarily responsible for collecting fuel for cooking[92].

Applied CDM Approved Methodology: AMS.II.G (energy efficiency measures in thermal application of non-renewable biomass)

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 6: Methane Gas Recovery From MSWDs-PoA

Objective:

With the ultimate goal of reducing GHG emissions and meeting the NDC conditional goals, methane gas recovery from MSW is proposed to improve the socio-economic conditions in urban areas and reduce the pollution caused by MSW. The key objectives of the project are:

- Reducing pollution and improving the living conditions in urban areas,
- Creating job opportunities and improving the socio-economic status of the urban populations,
- Increasing domestic electricity generation and ensuring electricity security.

Information on the nature of the action

Sector: Waste/ Energy

According to a survey conducted in 2008, only 25-48% of MSW is collected and disposed of in open dumps[93]. This is expected to generate 42.6 Gg of CH_4 gas in the project start year (2026). The more MSW collected and disposed of in managed dump sites, the more CH_4 gas could be recovered and used. The project consists of using anaerobic sanitary managed landfills equipped with methane collecting systems and generators to convert methane into electricity.

Applied CDM Approved Methodology: Methodology ACM0001 (flaring or use of landfill gas)

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 7: Natural Gas Combined Cycle Power Plant-PoA

Objective:

The goal is to maximise energy production by increasing the overall efficiency of the national power system, meeting the demand for electricity needed for new consumers. The project has the following key objectives:

- Reducing air pollution and improving the living conditions in urban areas,
- Creating job opportunities and improve the socio-economic status of the urban populations,
- Increasing domestic electricity generation and ensuring electricity security.

Information on the nature of the action

Sector: Energy/IPPU

In the pre-project scenario, power is produced using a single-cycle power plant (gas generators) and waste heat from the gas turbine is released to the atmosphere. In the project scenario, the existing single-cycle power plant is converted to a combined-cycle power plant with co-generation of power and heat. The waste heat of flue gases from all gas turbines is recovered, and steam generated in the Heat Recovery Steam Generator is used to generate additional electricity.

Applied CDM Approved Methodology: AMS.III.AL. (Conversion from single cycle to combined cycle power generation)

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Mitigation Project 8: Bus Rapid Transit in Kabul-PoA

Objective:

With the ultimate goal of reducing GHG emissions from transport as one of the key categories in national GHG emissions, this project was proposed to establish an efficient, safe, rapid, convenient, comfortable and effective modern Bus Rapid Transit System (BRTS) that will decrease traffic congestion in the city and improve urban living conditions. The following are the key objectives of the project:

- Reducing urban pollution problems and improving the living conditions in urban areas,
- Creating new jobs and improving the socio-economic condition of the residents,
- Decreasing fuel consumption and reducing GHG emissions.

Information on the nature of the action

Sector: Energy

Kabul, like other major cities of Afghanistan, has been experiencing a rapid rate of motorisation with increasing numbers of private vehicles. The project envisages four exclusive BRT bus lanes plus feeder lines in Kabul. The project will partially substitute the existing Compressed Natural Gas buses, diesel buses, gasoline buses and gasoline taxis, gasoline passenger cars, and Non-Motorised Transport for transit purposes.

Progress evaluation indicators

Table 23 highlights the indicators to be measured/monitored in each phase of the project cycle.

Information on the progress

The project was presented to the relevant governmental entities for further appraisal and development. Ex-ante calculations and protocols, indicating the operational variables to be monitored were provided.

Kabul © Facebook.com/Hekmat Safi

Table 23: Summary of All Mitigation Actions and Project									
Number of programme/ project	Name of Mitigation Action	Progress Indicators and Phases			Estimated GHG Reductions (Gg CO_2 eq)				
		Conceptualisation	Implementation	Operation	2020	2025	2030	2035	Accumulated reductions over 16 years of project life
1	Soft programmes CCNIS, REEEF, Energy Building Codes, Labeling & Standards (Total Impact %2 reduction)	Preparation of the project proposal, Description of the policy framework for establishing the CCNIS, REEEF, developing energy codes in buildings and developing household appliances labelling and standards, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement, Donors identification & agreements, Laboratory establishment, Financing flow, Resolutions and decrees by the government, Staffing	Design standardised data templates, financing modules, request for permit forms and its issuance, Announcing & publicising the fund and distribution to the relevant stakeholders, Liaison officers identification, Data collection & QC, Proposals received, approved, rejected, Signing contracts, Measure direct & indirect impacts, Monitoring market development	463.7	565.7	672.2	761.5	9,752.43
2	Solar Water Heaters-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework for solar water heaters for households, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Identification of the number of dwellings served, Information on the total area of solar collectors installed on, Type and quantity of energy served, Prepare the verification report, Information on the CERs granted	12.23	73.41	134.6	195.8	1,663.94
3	Rooftop PV Units-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework forrooftop PV installation, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Identification of the number of dwellings served, Information on the total area of solar collectors installed on, Type and quantity of energy served, Prepare the verification report, Information on the CERs granted	57.6	345.6	633.6	921.6	7,833.6

Table 23: Summary of All Mitigation Actions and Project									
Number of programme/ project	Name of Mitigation Action	Progress Indicators and Phases			Estimated GHG Reductions (Gg CO_2 eq)				
		Conceptualisation	Implementation	Operation	2020	2025	2030	2035	Accumulated reductions over 16 years of project life
4	Grid-Connected PV Power Plants-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework for grid-connected PV power plants, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Identification of the number of plants installed, power generated, Information on the total area of solar collectors installed on, Type and quantity of energy served, Prepare the verification report, Information on the CERs granted	21.6	129.6	237.6	259.2	2,721.6
5	Mini Hydro Power Plants-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework for mini hydro-power plants, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, Programme of Activities Design Document submission, Validation of the project, Registration in the CDM	Identification of the number of plant installed, Type and quantity of energy served, Prepare the verification report, Information on the CERs granted	48	288	528	768	6,528.00
6	Improved cookstove-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework for improved cook-stoves, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Information about the number of cooking stoves distributed, Information about the type and quantity of traditional energy saved, Prepare the verification report, Information on the CERs granted	11.27	67.64	124	180.4	1,533.13

Table 23: Summary of All Mitigation Actions and Project									
Number of programme/ project	Name of Mitigation Action	Progress Indicators and Phases			Estimated GHG Reductions (Gg CO_2 eq)				
		Conceptualisation	Implementation	Operation	2020	2025	2030	2035	Accumulated reductions over 16 years of project life
7	Methane Gas Recovery from MSWDs-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework for generating energy from waste, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Information about the consumption and quantity of waste diverted to landfill, Information about the direct and indirect job opportunities created, Amount of Gas flared and/or used to generate electricity, Prepare the verification report, Information on the CERs granted	1078	2157	3235	3235	35,588.04
8	Natural Gas Combined Cycle-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework forfor generating electricity using natural gas combined cycle, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Information about the added capacity to each of the existing gas turbine, Information about the direct and indirect job opportunities created, Amount of additional electricity generated, Prepare the verification report, Information on the CERs granted	72	72	72	72	1,152.00
9	Bus Rapid Transit in Kabul-PoA	Preparation of the Project Idea Note (PIN), Description of the policy framework for using rapid buses for transposition in Kabul city, Institutional setup, Implementation and resource scheduling, Stakeholders identification/participation, Training	Official endorsement by the government, Donors identification & agreements, Financing flow, Resolutions and decrees by the government, Staffing, PoA-DD submission, Validation of the project, Registration in the CDM	Information about the number of passengers using the system, Information about the number of replaced vehicles by their types, Information about the direct and indirect job opportunities created, Information about the fuel saved by the system, Prepare the verification report, Information on the CERs granted	120	156	192	230	2,791.00

4 Domestic Measurement Reporting and Verification

Badakhshan © UNEnvironment/Haris Sherzad

4.1 INTRODUCTION

Afghanistan has initiated a process to improve climate change governance in the country. As part of the activities, two case studies on climate change mitigation were conducted[94]. To improve climate change governance, the establishment of a CCNIS was proposed to ensure producing transparent, consistent, comparable, complete and accurate inventories, and standard quality results. The CCNIS proposal was complemented with new guidelines and procedures for NAMAs and Support Received MRV protocols.

As part of the system, a database needs to be established to serve the MRV requirements of NCs and BURs (Inventory, Mitigation Actions, and Support Received). The CCNIS incorporates all elements necessary to compile the GHG inventory (emissions and removals), including institutional arrangements, calculation tools and methodologies.

Once implemented, the CCNIS will help the GIRoA in the compilation of its national GHG inventory, and preparing its NCs and BURs for which IPCC provides the measurement and reporting tools through its guidelines, methodologies and procedures.

The proposed system is designed in accordance with the existing regulatory and institutional frameworks; therefore, it is expected to become functional in the short term without any significant structural changes. in the long term, GIRoA can pursue the development of a more comprehensive and stable framework for the CCNIS.

4.2 AFGHANISTAN'S PROPOSED MRV SYSTEM

Implementing a fully functional domestic MRV system depends on the implementation of the following activities in a satisfactory manner:

- Developing of overarching policy guidelines
- Formation of the CCNIS Technical Working Group
- Elaborating a framework of the CCNIS
- Evolution of web-based data systems
- Capacity building

For the collation and compilation of the previous GHG inventories (INC and SNC), NEPA applied the 1996 IPCC Guidelines and Methodologies due to lack of data and capacity. To facilitate data sharing and improve the flow of information for future inventory compilations, data request templates satisfying the needs of the IPCC 2006 Inventory Software were developed. Training was also provided to the national experts on data management and QA/QC procedures. Moreover, extensive training on the application of the 2006 Inventory Software and Guidelines were delivered to the national experts involved in the GHG inventory process.

For MRV of Mitigation and Needs and Support Received parts, the proposed MRV is based entirely on the NAMAs adopted by the GIRoA as the basis on which Afghanistan's NDC was determined.

The proposed MRV System is a set of protocols consisting of standardised measurement methodologies where applicable. For other cases where quantitative measurement is not practical, indicators were developed to facilitate quantitative assessment.

The protocols facilitate the measurement and evaluation of the outputs of each individual mitigation activity. For example, GHG reductions from individual projects or actions are aggregated as the outputs of the respective CDM-PoAs. The outputs of a number CDM-PoAs are then aggregated under the relevant NAMA mitigation component. At the component level, the protocols guide reporting and evaluation of the outcomes of each component. Based on the aggregated evaluations of the mitigation components comprising a given NAMA, the overall impact of that NAMA is thus evaluated. Adopting this approach will therefore establish an MRV system that meets both verification and evaluation requirements.

An overarching protocol is also proposed for MRV at the national level based on the results of the above sequence of actions using a bottom-up approach. Since the individual activities under NAMAs are identified, and the agencies involved in the various stages of the individual activities/projects are determined according to the activities, the overall institutional structure required for the implementation of the MRV can be established with these agencies. Figure 61 illustrates the basic institutional structure for MRV in Afghanistan and the role of each stakeholder involved to maintain the system.

Lack of proper communication and data sharing mechanism remains a key barrier for the implementation of a domestic MRV system. To address this challenge, an approach based on signing of MoUs between relevant data suppliers and the data user (NEPA) is proposed as a short-term solution. In the long term, GIRoA will undertake the necessary institutional and regulatory adjustments to ensure an efficient and effective process for data and information flow.

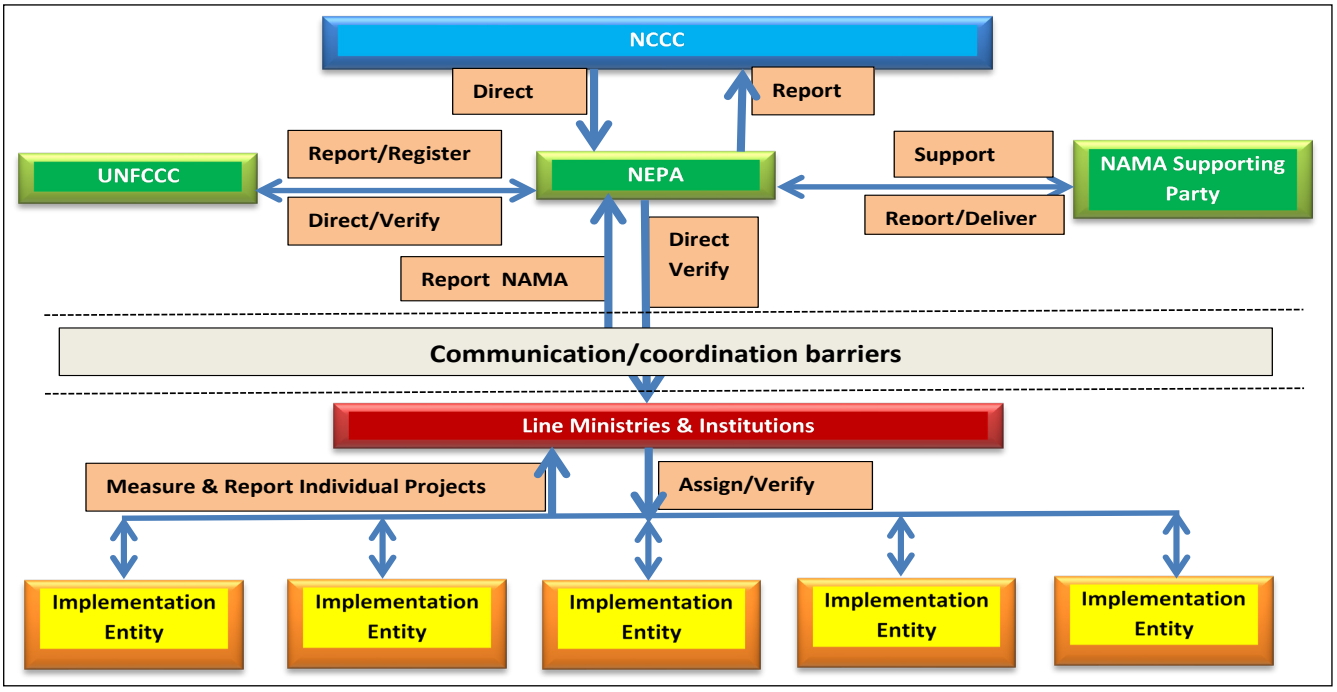


Figure 61: Basic institutional structure for MRV in Afghanistan

4.3 OVERALL COORDINATION OF MRV FROM MITIGATION ACTIONS

As per Article 9 of the Environmental Law, NEPA is the supreme governmental agency responsible for developing strategies and action plans related to the environment[95] this includes issues related to climate change including preparation of NCs and BURs as well as the implementation of the domestic MRV system.

The NCCC composed of deputy ministers from line ministries and agencies is the highest body determining and approving climate change-related policies in the country. As such, the NCCC directs, monitors and approves all climate change-related activities.

Line ministries and national agencies are also responsible for the continuous provision of information and feedback to NEPA according to specific protocols and guidelines mutually

agreed upon and adopted as per the process discussed above. The recommended approach for cooperation between government institutions involved in climate change in the short term is the adoption of a national official setup instrument, WP-MoU. This instrument would cover all climate change-related activities such as GHG inventories and BUR preparations and does not require amendments to the current regulatory or institutional frameworks.

NEPA lacks a sustainable structure for the continuous process of data and information gathering, processing and archiving. Recently, and as a consequence of the GIRoA decision to start preparing and communicating BUR, the necessity for a formal and permanent operational structure became evident; and a case study[96] was conducted in 2018 to assess the technology and capacity building needs for climate change mitigation and MRV in Afghanistan. This study proposes the following actions:

- The establishment of a CCNIS;
- Establishment of domestic MRV system, and;
- A comprehensive training programme that will provide the GIRoA with the necessary institutional, regulatory and human capacity basis for the formal, permanent and institutionalized structure needed for climate change governance.

The training programme, alongside the tools, templates and guidelines explicitly developed for Afghanistan will ensure that the involved personnel are capable of performing professionally at all levels including QA/QC processes, documentation and archiving of data needed for the preparation of NCs and BURs and interaction between different institutions for MRV.

Starting from the individual projects level, which represents key performance indicators for their respective NAMAs, eight MRV protocols were developed for the eight CDM-PoA identified as mitigation options. In addition, protocols were developed for the four soft programmes proposed as mitigation activities and four MRV protocols for the support received for individual activities under each NAMA. At the NAMA component level (programme or policy encompassing several individual activities) and NAMA level, four MRV Protocols were developed. Figure 62 illustrates the hierarchy covered by the protocols.

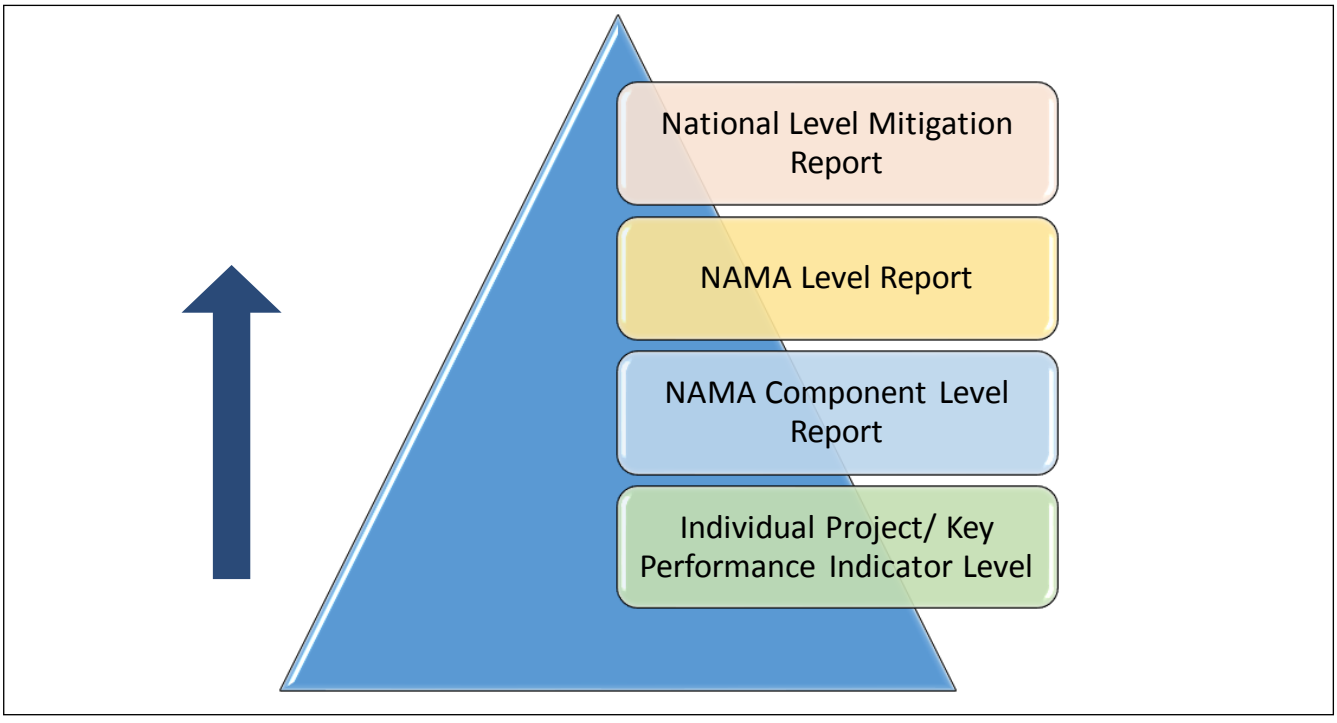


Figure 62: Afghanistan MRV Protocol Hierarchy

Finally, an overall national level MRV Protocol was developed, covering all mitigation-related activities and NDC achievement. See Table 24 for a complete list of all MRV protocols.

Table 24: List of all MRV Protocols Developed by Level and Scope (see the MRV report for more details)[97]

Number	Category	Description of the Protocol
1	National Level MRV Protocol	National Level Mitigation Report Template
2	N1	Support to National Policy and Guideline Development
3	N2	Sustainable Urban Infrastructure Development
4	N3	Sustainable Urban Transportation & Low Emission Mass Transportation Network for Kabul and Kandahar, Along with Improved Traffic Management and Monitoring of Vehicular Pollution
5	N4	Introduce solar PV, Biomass and other Technologies for Enhanced Energy Access in Rural Areas
6	Soft Programmes	Climate Change National Information System (CCNIS) MRV Protocol
7		Renewable Energy and Energy Efficiency Fund (REEEF) MRV Protocol
8		Energy Building Codes MRV Protocol
9		Household Appliances Labelling & Standards MRV Protocol
10	CDM-PoA	MRV Protocol for Solar Water Heaters Project
11		MRV Protocol for Rooftop PV Units Programme of Activities
12		MRV Protocol for Grid-connected PV Power Plant Programme of Activities
13		MRV Protocol for Mini Hydro Power Plants Programme of Activities
14		MRV Protocol for Improved Cooking Stove Programme of Activities
15		MRV Protocol for Methane Gas Recovery from Municipal Solid Waste Disposal Programme of Activities
16		MRV Protocol for Natural Gas Combined Cycle Power Plant Programme of Activities
17		MRV Protocol for Bus Rapid Transit in Kabul CDM Project Programme of Activities
18	Support Received	Stocktaking Protocol for Past Financial, Technology Transfer and Capacity-Building Support
19		MRV Protocol for Climate-Related Support at NAMA Level
20	NAMA Component Level	MRV Protocol for Individual Activities under NAMA N1: Support to National Policy and Guideline Development
21		MRV Protocol for Individual Activities under NAMA N2: Urban Infrastructure Development
22		MRV Protocol for Individual Activities under N3 Sustainable Urban Transportation & Low Emission Mass Transportation Network
23		MRV Protocol for Individual Activities under N4 Introduce solar PV, Biomass and Other Technologies for Enhanced Energy Access in Rural Areas

4.4 DESCRIPTION OF THE PROTOCOLS DEVELOPED FOR MRV

4.4.1 NAMA-level MRV Protocol

At this level, the protocol provides guidance on how to Measure, Report and Verify a NAMA by aggregating the results of MRV from activities at individual project level into the component (multi-activity/action programme) and finally into the overall NAMA (see a sample of the protocol in Annex 2.1).

4.4.2 MRV Protocols for Soft Mitigation Programmes

Aside from hard projects identified to be developed under CDM-PoA, several soft programmes were also identified as part of the overall mitigation activities. The protocols developed for the mentioned soft programmes provide guidance for MRV during different stages, namely appraisal, implementation and operation (see a sample of the protocol in Annex 2.2).

4.4.3 MRV Protocols for CDM-PoA Mitigation Activities

As a result of a case study exploring the opportunities for climate change mitigation in Afghanistan, the GIRoA identified eight mitigation projects to be developed under the CDM – PoA. To Measure, Report and Verify, the progress of these projects, protocols were developed covering all phases of the activity, namely appraisal, implementation and operation.

The protocols are based on the approved CDM guidelines, procedures & modalities and international practice (see a sample of the protocol in Annex 2.3).

4.4.4 Proposed MRV of Needs and Support Received

GIRoA realises that centralised governance of Official Development Assistance (ODA) has distinct advantages compared to the present practice. Therefore, the establishment of a Climate Change Financing Framework for Afghanistan (National Implementing Entity) is proposed, and a specific training programme on climate finance is recommended.

Under the prevailing practice, the Ministry of Finance (MoF) receives bilateral ODA under two forms, namely On-Budget and Off-Budget. The former comprises a direct budget support flow to the National Budget and is fully administrated by MoF, while the latter is sector-and activity-specific, where the donors control the release of funds according to progress indicators established jointly with beneficiaries. A challenge under this arrangement is weak coordination between the direct beneficiaries and the central government. Overall planning of donor activities in the country is overseen by the Strategic Working Group formed by MoF and international donors active in the country.

Given the current circumstances and institutional setup, a feasible and practical Support MRV System would be based on a bottom-up approach whereby executing national agencies report support flows based on the source of support/donor, disaggregated according to programme and activity. Relevant information is to be measured/monitored accordingly.

Overall, a more centralised system of ODA disbursement and management is required, especially when Multilateral ODA is concerned. Figure 63 illustrates the proposed new structure for such centralised governance.

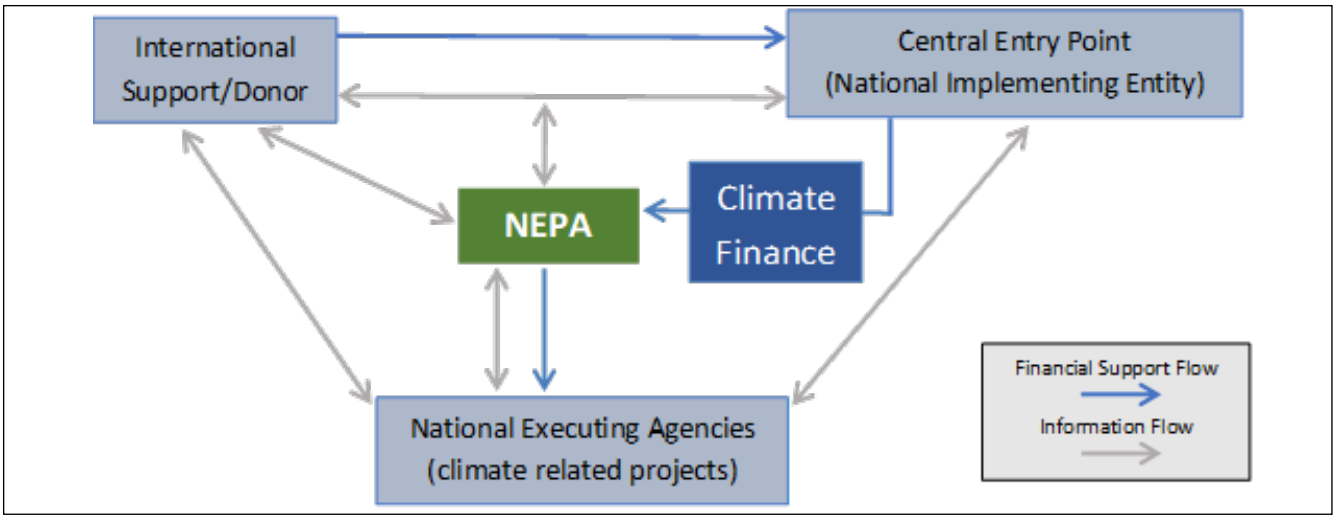


Figure 63: Proposed Centralised Governance Support Flow Diagram

4.4.5 MRV Protocol for Individual Activities under Communicated NAMAs

GIRoA is in the process of setting up the structure (see Figure 61) to prepare its national reports under the UNFCCC. Therefore, MoUs will be signed with all relevant stakeholders to ensure the smooth and continuous flow of information.

While members of the NSTs were trained on applying the MRV System, additional training according to the Capacity Building and Technology Transfer Programme is a high priority (see a sample of the protocol in Annex 2.4).

MRV Training, Kabul © UNEnivronment

5 FINANCE, TECHNOLOGY AND CAPACITY BUILDING NEEDS AND SUPPORT RECEIVED

Pamir © Ayub Alavi/WCS

5.1 INTRODUCTION

Efforts by Afghanistan to reduce its GHG emissions and enhance its resilience to the increasing impacts of climate change have been supported by both national and international resources. As per Article 4.3 of the UNFCCC, Afghanistan has received capacity-building, technical and financial support from international sources to enable the country to fulfil its reporting obligations under the convention and to implement better actions to address climate change.

This chapter only provides information on the support received by NEPA to address climate change specifically. It does not include financial support received directly by private and nongovernment entities. The manner in which international funds have been channelled through NGOs and the private sector has not enabled tracking and precise identification of such support received.

According to decision 2/CP.17, non-Annex I Parties are to provide updated information on constraints and gaps, and related financial, technical and capacity-building needs, as well as updated information on financial resources, technology transfer, capacity-building and technical support received from the GEF, Parties included in Annex II to the convention and other developed country Parties, the Green Climate Fund (GCF) and multilateral institutions for activities related to climate change, including for the preparation of this BUR.

5.2 SUPPORT RECEIVED

GIRoA has received funding from GEF to prepare and submit its first BUR to the UNFCCC. The funds for the BUR have enabled the development of the national GHG inventory and the mitigation analysis for the report. Moreover, under this project, national experts were trained on the 2006 IPCC Software and Guidelines for GHG Inventory. In addition, the national experts from line ministries and agencies received training on baseline and mitigation scenarios as well as the domestic MRV System. This enabled Afghanistan to prepared its NIR covering the 1990–2017 time series for the first time.

Concerning technical assistance received from other parties, NEPA received 184,300 USD from DFID to establish a Climate Finance Unit within its structure. The objective of establishing this unit was to help NEPA in resources mobilisation from multilateral financial mechanisms such as GEF, GCF, LDFC, etc. As an achievement of this unit, for the first time, in 2018 NEPA secured its first funding from GCF of USD 300,000 to help the GIRoA to establish a Country Programme with the ultimate goal of securing further funds from GCF to achieve its NDC conditional goals. The project was approved by the GCF Board in December 2018 and will be implemented over 12 months, starting from May 2019.

In terms of technology transfer, NEPA received an amount of USD 132,000 from GEF in 2019 to assess the technological needs of the country to reduce GHG emissions and adapt to the adverse impacts of climate change. This project is expected to be completed in November 2020. In addition to this, in 2014 NEPA received USD 35,000 from the Climate Technology Centre and Network (CTCN) to identify and advocate for sustainable climate technology for low carbon emission.

Overall, NEPA has received a total of USD 26,412,160 from GEF for the execution of climate change-related activities. Table 25 illustrates the list of projects funded by GEF to NEPA for climate change activities in Afghanistan.

Table 25: Financial Support Received from Global Environment Facility by the National Environmental Protection Agency for Execution of the Climate Change Activities[98]							
Project Name	**Focal Area**	**Period**	**Received Amount (project level) USD**	**National Execution Agency**	**GEF Cycle**	**Grant Source**	**Project Status and Output**
National Capacity Needs Self-Assessment for Global Environment Management (NCSA)	Multi-Focal Areas	2004-2006	200,000	MIRWE	GEF-3	Trust Fund	Completed
Enabling Activities for the Preparation of National Adaptation Programmes of Action (NAPAs)	Climate Change	2004-2005	200,000	NEPA	GEF-3	LDCF	Completed
Piloting Integrated Processes and Approaches to Facilitate National Reporting to Rio Conventions	Climate Change	2009-2012	740,000	NEPA	GEF-4	Trust Fund	Completed
Initial National Communication under the UN Framework Convention on Climate Change	Climate Change	2008-2012	405,000	NEPA	GEF-4	Trust Fund	Completed
Intended National Determined Contribution	Climate Change	2015-2017	120,000	NEPA	FEF-6	Trust Fund	Completed
Strengthening the Resilience of Rural Livelihood Options for Afghan Communities in Panjshir, Balkh, Uruzgan and Herat Provinces to Manage Climate Change Introduced Disaster Risks	Climate Change	2014-2019	9,000,000	MAIL & NEPA	GEF-5	LDCF	Ongoing
GEF Small Grants Programme	Multi-Focal Areas	2013-2019	2,660,000	NEPA	GEF-5	SGP	Ongoing
Adapting Afghan Communities to Climate Change Disaster Risks	Climate Change	2017-2022	5,600,000	NEPA	GEF-6	LDCF	Ongoing
Building Adaptive Capacity and Resilience to Climate Change in Afghanistan	Climate Change	2011-2020	4,900,000	NEPA	GEF-5	LDCF	Ongoing
Biennial Updtate Report to the UNFCCC	Climate Change	2017-2019	352,000	NEPA	GEF-6	EA	Ongoing
Preparation of the Second National Communication under the UNFCCC	Climate Change	2014-2019	500,000	NEPA	GEF-5	EA	Ongoing
Reducing GHG Emissions Through Community Forests and Sustainable Biomass Energy	Climate Change	2016-2019	1,735,160	NEPA	GEF-5	Trust Fund	Ongoing
Total Fund received from GEF by NEPA 2004-2019 in USD						**26,412,160**	

Note: *The information provided in this table shows the status of the projects only until June 2019.*

5.3 CONSTRAINTS, GAPS AND NEEDS

As an LDC, Afghanistan faces many challenges in addressing climate change issues and meeting UNFCCC obligations due to lack of resources and technical capacity. However, being amongst the world's most vulnerable countries to climate change, Afghanistan remains determined to address climate change by utilising its limited resources and expects the necessary technical and financial support from developed countries (Annex I Parties) for strengthening national capacities to respond to climate change. In the following sections, the needs of the country to address climate change have been discussed in further detail.

5.3.1 Finance and Technology Needs

Afghanistan's plans and commitments to reduce GHG emissions are encapsulated in the NDC, which estimates that international support of approximately USD 662 million per year is required to cover the necessary technology and capacity building activities for climate change mitigation.

Table 26: Climate Change Mitigation Gaps and Barriers and Support Needs[99]

Sector	Technology and Capacity Building Needs	Finance Needs (USD)
Energy Efficiency in Buildings and in Transport Sector	• Carbon finance and project development skills. • Information on available technologies, measures, and financing skills. • Traditional customs and administered pricing. • Building codes and standards on appliances and equipment. • Clean cooking, heating and power projects.	100 Million/Year
Energy	• Human and institutional capacity for the adoption of cleaner technology. • Capital markets that encourage investment in decentralized systems. • Information and intellectual property rights for mitigation technologies. • Renewable energy, entry costs support, access to capital, and subsidies. • Environmental compliance standards (emission and indoor).	188 Million/Year
Waste Management	• Landfill management, decentralised wastewater treatment. • Climate project development skills.	74 Million/Year
Forests and Rangelands	• Carbon sequestration on forest/rangelands, and forest carbon skills. • Funding institutional capacity to monitor and verify projects. • Better spatial planning for community and production agriculture. • Reduce rural peoples' dependence on fuel for cooking and heating.	100 Million/Year
Industry and Mining	• Cleaner coal mining, leave-it-in-the-ground approaches, combustion, and transportation of minerals. • Hydrocarbon fields management. • Technical industrial capacity to link basic industry and mining private and public sector with climate sector experts.	100 Million/Year
Agriculture and Livestock	• National herd, reduction in fuel used, or cleaner fuel technologies. • South-south collaboration on low-carbon agriculture, study tours. • Funding for R&D activities. • Improved national dataset on agriculture, food security data.	Million/Year 100
Total finacial recources needed:		**662 Million/Year**

Considerable efforts were made in the past years in regard to climate change, the majority of which concentrated on the policy and strategy levels. Through its INC, SNC, NDC and ACCSAP, Afghanistan has broadly identified its needs for technology transfer. However, the GIRoA lacks the capacity to identify and implement its exact technology needs to achieve its NDC targets set for 2030.

As demonstrated in the GHG inventory chapter, energy is one of the most important sectors of GHG emissions in Afghanistan, which contributes to 48.9 % of the national total (excluding LULCF). Therefore, the focus for technology transfer for climate change mitigation should be mainly on the energy sector. Table 27 outlines the training needs to build the capacity at the national level for identifying the most appropriate technologies for climate change mitigation.

Table 27: Technology Transfer and its Related Capacity Building Needs[100]

Training Activities on Technology Needs Assessment	Topics to be covered	Target Participants
Wind	**Wind Turbine Basics** **Wind Project Variables:** • Wind Speed • PPA Rate • Turbine Selection • Financing • Available land/scale • Community Support • Environment • Political Landscape • Interconnect/Transmission • Wind Products Market	The core team from NEPA in addition to supporting other members of the NSTs should actively participate in the sessions presenting project proposals in their respective sectors identifying technical opportunities, technology needs and barriers facing each institution in implementing the projects. The participants will identify and develop at least one project proposal in each key sector for farther development by the end of the training sessions using available actual data. The expected duration is two weeks. Expected duration: One week for each topic to be held in the premises of the sector leading institution.
Photovoltaic	**Utility-Scale Solar Power Plants** • Solar PV technology • The solar resource • Project development • Site selection • Energy yield prediction • Plant design • Permits and licensing • Construction • Commissioning • Operation and maintenance • Economics and financial • Modelling • Supply chain • Operator Training Manual	
Small Hydro Power	**Overview of SHP Development** **Planning, Implementation & Operation of SHP projects** • Design of Sub Stations • Design of Small Hydro Power Stations • Small Hydro Power Development on Canal Falls & Irrigation Dams • Run-off river Small Hydro Development • SHP & Rural electrification • Use of modern techniques (GPS, GIS) for conducting investigations and assessment • SHP Market and new equipment • Operator Training Manual	

5.3.2 Domestic MRV System

A domestic MRV system is nationally as well as globally a very new concept. The GIRoA seeks funding to put in place a CCNIS that will serve domestic MRV system requirements. Meanwhile, due to deficient capacity, capacity building activities related to running and maintaining an MRV system are identified as a high priority.

5.3.3 Preparation of National GHG Inventory

For the first time, Afghanistan prepared a time series inventory for the period of 1990 – 2017. Due to lack of technical capacity and a system for preparation of GHG inventories inside the country, Afghanistan outsourced the preparation of its time-series GHG inventory. The country has embarked on the process to establish the appropriate framework to produce future GHG inventories in-house through more active participation of the key stakeholders. In-depth discussions took place on what would be the best framework for establishing a structure that will work on a continuous basis for producing the inventories regularly for reporting in NCs and BURs.

The LULUCF sector was excluded from the time series GHG inventory due to lack of data from this sector. The GIRoA requires support from the developed countries to collect the data required by the 2006 IPCC guidelines for GHG inventory from the LULUCF sector.

Another major constraint for the preparation of the GHG inventory is the non-availability and inaccuracy of data. For example, data of the energy balance from the IEA is different from the data provided by the NSIA. Moreover, in Afghanistan, different institutions use different formats and report differently on their activities. Therefore, NEPA is planning to establish a CCNIS. As part of this system, a harmonised data collection, sharing and management framework that is aligned with the IPCC Guidelines has been designed. However, establishing such a system requires technical and financial assistance from international donors and developed countries.

To address the constraints and gaps related to the GHG inventory, NEPA has prepared an improvement plan, the implementation of which requires technical and financial support from the international donors and developed countries.

Tables 28 and 29 below outline the improvement plans of the GIRoA for addressing issues related to the GHG inventory. GIRoA seeks support from multilateral and bilateral funding mechanisms for the implementation of its GHG inventory improvement plan in alignment with principles of Transparency, Accuracy, Consistency, Comparability and Completeness of the UNFCCC.

GHG training, Kabul © UNEnvironment

Table 28: GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
1 Energy	Regardless of the tier used, consumption of fuels by fuel/product type is the very first basic step in the estimation of CO_2 emissions from fuel combustion. If this basic step is not done properly, the subsequent steps cannot result in an accurate estimate. It is therefore unequivocal that the quality of GHG estimates depends critically on the quality of national energy statistics. (UNSD 2018). (A) Preparation of an energy statistics/balance (full-time series) including country-specific Gross Calorific Values (GCV) and/or Net Caloric Values (NCV) according to: • Guidelines for the 2017 United Nations Statistics Division (UNSD) for the Annual Questionnaire on Energy Statistics[101] • International Recommendations for Energy Statistics (IRES)[102] (B) Submission of energy statistics/balance to UNSD (Department of Economic and Social Affairs, Energy Statistics Section).	Internationally agreed: • definitions & classification of energy products • definitions of energy flows Complete data set (full-time series) in the internationally agreed format applicable for use for GHG inventories	AD	Transparency Accuracy Completeness Comparability Consistency	High
1 Energy	Analysis of electricity production and import electricity as well as consumption by economic activities: • Production by fuel type, • Own consumption by the public power plant and auto producer, • Production – Supply.	Complete data set (full-time series) in the internationally agreed format applicable for use as an indicator.	AD	Transparency Accuracy Completeness Comparability Consistency	Medium
1 Energy	Cross-check of national and international data sources (full-time series) and incorporation of feedback (on both sides) (e.g.) • Afghanistan's Statistical yearbook, online data, • United Nations Statistics Division (UNSD)[103] • British Geological Survey (BGS) • US Geological Survey (USG) • Application of the concept of Recalculation.	Consistent and updated time series, including historical data.	AD	Transparency Accuracy Completeness Comparability Consistency	High
1 Energy	Revisions are an important part of the compilation of energy statistics. In general, two types of revisions are distinguished: (a) routine, normal or concurrent revisions and (b) major or special revisions. With respect to routine revisions, it is recommended that countries develop a revision policy that is synchronized with the release calendar. (UNSD 2018) Performing recalculations (revisions) in accordance with the 'UNFCCC reporting Guidelines' for NC and BUR as well as 2006 IPCC Guidelines.	Recalculated emission estimates (ensuring time-series consistency) including explanatory information and justifications for recalculations provided by the data provider.	AD EF	Transparency Accuracy Consistency	High
1 Energy	Preparation of country-specific and/or plant-specific emission factors for used fuel (national / imported) in fuel combustion • Carbon Content (%) ➡ CS EF CO2 [t/TJ] = (C [%] • 44 • Ox)/(NCV [TJ/t] • 12• 100) • Sulphur content (%) CS EFSO2 [g/GJ] = (S [%] • 20000) / (NCV [GJ/t])	Country-specific and/or plant-specific emission factors for key categories Input data for TIER 2 methodology.	EF	Transparency Accuracy Comparability	Medium
1 Energy	• Information about the combustion technologies used: information about the type of combustion plant (steam generator, gas turbine, dry bottom boiler etc.) • Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	Country-specific and/or plant-specific emissions factors for key categories.	EF	Transparency Accuracy Comparability	Medium

Table 28: GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
1 Energy	Data obtained from measurements made on the emission of air polluters (NON-GHG inventory) • Determination of the temperature in waste gases [°C]; • Determination of the static pressure and the dynamic pressure [kPa]; • Determination of the flow rate [m/s]; • Determination of volume flow rate [m^3/h and Nm3/h]; • Determination of the concentration of CO, SO_2, NOx in the exhaust gases [mg/Nm^3]; and • Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm^3).	Country-specific and/or plant-specific emission factors for key categories.	EF	Transparency Accuracy Comparability	Low
1 Energy	Analysis of all production processes, e.g. coke oven coke production, refinery • raw material as input for coke oven process; • fuel type and fuel consumption for coke oven heating; • use of coke oven coke gas; • use of by-products like coal tar and light oils	Country-specific and/or plant-specific emissions factors for key categories. Input data for TIER 2 methodology.	AD EF	Transparency Accuracy Completeness	High
1 Energy	Analysis of charcoal production (1) Raw materials for carbonisation. • Fuelwood & wood fuel: type of wood and wood waste • Agricultural residues • Bark waste (2) Charcoal making technologies (3) Efficiencies of various types of kiln	Complete data set of charcoal including information on parent wood density, the yield of charcoal from fuelwood, net caloric value.	AD EF	Transparency Accuracy Completeness	Medium
1 Energy	• Analysis of moisture content, energy values etc. of the selected animal and vegetal wastes (e.g. dried cakes of animal dung) used in household for cooking and heating, • Survey on amounts of used fuel based animal and vegetal wastes including generation of a historical time series, • Survey on projects producing biofuels.	Complete data set of solid and gaseous biofuels based on animal and vegetal wastes.	AD EF	Transparency Accuracy Completeness	Medium
1 Energy 2 IPPU Chemical industry	Analysis of the Fertiliser plant: • Processing and downstream units, • Input data: fuel combustion and the annual amount of feedstock / Total fuel requirement (GJ(NCV)/tonne NH_3), • The average number of start-ups & shut-downs including maintenance period of entire/ part of the fertiliser plant, • Amount of CO_2 used in the downstream process, • Quantity of intermediate products for downstream, • Quantity of final products (for sale).	Complete data regarding ammonia production, including historical data set	AD EF	Transparency Accuracy Completeness	High

Table 28:GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
1 Energy Aviation	Survey on domestic and international aviation • Aircraft types and fuel types, • LTO by aircraft type, • Origin and Destination (OD) by aircraft type, • Air passengers carried, • Air freight, • Registered carrier departures.	Complete data set, including information on historical data.	AD	Transparency Accuracy Completeness Comparability	High
1 Energy Aviation	Survey on full flight movements with aircraft and engine data.	Complete data set, including information on historical data.	AD	Transparency Accuracy	Medium / Low
1 Energy Road transport	Survey on national/regional vehicle fleet data - Road vehicle categories, and relevant Legislation/ Technology classes: • Passenger Cars, • Light-Duty/Commercial Vehicles (LDV), • Heavy-Duty Vehicles (HDV) including buses and, • Mopeds and Motorcycles.	Complete data set including information on the penetration of new technology.	AD non-CO_2, EF	Transparency Accuracy Completeness Comparability Consistency	High
1 Energy Road transport	Survey on national/regional vehicle kilometre data: • Annual mileage, • Passenger Kilometres, • Freight kilometres.	Complete data set, including information on historical data.	AD non-CO_2, EF	Transparency Accuracy Completeness	High
1 Energy Road transport	Estimation of CO_2 and non-CO_2 emissions as well as non-GHG emission from road transport with a tool like HBEFA, ARTEMIS, COPERT, MOVES and PARAMIX models • Estimation of emission of fuel according to energy statistics • Estimation of emission of smuggled fuels • Estimation of emissions from evaporation	Emission from road transport estimated based on the transport model. Country-specific emissions factors for key categories.	Model non-CO_2, EF & Non-GHG	Transparency Accuracy Completeness Comparability Consistency	High
1 Energy Off-road	Survey on national/regional vehicle data – agriculture, construction, household, and relevant technology classes • Operation hourst • Utilisation rate	Complete data set including information on the penetration of new technology.	AD non-CO_2, EF	Transparency Accuracy Completeness	High
1 Energy Off-road	Estimation of CO_2 and non-CO_2 emissions as well as non-GHG emission from off-road vehicles with a tool like HBEFA, COPERT, MOVES and NONROAD Model models • Estimation of emission of fuel according to energy statistics • Estimation of emission of smuggled fuels • Estimation of emissions from evaporation	Emission from off-road estimated based on the transport model. Country-specific emission factors for key categories.	Model non-CO_2, EF & Non-GHG	Transparency Accuracy Completeness Comparability Consistency	High

Table 28: GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
1 Energy Military Multilateral operation	Survey on activities from Military and Multilateral operation • Fuel combustion for producing heat and electricity from Military and Multilateral operation, • Fuel combustion in road transport and off-road.	Emission estimated from Military and Multilateral operation.	AD	Transparency Accuracy Completeness	Low
2 IPPU Fugitive Emissions	Survey on underground and surface mining • Quantities of each underground and surface mining.	Improvement of mining statistics, including historical data (time series development).	AD	Transparency Accuracy Completeness	Medium
2 IPPU Mineral industry	Survey and/or research on the annual amount of limestone and/or dolomite used in cement industry, lime industry, brick production including information of lime used in 'down-stream' processes (e.g. sugar production).	Country-specific and/or plant-specific emissions factors for key categories. Input data for TIER 2 methodology.	AD	Transparency Accuracy Completeness	High
2 IPPU Non-Energy Products from Fuels and Solvent Use	Survey on imports of Non-Energy products from fuels and solvent use in order to estimate GHG and NMVOC emissions • Product type and quantities, • Solvent content, • Application conditions.	Improvement of statistics, including historical data (time series development).	AD	Transparency Accuracy Completeness Comparability Consistency	Medium
2 IPPU Product Uses as Substitutes for Ozone Depleting Substances (ODS)	Survey and/or research on import and distribution of air-conditioning (mobile / stationary) and refrigeration Sector Preparation of an (annual) questionnaire to/for Importer, Sales and Distributors: • Number of unit imports/sales in historical years / in recent years, • General technical specifications of products being sold, • Used cooling agent, • Refrigerant distribution, • Important brands / Price estimates, • Countries importing from / Countries exporting to, • Estimated market growth, • Time used / Re-use/ Maintenance / topics of importance.	Improvement of statistics regarding any cooling agent and applications, including historical data (time series development). Input data (for TIER 2 methodology) Country-specific emissions factors for key categories.	AD	Transparency Accuracy Completeness Comparability Consistency	High
2 IPPU Other Product Manufacture and Use	Survey regarding the use of: • Electrical Equipment, • SF6 and PFCs from Other Product Uses, • N2O from Product Uses.	Improvement of statistics regarding any cooling agent and applications, including historical data (time series development)	AD	Transparency Accuracy Completeness Comparability Consistency	Medium
3 Agriculture Livestock	Survey and/or research on characteristics of Livestock Husbandry and Management Practice with consideration of regional and district as well as urban and rural diversity: • Characteristics of Livestock Husbandry: breed, age distribution, weight, milk/wool yield, working hours, • Characteristics of Management Practice: e.g. manure system, nitrogen excretion.	Improvement of agricultural statistics, including historical data (time series development). Country-specific and/or plant-specific emissions factors for key categories. Input data for TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High

Table 28: GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
3 Agriculture Rice Cultivation	Survey and/or research on characteristics of Rice Cultivation with consideration of regional and district diversity: • Regional differences in rice cropping practices, • Multiple crops: crop harvested on a given area of land during the year, growing conditions, • Water regime: ecosystem type, flooding pattern, • Organic amendments to soils, • Other conditions, e.g. soil type, rice cultivar.	Improvement of agricultural statistics/information, including historical data (time series development). Country-specific and/or plant-specific emissions factors for key categories. Input data for TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
3 Agriculture N_2O Emissions from Managed Soils	Survey and/or research on characteristics of cultivation and soil management with consideration of regional and district as well as urban and rural diversity: • Type and amount of synthetic N fertilisers, • Type and amount of organic N applied as fertiliser (e.g., animal manure, compost, sewage sludge, rendering waste), • Type, area and yield of crops: N in crop residues (above-ground and below-ground), including from N-fixing crops and from forages, • Drainage/management of organic soils.	Improvement of agricultural statistics, including historical data (time series development). Country-specific emissions factors Input data for TIER 1 and TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF General	Development of a national land classification system applicable to all six land-use categories (Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land) and further subdivide by climate, soil type and/or ecological regions (i.e., strata) • Land use definitions, • Land cover classification and Land cover data/map covering information 20 years before 1990 or 2005, • Climate classification based on elevation, mean annual temperature (MAT), mean annual precipitation (MAP), mean annual precipitation to potential evapotranspiration ratio (MAP: PET), and frost occurrence. • Ecological zones, • Soil classification for mineral soil types based on USDA taxonomy, • Area burned, • Information of type, age and condition of biomass.	Emission and removals from LULUCF. Complete data set, including information on historical data. Improvement of (agricultural) statistics, including historical data (time series development). Country-specific parameter and emissions factors. Input data for TIER 1 / TIER 2 methodology.	AD EF method	Transparency Accuracy Completeness Comparability Consistency	High

4 LULUCF
Cropland
	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata)
	• Estimates of land areas remaining cropland or converted to Cropland,
	• Information on Cropland
	  • arable and tillable land, rice fields, and agroforestry systems,
	  • annual and perennial crops as well as temporary fallow land,
	  • crop-pasture rotation (mixed system),
	• Land areas of growing stock and harvested land with perennial woody crops including information of broad subcategories (i.e. fruit orchards, plantation crops, agroforestry system) and related Specific subcategories
		Improvement of agricultural statistics, including historical data (time series development).
		Country-specific parameter and emissions factors.
		Input data for TIER 1 / TIER 2 methodology.
			AD
			EF
				Transparency
				Accuracy
				Completeness
				Comparability
				Consistency
					High

Table 28: GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
4 LULUCF Forest	• Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • Estimates of land areas remaining forest and converted to forest, • Forest inventory and/or forest management system/area of plantation/ forests, • Area annually affected by disturbances including frequency of disturbances (pest and disease outbreaks, flooding, fires, etc.), • Area annually affected by harvest (harvest categories, commercial harvest, fuelwood consumption, traditional fuelwood uses and other wood uses.), • Assessment of changes in carbon stock in DOM, • Conversion of: • unmanaged to managed forest; • native forest into a new forest type; • Intensification of forest management activities (i.e. site preparation, tree planting and rotation length changes; changes in harvesting practices, • Harvested Wood Products: Waste deposit, sawn wood, wood panels, paper, energy purpose,	Improvement of agricultural statistics, including historical data (time series development). Country-specific parameter and emissions factors. Input data for TIER 1 / TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Grassland	• Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • Estimates of land areas remaining grassland or converted to grassland, • Share of land-use categories: Steppe/tundra/prairie grassland, Semi-arid grassland, Sub-tropical/ tropical grassland, Woodland/Savannah, Shrubland, • Information on use/management systems, • Area under managed organic soils.	Improvement of agricultural statistics, including historical data (time series development). Country-specific parameter and emissions factors. Input data for TIER 1 / TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Wetland	Survey and/or research on characteristics of Rice Cultivation with consideration of regional and district diversity: • Regional differences in rice cropping practices, • Multiple crops: crop harvested on a given area of land during the year, growing conditions, • Water regime: ecosystem type, flooding pattern, • Organic amendments to soils, • Other conditions, e.g. soil type, rice cultivar.	Improvement of agricultural statistics, including historical data (time series development). Country-specific parameter and emissions factors. Input data for TIER 1 / TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High

Table 28: GIRoA Inventory Improvement Plan for the GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
4 LULUCF Settlements	Survey with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • Estimates of land areas remaining settlement or converted to settlement • Information on use/management systems	Improvement of agricultural statistics, including historical data (time series development). Country-specific parameter and emissions factors. Input data for TIER 1.	AD	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Other Lands	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • Estimates of land areas remaining Other land or converted to Other Land •]nformation on the use/management system	Improvement of agricultural statistics, including historical data (time series development). Country-specific parameter and emissions factors. Input data for TIER 1 / TIER 2 methodology.	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
5 Waste Waste Management	Survey and/or research of waste management practices of municipal, industrial, hazardous and clinical with consideration of regional and district as well as urban and rural diversity: • Waste generation rate, • Composition of waste, • Waste flow: collection and recycling as well as the informal sector, exports, • Waste management and treatment: landfill (grade of management), open burning, incineration by households and/or industries.	Improvement of Waste statistics, including historical data (time series development). Country-specific and/or plant-specific emissions factors for key categories. Input data for TIER 2 methodology.	AD	Transparency Accuracy Completeness Comparability Consistency	High
5 Waste Wastewater	Survey and/or research of wastewater treatment and management practices of municipal and industrial wastewater with consideration of regional and district as well as urban and rural diversity: • Wastewater generation, • wastewater characterisation, • Wastewater flow, management and treatment.	Improvement of municipal and industrial wastewater statistics, including historical data (time series development). Country-specific and/or plant-specific emissions factors for key categories. Input data for TIER 2 methodology.	AD	Transparency Accuracy Completeness Comparability Consistency	

Table 29: GIRoA Plan for Addressing Capacity Building Needs for GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**

1 Energy	The availability of good, reliable and timely basic energy statistics and energy balances is fundamental for the estimation of GHG emissions and to address the global concerns for climate change. (UNSD 2018)
	Intensive/tailor-made training for preparation of energy statistics / balances (e.g.)
	• In-house by UNSD,
	• Participation in international:
	  • Energy Statistics Courses by International Energy Agency (IEA)[104]
	  • Trainings on Energy Statistics by Joint Organisations Data Initiative (JODI)
	  • Training by the South Asian Association for Regional Cooperation (SAARC)
	• Participation in webinars and online training programmes.
		Increased capacity of involved ministries and institutions, including field offices:
		• Ministry of Mines and Petroleum (MoMP)
		• Ministry of Energy and Water (MEW)
		• National Statistics and Information Authority (NSIA)
		• Ministry of Rural Rehabilitation and Development (MRRD)
		• Da Afghanistan Breshna Sherkat (DABS)
			AD	Transparency
				Accuracy
				Completeness
				Comparability
				Consistency
					High

1 Energy Road transport & Off-road	Intensive/tailor-made training for estimation of non-CO_2 emissions and non-GHG emissions from road transport and off-road with a tool like HBEFA, ARTEMIS, COPERT, MOVES and PARAMIX models • In-house / tailor-made training on a model for estimating emission from road transport and off-road • Participation in international training	Increased capacity of involved ministries and institutions including field offices (e.g.) • National Ozone Unit (NOU) • Customs and Revenues • Ministry of Commerce and Industries	Model	Transparency Accuracy Completeness Comparability Consistency	High
Training on F-gases	• Intensive/tailor-made training for estimation of GHG emissions from the import, use, maintenance, recycling and destruction of F-gas containing products/installations.	Increased capacity of involved ministries and institutions including field offices (e.g.) • National Ozone Unit (NOU) • Customs and Revenues • Ministry of Commerce and Industries		Transparency Accuracy Completeness Comparability Consistency	High
Training on Agriculture	• Intensive/tailor-made training for estimation of GHG emissions from Livestock Husbandry and Management Practice, soil cultivation	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High
Training on LULUCF	• Intensive/tailor-made training for estimation of GHG emissions from LULUCF • Land definition and classification • Land cover mapping • Estimation of GHG of each land use category	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High
Training on Waste	Intensive/tailor-made training for estimation of GHG emissions from • Solid waste disposal • Wastewater treatment	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High

Table 29: GIRoA Plan for Addressing Capacity Building Needs for GHG Inventory Preparation					
IPCC code	**Planned improvement**	**Improvement**	**Type of improvement**		**Priority**
General	Tailor-made training on Quality Assurance & Quality Control and verification according to the 2006 IPCC Guidelines, Chapter 6 • Quality objectives: TACCC - Transparency, Accuracy, Completeness, Comparability, Consistency • QA/QC plan • Roles and Responsibilities with • QA/QC activities during the inventory preparation process • Verification • Archiving	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High
General	Tailor-made training on Uncertainty Analysis according to the 2006 IPCC Guidelines, Chapter 3 • Causes of uncertainty • Quantifying Uncertainties • Sources of data and information • Techniques for quantifying uncertainties • Methods to combine uncertainties • Reporting and Documentation of Uncertainties	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High
General	Tailor-made training on reporting and data management	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High
General	Computer skills training - Intensive/tailor-made training/hands-on-exercises • Advanced Excel Training - Formulas & Functions, large dataset • Advanced word training – working with large, complex documents	Inventory team		Transparency Accuracy Completeness Comparability Consistency	High

6 TECHNICAL ANNEXES

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1. GHG Inventory Tables for 2012-2017 Time Series

1.1 Trend of GHG emissions in CO_2 equivalent by sources and removals by sinks for 2012–2017.

Greenhouse gas source and sink categories	2012	2013	2014	2015	2016	2017
Greenhouse gases (GHG)	Gg CO_2 equivalent					
1. Energy	**17,324.81**	**18,155.72**	**18,784.66**	**19,614.68**	**20,664.69**	**21,649.43**
A. Fuel Combustion (sectoral approach)	17,270.70	18,101.34	18,732.09	19,561.77	20,609.17	21,593.37
1. Energy Industries	301.92	334.93	341.15	292.41	336.20	408.05
2. Manufacturing Industries and Construction	4,040.54	4,405.10	3,979.55	4,040.48	4,816.94	5,962.76
3. Transport	12,156.56	12,649.52	12,880.92	13,015.30	13,136.61	13,136.61
4. Other Sectors	771.67	711.79	1,530.47	2,213.58	2,319.42	2,085.95
5. Other	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	54.11	54.39	52.56	52.91	55.52	56.05
1. Solid Fuels	35.43	35.80	35.47	35.51	36.20	37.27
2. Oil and Natural Gas	18.68	18.58	17.09	17.40	19.33	18.78
2. Industrial Processes and Product Use	**260.30**	**261.31**	**223.77**	**233.87**	**278.59**	**245.78**
A. Mineral Products	126.82	131.18	95.66	99.92	125.82	81.68
B. Chemical Industry	100.04	96.70	94.67	100.51	119.33	130.67
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	33.43	33.43	33.43	33.43
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NE	NE	NE	NE
3. Agriculture	21,006.13	21,227.59	21,800.63	20,729.34	20,490.89	20,073.90
A. Enteric Fermentation	10,194.85	10,084.85	10,505.79	10,309.18	10,265.21	10,273.23
B. Manure Management	2,360.80	2,346.65	2,369.36	2,188.64	2,182.39	2,183.59
C. Rice Cultivation	1,901.44	1,901.44	2,040.57	2,040.57	2,040.57	2,040.57
D. Agricultural Soils	6,466.34	6,785.64	6,790.57	6,099.17	5,911.65	5,487.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	22.48	25.19	26.43	23.87	23.16	21.60
G. Other	60.22	83.82	67.92	67.92	67.92	67.92
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,333.39**	**1,358.72**	**1,386.69**	**1,417.30**	**1,446.59**	**1,502.27**
A. Solid Waste Disposal on Land	147.49	155.76	166.71	180.36	197.11	216.36
B. Biological Treatment of Solid Waste	46.70	48.45	50.14	51.76	51.49	54.13
C. Waste Incineration	30.33	30.46	30.41	30.19	28.76	28.87
D. Waste Water Handling	1,108.86	1,124.05	1,139.43	1,154.99	1,169.23	1,202.92
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**39,924.62**	**41,003.34**	**42,195.75**	**41,995.19**	**42,880.77**	**43,471.39**
Memo items						
International bunkers	**31.69**	**31.69**	**32.01**	**31.38**	**31.69**	**31.69**
Aviation	31.69	31.69	32.01	31.38	31.69	31.69
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,168.42**	**4,111.53**	**4,185.72**	**4,234.56**	**4,218.94**	**4,230.35**

1.2 Trend of CO_2 emissions by sources and removals by sinks for 2012 – 2017

Greenhouse gas source and sink categories	2012	2013	2014	2015	2016	2017
Carbon Dioxide (CO_2)	Gg					
1. Energy	**16,443.91**	**17,253.01**	**17,852.65**	**18,685.63**	**19,692.65**	**20,615.03**
A. Fuel Combustion (sectoral approach)	16,432.20	17,241.72	17,842.29	18,674.95	19,680.58	20,603.33
1. Energy Industries	93.97	113.65	100.08	63.78	72.41	93.30
2. Manufacturing Industries and Construction	4,016.52	4,378.36	3,955.79	4,016.18	4,787.07	5,924.39
3. Transport	11,919.48	12,402.97	12,630.02	12,761.96	12,881.00	12,881.00
4. Other Sectors	402.23	346.74	1,156.39	1,833.02	1,940.11	1,704.65
5. Other (please specify)	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	11.70	11.29	10.37	10.68	12.07	11.71
1. Solid Fuels	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	11.70	11.29	10.37	10.68	12.07	11.71
2. Industrial Processes and Product Use	**260.30**	**261.31**	**223.77**	**233.87**	**278.59**	**245.78**
A. Mineral Products	126.82	131.18	95.66	99.92	125.82	81.68
B. Chemical Industry	100.04	96.70	94.67	100.51	119.33	130.67
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	33.43	33.43	33.43	33.43
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NE	NE	NE	NE
3. Agriculture	**60.22**	**83.82**	**67.92**	**67.92**	**67.92**	**67.92**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA
B. Manure Management	NA	NA	NA	NA	NA	NA
C. Rice Cultivation	NA	NA	NA	NA	NA	NA
D. Agricultural Soils	0.00	0.00	0.00	0.00	0.00	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA
G. Other - Liming	60.22	83.82	67.92	67.92	67.92	67.92
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**6.56**	**6.59**	**6.58**	**6.53**	**6.22**	**6.25**
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00
B. Biological Treatment of Solid Waste	NA	NA	NA	NA	NA	NA
C. Waste Incineration	6.56	6.59	6.58	6.53	6.22	6.25
D. Waste Water Handling	NA	NA	NA	NA	NA	NA
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**16,770.99**	**17,604.73**	**18,150.92**	**18,993.95**	**20,045.39**	**20,934.98**
Memo items						
International bunkers	**31.53**	**31.53**	**31.85**	**31.22**	**31.53**	**31.53**
Aviation	31.53	31.53	31.85	31.22	31.53	31.53
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,168.42**	**4,111.53**	**4,185.72**	**4,234.56**	**4,218.94**	**4,230.35**

1.3 Trend of CH_4 emissions by sources and removals by sinks for 2012 – 2017

Greenhouse gas source and sink categories	2012	2013	2014	2015	2016	2017
Methane (CH_4)	**Gg**					
1. Energy	**25.81**	**26.36**	**27.42**	**27.18**	**28.70**	**30.96**
A. Fuel Combustion (sectoral approach)	24.12	24.63	25.73	25.49	26.96	29.18
1. Energy Industries	8.31	8.84	9.64	9.14	10.55	12.59
2. Manufacturing Industries and Construction	0.35	0.39	0.34	0.35	0.43	0.55
3. Transport	2.65	2.75	2.79	2.81	2.83	2.83
4. Other Sectors	12.81	12.66	12.97	13.19	13.15	13.21
5. Other (please specify)	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	1.70	1.72	1.69	1.69	1.74	1.77
1. Solid Fuels	1.42	1.43	1.42	1.42	1.45	1.49
2. Oil and Natural Gas	0.28	0.29	0.27	0.27	0.29	0.28
2. Industrial Processes and Product Use	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	0.00	0.00	0.00	0.00	0.00	0.00
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO
3. Agriculture	**573.48**	**568.69**	**591.93**	**576.75**	**574.74**	**575.05**
A. Enteric Fermentation	407.79	403.39	420.23	412.37	410.61	410.93
B. Manure Management	88.90	88.44	89.24	82.01	81.79	81.83
C. Rice Cultivation	76.06	76.06	81.62	81.62	81.62	81.62
D. Agricultural Soils	0.00	0.00	0.00	0.00	0.00	0.00
E. Prescribed Burning of Savannahs	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.73	0.80	0.84	0.75	0.73	0.67
G. Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**45.09**	**45.94**	**46.90**	**47.97**	**49.06**	**50.73**
A. Solid Waste Disposal on Land	5.90	6.23	6.67	7.21	7.88	8.65
B. Biological Treatment of Solid Waste	1.09	1.13	1.17	1.21	1.20	1.26
C. Waste Incineration	0.08	0.08	0.08	0.08	0.07	0.07
D. Waste Water Handling	38.03	38.50	38.99	39.47	39.91	40.74
6. Other (please specify)	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**644.39**	**640.99**	**666.25**	**651.91**	**652.50**	**656.74**
Memo items						
International bunkers	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aviation	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass						

1.4 Trend of CH_4 emissions in CO_2 equivalent by sources and removals by sinks for 2012 – 2017

Greenhouse gas source and sink categories	2012	2013	2014	2015	2016	2017
Methane (CH_4)	Gg CO_2 equivalent					
1. Energy	**645.36**	**658.94**	**685.54**	**679.60**	**717.39**	**773.94**
A. Fuel Combustion (sectoral approach)	602.95	615.84	643.35	637.37	673.94	729.60
1. Energy Industries	207.80	221.09	240.92	228.55	263.72	314.66
2. Manufacturing Industries and Construction	8.67	9.64	8.57	8.76	10.76	13.81
3. Transport	66.35	68.72	69.70	70.29	70.76	70.76
4. Other Sectors	320.13	316.39	324.16	329.77	328.71	330.37
5. Other (please specify)	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	42.41	43.10	42.19	42.23	43.45	44.35
1. Solid Fuels	35.43	35.80	35.47	35.51	36.20	37.27
2. Oil and Natural Gas	6.97	7.29	6.72	6.71	7.25	7.07
2. Industrial Processes and Product Use	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	0.00	0.00	0.00	0.00	0.00	0.00
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO
3. Agriculture	**14,337.03**	**14,217.32**	**14,798.25**	**14,418.77**	**14,368.56**	**14,376.29**
A. Enteric Fermentation	10,194.85	10,084.85	10,505.79	10,309.18	10,265.21	10,273.23
B. Manure Management	2,222.48	2,210.98	2,230.92	2,050.27	2,044.64	2,045.68
C. Rice Cultivation	1,901.44	1,901.44	2,040.57	2,040.57	2,040.57	2,040.57
D. Agricultural Soils	0.00	0.00	0.00	0.00	0.00	0.00
E. Prescribed Burning of Savannahs	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	18.26	20.05	20.98	18.75	18.14	16.82
G. Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,127.32**	**1,148.57**	**1,172.56**	**1,199.33**	**1,226.62**	**1,268.27**
A. Solid Waste Disposal on Land	147.49	155.76	166.71	180.36	197.11	216.36
B. Biological Treatment of Solid Waste	27.23	28.25	29.23	30.18	30.02	31.56
C. Waste Incineration	1.96	1.97	1.97	1.95	1.86	1.87
D. Waste Water Handling	950.65	962.59	974.66	986.84	997.63	1,018.49
6. Other (please specify)	**1,127.32**	**1,148.57**	**1,172.56**	**1,199.33**	**1,226.62**	**1,268.27**
Total national emissions and removals	**16,109.71**	**16,024.83**	**16,656.36**	**16,297.70**	**16,312.58**	**16,418.51**
Memo items						
International bunkers	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Aviation	0.01	0.01	0.01	0.01	0.01	0.01
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass						

1.5 Trend of N_2O emissions by sources and removals by sinks for 2012 – 2017

Greenhouse gas source and sink categories	2012	2013	2014	2015	2016	2017
Nitrous oxide (N_2O)	Gg					
1. Energy	**0.79**	**0.82**	**0.83**	**0.84**	**0.85**	**0.87**
A. Fuel Combustion (sectoral approach)	0.79	0.82	0.83	0.84	0.85	0.87
1. Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing Industries and Construction	0.05	0.06	0.05	0.05	0.06	0.08
3. Transport	0.57	0.60	0.61	0.61	0.62	0.62
4. Other Sectors	0.17	0.16	0.17	0.17	0.17	0.17
5. Other (please specify)	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes and Product Use	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	0.00	0.00	0.00	0.00	0.00	0.00
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NO	NO	NO	NO	NO	NO
G. Other (please specify)	NO	NO	NO	NO	NO	NO
3. Agriculture	**22.18**	**23.24**	**23.27**	**20.95**	**20.32**	**18.89**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA
B. Manure Management	0.46	0.46	0.46	0.46	0.46	0.46
C. Rice Cultivation	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	21.70	22.77	22.79	20.47	19.84	18.41
E. Prescribed Burning of Savannahs	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.01	0.02	0.02	0.02	0.02	0.02
G. Other - Liming	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**0.67**	**0.68**	**0.70**	**0.71**	**0.72**	**0.76**
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00
B. Biological Treatment of Solid Waste	0.07	0.07	0.07	0.07	0.07	0.08
C. Waste Incineration	0.07	0.07	0.07	0.07	0.07	0.07
D. Waste Water Handling	0.53	0.54	0.55	0.56	0.58	0.62
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**23.64**	**24.74**	**24.79**	**22.50**	**21.89**	**20.53**
Memo items						
International bunkers	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aviation	0.00	0.00	0.00	0.00	0.00	0.00
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass						

1.6 Trend of N_2O emissions in CO_2 equivalent by sources and removals by sinks for 2012 – 2017

Greenhouse gas source and sink categories	2012	2013	2014	2015	2016	2017
Nitrous oxide (N_2O)	Gg CO_2 equivalent					
1. Energy	**235.54**	**243.77**	**246.46**	**249.45**	**254.65**	**260.45**
A. Fuel Combustion (sectoral approach)	235.54	243.77	246.45	249.45	254.64	260.44
1. Energy Industries	0.15	0.19	0.15	0.07	0.08	0.10
2. Manufacturing Industries and Construction	15.35	17.10	15.19	15.53	19.11	24.56
3. Transport	170.72	177.83	181.20	183.05	184.86	184.86
4. Other Sectors	49.31	48.65	49.91	50.79	50.60	50.92
5. Other (please specify)	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes and Product Use	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
A. Mineral Products	NO	NO	NO	NO	NO	NO
B. Chemical Industry	NO	NO	NO	NO	NO	NO
C. Metal Production	NO	NO	NO	NO	NO	NO
D. Other Production	0.00	0.00	0.00	0.00	0.00	0.00
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NO	NO	NO	NO	NO	NO
G. Other (please specify)	NO	NO	NO	NO	NO	NO
3. Agriculture	**6,608.88**	**6,926.45**	**6,934.47**	**6,242.66**	**6,054.41**	**5,629.70**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA
B. Manure Management	138.32	135.66	138.44	138.37	137.76	137.91
C. Rice Cultivation	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	6,466.34	6,785.64	6,790.57	6,099.17	5,911.65	5,487.00
E. Prescribed Burning of Savannahs	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	4.22	5.15	5.45	5.12	5.01	4.78
G. Other - Liming	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry (LULUCF)	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**199.50**	**203.56**	**207.55**	**211.44**	**213.75**	**227.75**
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00
B. Biological Treatment of Solid Waste	19.47	20.20	20.91	21.58	21.47	22.57
C. Waste Incineration	21.81	21.90	21.87	21.70	20.68	20.75
D. Waste Water Handling	158.22	161.46	164.77	168.15	171.60	184.43
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**7,043.92**	**7,373.78**	**7,388.47**	**6,703.54**	**6,522.81**	**6,117.89**
Memo items						
International bunkers	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**
Aviation	0.16	0.16	0.16	0.16	0.16	0.16
Marine	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass						

1.7 National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2017

Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SOx
	Gg eq	Gg							
1. Energy	**21,649.43**	**20,615.03**	**NA**	**30.96**	**0.87**	**820.40**	**625.38**	**89.10**	**597.80**
A. Fuel Combustion (sectoral approach)	21,593.37	20,603.33	NA	29.18	0.87	820.40	625.38	88.67	597.80
1. Energy Industries	408.05	93.30	NA	12.59	0.00	28.27	0.10	6.86	0.14
2. Manufacturing Industries and Construction	5,962.76	5,924.39	NA	0.55	0.08	55.95	10.62	5.40	54.00
3. Transport	13,136.61	12,881.00	NA	2.83	0.62	344.83	37.22	44.93	0.51
4. Other Sectors	2,085.95	1,704.65	NA	13.21	0.17	391.35	577.44	31.47	543.14
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	56.05	11.71	NA	1.77	0.00	NA	NA	0.43	NA
1. Solid Fuels	37.27	NA	NA	1.49	NA	NA	NA	NA	NA
2. Oil and Natural Gas	18.78	11.71	NA	0.28	0.00	NA	NA	0.43	NA
2. Industrial Processes and Product Use	**245.78**	**245.78**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.08**	**NE**
A. Mineral Products	81.68	81.68	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	130.67	130.67	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.08	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**20,073.90**	**67.92**	**NA**	**575.05**	**18.89**	**14.13**	**4.78**	**35.20**	**NA**
A. Enteric Fermentation	10,273.23	NA	NA	410.93	NA	NA	NA	NA	NA
B. Manure Management	2,183.59	NA	NA	81.83	0.46	NA	1.03	NA	NA
C. Rice Cultivation	2,040.57	NA	NA	81.62	NO	NA	NA	NA	NA
D. Agricultural Soils	5,487.00	0.00	NA	0.00	18.41	0.00	2.13	35.20	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NA
F. Field Burning of Agricultural Residues	21.60	NA	NA	0.67	0.02	14.13	0.58	NA	NA
G. Other (urea application)	67.92	67.92	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,502.27**	**6.25**	**NA**	**50.73**	**0.76**	**69.43**	**3.95**	**4.04**	**0.14**
A. Solid Waste Disposal on Land	216.36	0.00	NA	8.65	0.00	NA	NA	2.51	NA
B. Biological Treatment of Solid Waste	1,202.92	NA	NA	40.74	0.62	NA	NA	NA	NA
C. Waste Incineration	28.87	6.25	NA	0.07	0.07	69.43	3.95	1.53	0.14
D. Waste Water Handling	54.13	NA	NA	1.26	0.08	NE	NE	NE	NE
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**43,471.39**	**20,934.98**	**NE**	**656.74**	**20.53**	**903.96**	**634.13**	**128.42**	**597.94**
Memo items									
International bunkers	**31.69**	**31.53**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.69	31.53	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,230.35**	**4,230.35**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

1.8 National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2016

Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SOx
	Gg eq	Gg							
1. Energy	**20,664.69**	**19,692.65**	**NA**	**28.70**	**0.85**	**793.72**	**586.54**	**87.37**	**552.12**
A. Fuel Combustion (sectoral approach)	20,609.17	19,680.58	NA	26.96	0.85	793.72	586.54	86.94	552.12
1. Energy Industries	336.20	72.41	NA	10.55	0.00	27.50	0.07	6.68	0.06
2. Manufacturing Industries and Construction	4,816.94	4,787.07	NA	0.43	0.06	44.57	8.53	4.32	42.99
3. Transport	13,136.61	12,881.00	NA	2.83	0.62	344.83	37.22	44.93	0.51
4. Other Sectors	2,319.42	1,940.11	NA	13.15	0.17	376.82	540.72	31.00	508.56
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	55.52	12.07	NA	1.74	0.00	NA	NA	0.43	NA
1. Solid Fuels	36.20	NA	NA	1.45	NA	NA	NA	NA	NA
2. Oil and Natural Gas	19.33	12.07	NA	0.29	0.00	NA	NA	0.43	NA
2. Industrial Processes and Product Use	**278.59**	**278.59**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.05**	**NE**
A. Mineral Products	125.82	125.82	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	119.33	119.33	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.05	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**20,490.89**	**67.92**	**NA**	**574.74**	**20.32**	**15.24**	**4.80**	**34.45**	**NA**
A. Enteric Fermentation	10,265.21	NA	NA	410.61	NA	NA	NA	NA	NA
B. Manure Management	2,182.39	NA	NA	81.79	0.46	NA	1.03	NA	NA
C. Rice Cultivation	2,040.57	NA	NA	81.62	NO	NA	NA	NA	NA
D. Agricultural Soils	5,911.65	0.00	NA	0.00	19.84	0.00	2.13	34.45	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	23.16	NA	NA	0.73	0.02	15.24	0.61	NA	NA
G. Other (urea application)	67.92	67.92	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,446.59**	**6.22**	**NA**	**49.06**	**0.72**	**69.17**	**3.94**	**3.69**	**0.14**
A. Solid Waste Disposal on Land	197.11	0.00	NA	7.88	0.00	NA	NA	2.17	NA
B. Biological Treatment of Solid Waste	1,169.23	NA	NA	39.91	0.58	NA	NA	NA	NA
C. Waste Incineration	28.76	6.22	NA	0.07	0.07	69.17	3.94	1.52	0.14
D. Waste Water Handling	51.49	NA	NA	1.20	0.07	NE	NE	NE	NE
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**42,880.77**	**20,045.39**	**NE**	**652.50**	**21.89**	**878.14**	**595.30**	**125.55**	**552.25**
Memo items									
International bunkers	**31.69**	**31.53**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.69	31.53	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,218.94**	**4,218.94**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

1.9 National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2015

Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SOx
	Gg eq	Gg							
1. Energy	**19,614.68**	**18,685.63**	**NA**	**27.18**	**0.84**	**780.31**	**578.14**	**86.12**	**538.59**
A. Fuel Combustion (sectoral approach)	19,561.77	18,674.95	NA	25.49	0.84	780.31	578.14	85.66	538.59
1. Energy Industries	292.41	63.78	NA	9.14	0.00	26.75	0.07	6.50	0.06
2. Manufacturing Industries and Construction	4,040.48	4,016.18	NA	0.35	0.05	37.14	7.14	3.61	35.81
3. Transport	13,015.30	12,761.96	NA	2.81	0.61	341.58	36.89	44.52	0.50
4. Other Sectors	2,213.58	1,833.02	NA	13.19	0.17	374.84	534.04	31.03	502.21
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	52.91	10.68	NA	1.69	0.00	NA	NA	0.47	NA
1. Solid Fuels	35.51	NA	NA	1.42	NA	NA	NA	NA	NA
2. Oil and Natural Gas	17.40	10.68	NA	0.27	0.00	NA	NA	0.47	NA
2. Industrial Processes and Product Use	**233.87**	**233.87**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.08**	**NE**
A. Mineral Products	99.92	99.92	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	100.51	100.51	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.08	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**20,729.34**	**67.92**	**NA**	**576.75**	**20.95**	**15.75**	**4.82**	**34.20**	**NA**
A. Enteric Fermentation	10,309.18	NA	NA	412.37	NA	NA	NA	NA	NA
B. Manure Management	2,188.64	NA	NA	82.01	0.46	NA	1.03	NA	NA
C. Rice Cultivation	2,040.57	NA	NA	81.62	NO	NA	NA	NA	NA
D. Agricultural Soils	6,099.17	0.00	NA	0.00	20.47	0.00	2.13	34.20	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	23.87	NA	NA	0.75	0.02	15.75	0.62	NA	NA
G. Other (urea application)	67.92	67.92	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,417.30**	**6.53**	**NA**	**47.97**	**0.71**	**72.61**	**4.14**	**3.44**	**0.14**
A. Solid Waste Disposal on Land	180.36	0.00	NA	7.21	0.00	NA	NA	1.84	NA
B. Biological Treatment of Solid Waste	1,154.99	NA	NA	39.47	0.56	NA	NA	NA	NA
C. Waste Incineration	30.19	6.53	NA	0.08	0.07	72.61	4.14	1.60	0.14
D. Waste Water Handling	51.76	NA	NA	1.21	0.07	NE	NE	NE	NE
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**41,995.19**	**18,993.95**	**NE**	**651.91**	**22.50**	**868.68**	**587.11**	**123.84**	**538.73**
Memo items									
International bunkers	**31.38**	**31.22**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.38	31.22	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,234.56**	**4,234.56**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

1.9 National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2014

Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SOx
	Gg eq	Gg							
1. Energy	**18,784.66**	**17,852.65**	**NA**	**27.42**	**0.83**	**763.57**	**552.08**	**84.95**	**513.66**
A. Fuel Combustion (sectoral approach)	18,732.09	17,842.29	NA	25.73	0.83	763.57	552.08	84.44	513.66
1. Energy Industries	341.15	100.08	NA	9.64	0.00	26.01	0.10	6.31	0.08
2. Manufacturing Industries and Construction	3,979.55	3,955.79	NA	0.34	0.05	36.55	7.03	3.55	35.24
3. Transport	12,880.92	12,630.02	NA	2.79	0.61	338.40	36.50	44.11	0.50
4. Other Sectors	1,530.47	1,156.39	NA	12.97	0.17	362.61	508.45	30.46	477.84
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	52.56	10.37	NA	1.69	0.00	NA	NA	0.51	NA
1. Solid Fuels	35.47	NA	NA	1.42	NA	NA	NA	NA	NA
2. Oil and Natural Gas	17.09	10.37	NA	0.27	0.00	NA	NA	0.51	NA
2. Industrial Processes and Product Use	**223.77**	**223.77**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.15**	**NE**
A. Mineral Products	95.66	95.66	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	94.67	94.67	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.15	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**21,800.63**	**67.92**	**NA**	**591.93**	**23.27**	**17.62**	**4.97**	**33.94**	**NA**
A. Enteric Fermentation	10,505.79	NA	NA	420.23	NA	NA	NA	NA	NA
B. Manure Management	2,369.36	NA	NA	89.24	0.46	NA	1.09	NA	NA
C. Rice Cultivation	2,040.57	NA	NA	81.62	NO	NA	NA	NA	NA
D. Agricultural Soils	6,790.57	0.00	NA	0.00	22.79	0.00	2.13	33.94	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	26.43	NA	NA	0.84	0.02	17.62	0.66	NA	NA
G. Other (urea application)	67.92	67.92	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,386.69**	**6.58**	**NA**	**46.90**	**0.70**	**73.15**	**4.17**	**3.09**	**0.14**
A. Solid Waste Disposal on Land	166.71	0.00	NA	6.67	0.00	NA	NA	1.48	NA
B. Biological Treatment of Solid Waste	1,139.43	NA	NA	38.99	0.55	NA	NA	NA	NA
C. Waste Incineration	30.41	6.58	NA	0.08	0.07	73.15	4.17	1.61	0.14
D. Waste Water Handling	50.14	NA	NA	1.17	0.07	NE	NE	NE	NE
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**42,195.75**	**18,150.92**	**NE**	**666.25**	**24.79**	**854.34**	**561.24**	**122.13**	**513.80**
Memo items									
International bunkers	**32.01**	**31.85**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	32.01	31.85	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,185.72**	**4,185.72**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

1.10 National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2013

Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SOx
	Gg eq	Gg							
1. Energy	**18,155.72**	**17,253.01**	**NA**	**26.36**	**0.82**	**747.45**	**526.93**	**83.70**	**493.35**
A. Fuel Combustion (sectoral approach)	18,101.34	17,241.72	NA	24.63	0.82	747.45	526.93	83.15	493.35
1. Energy Industries	334.93	113.65	NA	8.84	0.00	25.29	0.11	6.14	0.08
2. Manufacturing Industries and Construction	4,405.10	4,378.36	NA	0.39	0.06	40.50	7.79	3.94	39.05
3. Transport	12,649.52	12,402.97	NA	2.75	0.60	332.26	35.86	43.34	0.49
4. Other Sectors	711.79	346.74	NA	12.66	0.16	349.41	483.16	29.74	453.72
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	54.39	11.29	NA	1.72	0.00	NA	NA	0.55	NA
1. Solid Fuels	35.80	NA	NA	1.43	NA	NA	NA	NA	NA
2. Oil and Natural Gas	18.58	11.29	NA	0.29	0.00	NA	NA	0.55	NA
2. Industrial Processes and Product Use	**261.31**	**261.31**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.38**	**NE**
A. Mineral Products	131.18	131.18	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	96.70	96.70	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.38	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**21,227.59**	**83.82**	**NA**	**568.69**	**23.24**	**16.84**	**5.41**	**33.62**	**NA**
A. Enteric Fermentation	10,084.85	NA	NA	403.39	NA	NA	NA	NA	NA
B. Manure Management	2,346.65	NA	NA	88.44	0.46	NA	1.08	NA	NA
C. Rice Cultivation	1,901.44	NA	NA	76.06	NO	NA	NA	NA	NA
D. Agricultural Soils	6,785.64	0.00	NA	0.00	22.77	0.00	2.63	33.62	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	25.19	NA	NA	0.80	0.02	16.84	0.62	NA	NA
G. Other (urea application)	83.82	83.82	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,358.72**	**6.59**	**NA**	**45.94**	**0.68**	**73.26**	**4.17**	**2.77**	**0.14**
A. Solid Waste Disposal on Land	155.76	0.00	NA	6.23	0.00	NA	NA	1.16	NA
B. Biological Treatment of Solid Waste	1,124.05	NA	NA	38.50	0.54	NA	NA	NA	NA
C. Waste Incineration	30.46	6.59	NA	0.08	0.07	73.26	4.17	1.61	0.14
D. Waste Water Handling	48.45	NA	NA	1.13	0.07	NE	NE	NE	NE
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**41,003.34**	**17,604.73**	**NE**	**640.99**	**24.74**	**837.55**	**536.53**	**120.47**	**493.49**
Memo items									
International bunkers	**31.69**	**31.53**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.69	31.53	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,111.53**	**4,111.53**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

1.11 National GHG inventory of anthropogenic emissions by sources and removals by sinks for 2012

Greenhouse gas source and sink categories	GHG	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO	NOx	NMVOC	SOx
	Gg eq	Gg							
1. Energy	**17,324.81**	**16,443.91**	**NA**	**25.81**	**0.79**	**723.04**	**500.83**	**81.42**	**467.08**
A. Fuel Combustion (sectoral approach)	17,270.70	16,432.20	NA	24.12	0.79	723.04	500.83	81.02	467.08
1. Energy Industries	301.92	93.97	NA	8.31	0.00	24.58	0.10	5.97	0.06
2. Manufacturing Industries and Construction	4,040.54	4,016.52	NA	0.35	0.05	36.87	7.13	3.59	35.54
3. Transport	12,156.56	11,919.48	NA	2.65	0.57	319.18	34.49	41.64	0.47
4. Other Sectors	771.67	402.23	NA	12.81	0.17	342.40	459.13	29.82	431.01
5. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	54.11	11.70	NA	1.70	0.00	NA	NA	0.40	NA
1. Solid Fuels	35.43	NA	NA	1.42	NA	NA	NA	NA	NA
2. Oil and Natural Gas	18.68	11.70	NA	0.28	0.00	NA	NA	0.40	NA
2. Industrial Processes and Product Use	**260.30**	**260.30**	**NA**	**NO**	**NO**	**0.00**	**0.02**	**0.09**	**NE**
A. Mineral Products	126.82	126.82	NA	NO	NO	NO	NO	NO	NO
B. Chemical Industry	100.04	100.04	NA	NO	NO	0.00	0.02	NO	NO
C. Metal Production	NO	NO	NA	NO	NO	NO	NO	NO	NO
D. Other Production	33.43	33.43	NA	0.00	0.00	0.00	0.00	0.09	0.00
E. Production of Halocarbons and SF_6	NO	NO	NA	NO	NO	NO	NO	NO	NO
F. Consumption of halocarbons and SF_6	NE	NE	NA	NE	NE	NE	NE	NE	NE
G. Other (please specify)	NE	NE	NA	NE	NE	NE	NE	NE	NE
3. Agriculture	**21,006.13**	**60.22**	**NA**	**573.48**	**22.18**	**15.34**	**4.56**	**33.82**	**NA**
A. Enteric Fermentation	10,194.85	NA	NA	407.79	NA	NA	NA	NA	NA
B. Manure Management	2,360.80	NA	NA	88.90	0.46	NA	1.08	NA	NA
C. Rice Cultivation	1,901.44	NA	NA	76.06	NO	NA	NA	NA	NA
D. Agricultural Soils	6,466.34	0.00	NA	0.00	21.70	0.00	1.89	33.82	0.00
E. Prescribed Burning of Savannahs	NA	NA	NA	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	22.48	NA	NA	0.73	0.01	15.34	0.51	NA	NA
G. Other (urea application)	60.22	60.22	NA	0.00	0.00	0.00	0.00	0.00	0.00
4. Land-Use, Land-Use, Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
5. Waste	**1,333.39**	**6.56**	**NA**	**45.09**	**0.67**	**72.95**	**4.16**	**2.48**	**0.14**
A. Solid Waste Disposal on Land	147.49	0.00	NA	5.90	0.00	NA	NA	0.87	NA
B. Biological Treatment of Solid Waste	1,108.86	NA	NA	38.03	0.53	NA	NA	NA	NA
C. Waste Incineration	30.33	6.56	NA	0.08	0.07	72.95	4.16	1.61	0.14
D. Waste Water Handling	46.70	NA	NA	1.09	0.07	NE	NE	NE	NE
6. Other	**NO**	**NO**	**NA**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total national emissions and removals	**39,924.62**	**16,770.99**	**NE**	**644.39**	**23.64**	**811.33**	**509.57**	**117.82**	**467.23**
Memo items									
International bunkers	**31.69**	**31.53**	**NA**	**0.00**	**0.00**	**NE**	**0.11**	**NE**	**NE**
Aviation	31.69	31.53	NA	0.00	0.00	NE	0.11	NE	NE
Marine	NO	NO	NA	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	**4,168.42**	**4,168.42**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

2. MRV PROTOCOLS

2.1 NAMA Level MRV Protocol

The table below illustrates in general terms the protocol where:

Ni: NAMA identification code (in case of Afghanistan four NAMAs N1-N4)

Ni-Cj: Component j from NAMA I (number of components varies for each NAMA)

KPI-Ni-Cj-n: Identification number for each individual activity within a given Component j of NAMA Ni (Individual activities considered as Key Performance Indicators

NAMA Code: Ni **NAMA Category:** **Scope:** **Intervention Description:** **Institutional Stakeholder:** **Assessment year:** **Assessment period:**		
NAMA Description		
Status:		
List of NAMA Components		
Ni-C1	Description:	
	MR Entity & Outcome Assessment:	
Ni-C2	Description:	
	MR Entity & Outcome Assessment:	
Ni-Cj	Description:	
	MR Entity & Outcome Assessment:	
Component Ni-Cj:		
List of Individual Activities/Key Performance Indicators (KPIs) under Ni-C1		**Quantitative KP IAssessment**
KPI-Ni-C1-1	Description:	
	MR Entity & Qualitative Output Assessment:	
KPI-Ni-C1-2	Description:	
	MR Entity & Qualitative Output Assessment:	
KPI-Ni-Cj-n	Description:	
	MR Entity & Qualitative Output Assessment:	
Supporting material: Data, figures and tables: (with explicit source referencing)		
KPI-Ni-C1-1		
KPI-Ni-C1-2		
KPI-Ni-Cj-n		
Final Impact Evaluation of NAMA N-1 based on the statements made above about adopted indicators and supporting material		
How successful have the MR entity been in contributing to the promotion of climate change mitigation and adaptation through Energy Efficiency activities?		

2.2 MRV Protocol for Climate Change National Information System CCNIS

Establishment of Climate Change National Information System (CCNIS)		
NAMA Scope	**Host Agency**	**Required Support**
Support to ALL NAMAs	**NEPA**	Training on 2006 IPCC Guidelines and Software, QC tools & procedures
Indicators to Monitor & Report During Conceptualisation & Appraisal Phase		**Result**
Project proposal		
Policy framework		
Institutional setup		
Implementation and resource scheduling		
Stakeholders identification/participation		
Training		
Indicators to Monitor & Report During Implementation Phase		**Result**
Official endorsement		
Donors identification & agreements		
Financing flow		
Resolutions and decrees by the government		
Staffing		
Indicators to Monitor & Report During Operation Phase		**Result**
Standardized Data templates design		
Issuance & distribution of templates		
Liaison officers identification		
Data Collection		
Quality Control		

Note 1: Details of these protocols are available in the MRV Report[105]

Note 2: The actual structure of the protocol depends on the type of programme.

2.3 MRV Protocol for Solar Water Heaters Project

CDM-PoA: Solar Water Heaters in Households		
NAMA Scope: **N2- Sustainable Urban Infrastructure Development[106]** **N4- Introduce solar PV, biomass and other technologies for enhanced energy access in rural areas[107]**		
Reporting Year:		
Reporting Period:		
Purpose and general description[108]		
Methodology to be applied		
Contribution to sustainable development		
Geographical Boundary		
Host institution responsible for MR		
Technologies/measures		
Implementation Phase		
Action	**Result**	
GIRoA Approval, Stakeholders identification and relegation		
Technical and Financial Appraisal		
PIN Completion		
Identify contract party		
Identify contract participant		
Start installation works & progress		
Variable	**Conceptualisation & Appraisal Phase (Ex-Ante Calculation/measurement)** ***Assumed Value***	**Operation Phase (Ex-Post Calculation/ measurement)** ***Actual Value***
HW/DWILLING LITER/DAY	158.800	
NUMBER OF DAYS/YEAR	300.000	
INLET TEMP C	20.000	
OUTLET TEMP C	60.000	
ENERGY CONSUMED J/DAY/DWELLING	26551.360	
ENERGY CONSUMED KJ/YEAR/DWELLING	7965408.000	
ENERGY CONSUMED KJ/YEAR/DWELLING	7.965	
FUEL HEAT VALUE GJ/T	43.000	
TERMAL HEATER EFFICEINCY	100.000%	
FUEL SAVED/DWELLING TON	0.185	
FLAT SWH AREA SqM/DWILLING	3.000	
TOTAL AREA PER CPA SqM	64000.000	
NUMBER OF DWELLINGS/CPA	21333.333	
TOTAL ENERGY SAVED/CPA TON	3951.830	
EMISSION FACTOR KG GHG/GJ	72.000	
EMISSIONS SAVED /CPA Gg	12.235	
OUTPUT: EMISSIONS SAVED FROM: 4 MILLION DWELLINGS (ex-ante), ACTUAL NUMBER OF DWELLINGS (Ex-Post)	2294.038	

Note: Details of these protocols are available in the MRV Report[109].

2.4 MRV Protocol for Individual Activities under NAMA Ni

Supporting Agency/Donor:						
NAMA Code and Scope: Ni: (Scope)						
KPI Code (KPI-Ni-Cj-n)	KPI Description	Financial Support (Article 9 Paris Agreement)	Technology Transfer (Article 10 Paris Agreement)		Capacity Building (Article 11 Paris Agreement)	
		USD	Financial USD	Other	Financial USD	Other

3. COMPOSITION OF THE GHG INVENTORY CORE TEAM

#	Name	Position	Onganisation	Email
1	Mr. Mohammad Shafiq Hamidi	Energy Sector Lead	MEW	shafiqhamidee@yahoo.com
2	Ms. Noor Bibi Gouhari	Energy Sector Deputy Lead	NEPA	nooribibigouhari@gmail.com
3	Mr. Noorullah Ibrahimi	Energy Sector Expert	MEW	noorullha.ab@gmail.com
4	Mr. Gulrassol Hamdard	Energy Sector Expert	DABS	gulrasool.hamdard@dabs.af
5	Mrs. Aria Neiaeesh Habibi	IPPU Sector Lead	NEPA	aria.gardizi@gmail.com
6	Mr. Ahmad Shoaib Jahesh	IPPU Sector Deputy Lead	NEPA	ahmad.jahesh@gmail.com
7	Mr. Mohammad Jamshid	Generalist (IPPU, Energy)	MoMP	h.mjamshid@googlemail.com
8	Mr. Habibullah Tahiri	AFOLU Sector Lead	NEPA	habibullaht@hotmail.com
9	Mr. Azizuraham Sakhizada	AFOLU Sector Deputy Lead	MAIL	azizrahmansakhizadah@yahoo.com
10	Mr. Sayed Azizullah Hashimi	AFOLU Sector Expert	MAIL	aziz_hashemi@yahoo.com
11	Mr. Mohammad Afzal Safi	Waste Sector Lead	MRRD	m.asafi@mrrd.gov.af
12	Mr. Edris Toukhi	Waste Sector Deputy Lead	KM	metoukhi@gmail.com
13	Mr. Mohammad Nabi Zhman	Waste Sector Expert	IDLG	znabi@yahoo.com
14	Mr. Khan Agha Shenwari	Waste Sector Expert	CFU	khanaghashenwari@yahoo.com
15	Mr. Sahabudin Jalali	Generalist	NSIA	jalali_161@yahoo.com
16	Mr. Kanishka Talash	Generalist	NSIA	kanishkatalaash1@gmail.com
17	Ms. Basila Yaqoobi	Generalist	MEW	basilayaqoobe@gmail.com
18	Mr. Abdul Ghias Safi	Generalist	KU	ghiassafi@yahoo.com
19	Mr. Mohammad Naiem Eqrar	Generalist	KU	naimeqrar@gmail.com
20	Mr. Zabihullah Paiman	Generalist	KPU	zabihullah_paiman@yahoo.com
21	Mr. Ajmal Rozbeh	Generalist	IDLG	ajmalrozbeh2014@gmail.com
22	Mr. Bashir Ahmad Rashidi	Generalist	AMD	bashir.rashedy@yahoo.com
23	Mr. Mohammad Monib Noori	National Inventory Compiler	UNEP	monib.noori@un.org

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