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The Fourth National Communication of Albania on Climate Change

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September 2022

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This document has been developed within the Project "Republic of Albania: Enabling Activities for the Preparation of the Fourth National Communication and the First Biennial Update Report under the United Nations Framework Convention on Climate Change" implemented by the Ministry of Tourism and Environment and the United Nations Development Program (UNDP), with financial support of the Global Environment Facility (GEF).

Foreword

"The planet where we are living, it is not inherited, thus we have to give it healthy to our children"

As Minister of Tourism and Environment, it is a pleasure to present Albania's Fourth National Communication to the United Nations Framework Convention on Climate Change.

The Fourth National Communication, in fulfilment of our commitment under Article 12 of the Convention, informs the UNFCCC parties, all relevant decisionmakers and the stakeholders on current trends of climate change and its consequences in Albania, provides an updated inventory of greenhouse gas emissions for the country, and describes the ability of Albania to contribute to climate change mitigation and adaptation. This document also provides a brief overview of completed, ongoing and planned measures of the Government, general public, business community and donors aimed at addressing climate change issues.

The Fourth National Communication acknowledges that climate change is a cross-cutting issue for all sectors and regions of Albania, and that several policies and strategies have or are being developed to address it in many of these sectors and regions to achieve the goal of sustainable development. Albania's greenhouse gas (GHG) emissions level compared to the rest of Europe is still low. However, Albania is committed to take measures to reduce the GHG emissions from different economic sectors, i.e., energy and transport, agriculture, land use and forestry, industrial processes, and waste, aiming to reach the new enhanced target in response to Paris Agreement on Climate Change.

The vulnerability and adaptation assessment is focused on the Vjosa River Basin, which is the second largest water system in Albania. This report provides a research-based analysis on climate vulnerabilities (current and future due to climate changes) for sectors/systems: water resources, agriculture, biodiversity and forests, soils, health, disaster risk, tourism, population and settlements, and gender. It also considers existing adaptive capacities and priority adaptation measures potential to cope with climate changes.

The main content of the Fourth National Communication was discussed through a series of national workshops engaging with and attended by a wide range of stakeholders, as well as international experts. All suggestions and comments received were thoroughly analysed and, as far as possible, addressed. I would like to congratulate all those involved in the process of preparing the Fourth National Communication. The document was prepared through a broad consultative process coordinated by the Ministry of Tourism and Environment.

The Ministry of Tourism and Environment would like to express its highest appreciation for the financial and technical support to the Global Environment Facility and the United Nations Development Programme that assisted in the fulfilment of this national obligation to the United Nations Framework Convention on Climate Change.

Mirela Kumbaro Furxhi

Minister of Tourism and Environment

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The development of the Fourth National Communication of Albania to the United Nations Framework Convention on Climate Change is a joint undertaking of the Ministry of Tourism and Environment and the United Nations Development Program (UNDP) upon support provided by the Global Environment Facility (GEF) to the Project "Republic of Albania: Enabling Activities for the Preparation of the Fourth National Communication and the First Biennial Update Report to the United Nations Framework Convention on Climate Change (UNFCCC)".

The First Biennial Update Report (BUR1) of Albania and the National Greenhouse Gas Inventory Report (NIR) were successfully submitted to the UNFCCC on October 12, 2021. With the support from UNDP Climate Promise and other developing agencies, Albania presented its revised National Determined Contribution (October 2021) with enhanced ambition, but also with a broader scope that encompasses more types of greenhouse gases (GHGs) and more sectors.

Within the framework of the Project, a core team of national and international experts has been mobilised representing research institutions, private companies and independent ones working on project basis. The team benefitted from the previous undertaken work and results of the BUR1, the NIR and the revised NDC. Albania's Fourth National Communication is a commitment to provide the following elements of information to the Conference of the Parties: (i) National circumstances; (ii) A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol; (iii) General description of steps taken or envisaged by Albania to implement the Convention, i.e., measures to mitigate climate change and measures to facilitate adequate adaptation to climate change; (iv) Any other information that Albania considers relevant to the achievement of the objectives of the Convention; and (v) Constraints and gaps, and related financial, technical, and capacity needs.

Reporting obligations of UNFCCC parties evolve. The Government of Albania, after submitting four national communications (in 2002, 2009, 2016 and 2022) and its First Biennial Update Report in 2021 will have to submit the fifth national communication (NC5) by 2026 and its first Biennial Transparency Report (BTR) by 2024, either as a summary of parts of the national communication in the year in which the national communication is submitted or as a stand-alone update report.

Special appreciation must be given to the support provided by the Ministry of Tourism and Environment of Albania, in particular to Minister H.E. Ms. Mirela Kumbaro Furxhi and her cabinet.

Special thanks go to Mr. Sofjan Jaupaj (GEF Operational Focal Point) and Ms. Eneida Rabdishta (Climate Change Expert and the Project's Focal Point), both from the Ministry of Tourism and Environment. Many credits go also to the other Project Steering Committee members representing the Ministry of Agriculture and Rural Development, Ministry of Infrastructure and Energy, Ministry of Finance and Economy, Ministry of Defence, Institute of Geoscience, INSTAT, Vlora Region and the EDEN Center.
Furthermore, I'd like to give special thanks to the UNDP Albania Resident Representative, Ms. Monica Merino and the Environment Programme Analyst, Ms. Elvita Kabashi for their continuous leadership, guide, and support.

Despite the wide range of inputs into the process, the responsibility for this final output rests with the Project Coordinator and any errors and omissions thereof are not to be attributed to the other participants in the process.

Mirela Kamberi
Climate Change Project Coordinator

Contents

Tables

Figures

List of acronyms and abbreviations

AEZ	Agro-ecological zones
AKM	National Environment Agency
CO_2 eq.	Carbon dioxide equivalent
EPM	Erosion Potential Method
EU	European Union
GDP	Gross domestic product
GEFF	Green Economy Financing Facility
GGF	Green for Growth Fund
GWP	Global Warming Potential
HDI	Human development index
HSW	Household solid waste
IGJEUM	Institute of Geosciences, Energy, Water and Environment
iMWGCC	inter-ministerial Working Group on Climate Change
INSTAT	Institute of Statistics
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
ktoe	Kilotonnes of oil equivalent
LULUCF	Land Use, Land Use Change and Forestry
MTE	Ministry of Tourism and Environment
MW	Megawatts
NAP	National Adaptation Plan
NAPM	National Action Plan on Mitigation
NASRI	National Agency for Scientific Research, Technology, and Innovation
NC	National Communication
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organisation
NSCC	National Strategy on Climate Change
NSDI	National Strategy for Development and Integration
NSGE	National Strategy on Gender Equality
PV	Photovoltaic
QA/QC	Quality Analysis/Quality Control
RCP	Representative Concentration Pathways
REEP	Regional Energy Efficiency Programme
TPP	Thermal power plant
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollars
V&A	Vulnerability and adaptation
VRB	Vjosa River Basin
WBIF	Western Balkans Investment Framework

Chemical symbols

CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2-eq	CO_2 equivalent
HFCs	Hydrofluorocarbons
NMVOCs	Non-methane volatile organic compounds
N_2O	Nitrous oxide
NO_X	Nitrogen oxides
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
SO_X	Sulphur oxides

Executive summary

National Circumstances

The Republic of Albania (hereafter referred to as Albania) is a constitutional republic with a democratically elected parliament. The Judiciary of Albania interprets and applies the law of Albania. Albania is divided into 12 regions (Qark) and 61 urban and rural municipalities (bashki and komuna). The capital of Albania is Tirana. Albania is in south-eastern Europe, in the western part of the Balkan Peninsula. It is located to the north of Greece and to the south of Montenegro and Kosovo. To the west, it borders the Ionian (south) and the Adriatic (north) seas, in the Mediterranean Sea, for 476 km. Albania's land area totals 28,748 km^2. The country's average altitude is 708 m above sea level, as 70% of the territory is mountainous. Albania is a rich country in water resources. The total annual rate of flow is 39.22 billion m^3/year, where 95 % is discharged into the Adriatic Sea and only 5% into the Ionian Sea. Water resources are an important source of hydropower, producing around 90% of the country's energy and providing irrigation for agriculture.

Albania has a Mediterranean climate, which involves mild and humid winters and hot and dry summers, with some continental influence in the south-eastern part of the country. Projections for the climate in 2050 include further increases in temperature and heat waves, decreases in total precipitation, increases in frequency and duration of extreme events like floods and droughts, and rising sea levels.

The population of Albania on January 1st, 2022, is 2,793,592, experiencing a decrease of 1.3%, compared to January 1st, 2021. Most studies project that the demographic decline will continue. In 2018, the average population density was 99.7 inhabitants per km^2. The urban population has increased from one-third in the early 1990s to an estimate of almost two-thirds (62%) in 2020 and is expected to continue to rise.

After 50 years of communist rule, Albania has transformed from one of the poorest countries in Europe in the early 1990s to an upper-middle-income country in 2020. As a result of three decades of remarkable economic growth, in 2020, its gross domestic product (GDP) was USD 14.89 billion, and its GDP per capita was USD 5,246.1. This economic growth has been associated with structural economic changes, with a transition from an economy based on raw materials, agriculture and industry, into a more diverse economy where the service sector plays a leading role.

The energy sector is a priority sector for the government. Albania is endowed with a wide variety of energy resources ranging from oil and gas, coal and other fossil fuels, hydropower, natural forest biomass and other renewable energy. The primary energy supply in Albania is dominated by oil products, hydro and net import electricity, fuel wood and a small amount of coal and natural gas. Electricity generation has been historically met almost exclusively by hydropower plants, with a total installed power capacity of 2,011 MW at the end of 2016. The country has exploited approximately 50% of its hydropower potential.

The transport sector, consisting of maritime, air, rail, and road transport, has been increasing rapidly since 2000. The number of vehicles on the road has increased as well while transport infrastructure has been improved. Consequently, the total traffic load both for transport of goods and of passengers has increased further. The transport sector has the highest energy consumption.

The industry sector has recorded very positive developments during the last decade. Value added from industry (including construction) reached 26% of GDP in 2020. The imports of Albania increased from USD 4.41B in 2015 to USD 5.42B in 2020. In 2020, the top imports are refined petroleum, cars, medicaments, tanned equine and bovine hides, footwear parts. Imports are mostly from Italy, China, Greece, Turkey and Germany. The exports of Albania have increased from USD 2.2B in 2015 to USD 2.62B in 2020. The top exports are leather footwear, footwear parts, non-knit men's suits, crude petroleum, raw iron bars. Exports are mostly to Italy, Serbia, Germany, Spain, and Greece.

Land use in Albania consists of 42.8% agricultural land**,** 28.8% forest and 28.2 % other. Even though the last decade's emigration and urbanisation brought a structural shift away from agriculture and towards industry and service, agriculture remains one of the largest and most important sectors in Albania, contributing to 18.9% of GDP in 2019. Currently, 1 billion cubic meters of water is needed per irrigation season to irrigate 360,000 hectares. In 2020, the total forest volume was 54,845,573 m^3. 94 % of this volume was of public forests and 6 % was private forests. Volume decreased by approximately 1,113 m^3 compared to 2019.

In Albania in recent years, the amount of waste generation has increased, while the way it is managed needs improvement. Waste management is performed in all urban areas and to a lesser extent in rural areas. Waste is mainly dumped in landfills designated by the Local Government Units. Recycling has progressed compared to a few years ago, companies have been set up to collect and recycle metals, plastics, paper and glass. Albania started the construction of 3 incinerators of urban waste in Elbasan, Tirana and Fier. The first one entered in operation in 2017 to perform tests and all the incinerators should be operational in 2023.

Over the years, tourism is crystallizing as one of the main engines of the country's economic development. During 2017, the tourism sector recorded a direct contribution of USD 1.12 billion, accounting for about 8.5% of GDP. The total contribution is almost three times higher at USD 3.47 billion, accounting for about 26.2% of GDP. For the next 10 years, a significant increase of the contribution of this sector to the economy is predicted.

The key national planning document currently in place is the National Strategy for Development and Integration 2015-2020 (NSDI-II), which was adopted by the Government of Albania in May 2016. This strategic document reflects the vision, priorities, objectives and means for social and economic development of the country up to 2020. The NSDI-II is organised around 13 cross-cutting foundations on good governance, democracy and rule of law, and four main sectoral pillars:

1. Growth through macroeconomic and fiscal stability
2. Economic growth through enhanced competitiveness and innovation
3. Investing in social capital and social cohesion
4. Growth through sustainable use of natural resources and territorial development.

The overarching goal of NSDI-II is the accession to the EU. After the EU's decision in March 2014 to open accession talks with the country, Albania is advancing the EU integration agenda.

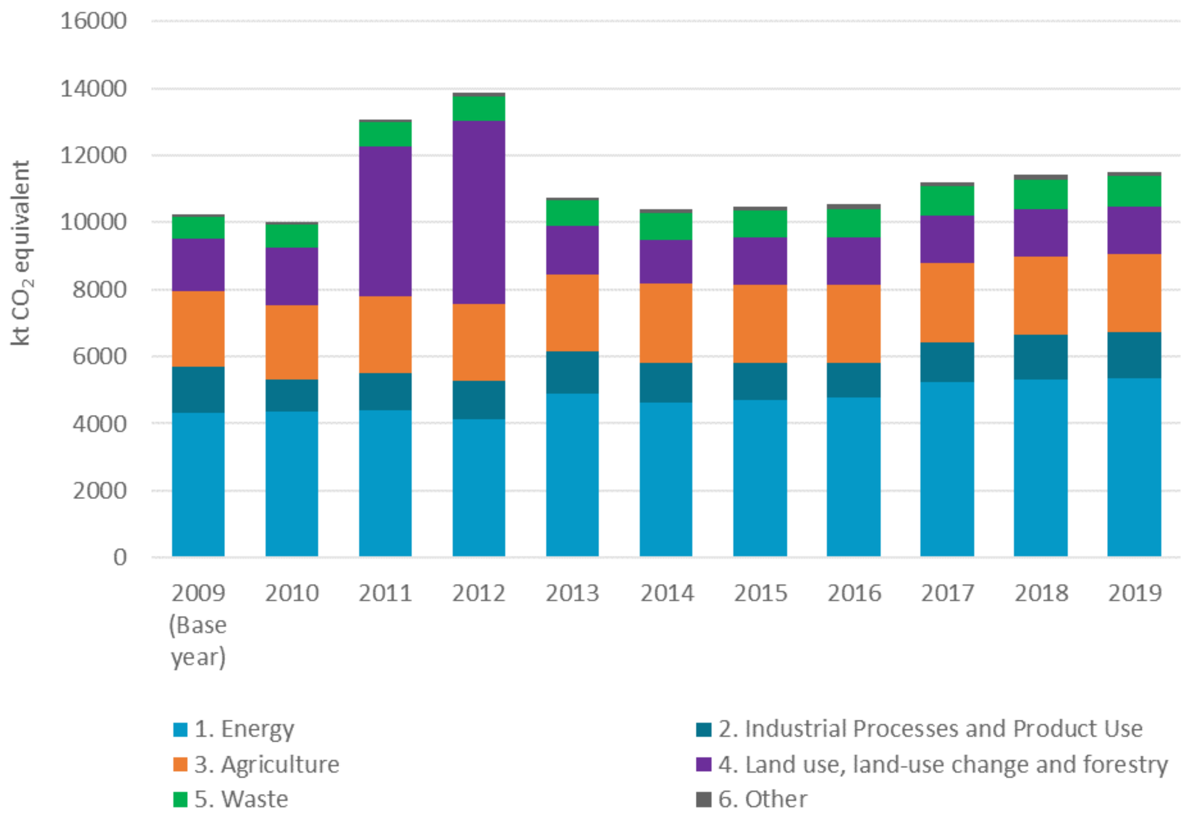
In line with global and regional commitments and national priorities, Albania has made progress on climate change mitigation and adaptation. In 2014, the Albanian government established the Inter-Ministerial Working Group on Climate Change (IMWGCC), which coordinates all institutions involved in climate change processes and facilitates the integration of climate change into relevant new and existing policies, programs, and activities. In July 2019, Albania approved a National Climate Change Strategy and corresponding national mitigation and adaptation plans. The country has implemented several mitigation and adaptation projects and studies. In October 2021, Albania submitted the revised NDC.

National greenhouse gas inventory

Albania, as a Non-Annex I country to the United Nations Framework Convention on Climate Change (UNFCCC), has been developing an inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs) emitted to or removed from the atmosphere since 1990 as part of its National Communications (NCs) on Climate Change. The national GHG inventory covers the years 2009-2019 and is consistent with the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines. Recalculations were not applied to years covered in previous national GHG inventories (2009-2016).

The inventory includes estimates of GHGs from Energy, Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change and Forestry (LULUCF) and Waste as shown in Figure 1. The inventory covers the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), and additional precursors and indirect greenhouse gases. To facilitate aggregate reporting of the GHG values, expressed as carbon dioxide equivalents (CO_2 eq.), as indicated in the Decision 17/CP.8, the global warming potentials (GWPs) values provided in the IPCC Second Assessment Report (temporal horizon 100 years) are used. The Tier 1 methods provided in the 2006 IPCC Guidelines are applied for all subsectors due to the absence of country specific emission factors.

Figure 1: National GHG emissions by sector (2009-2019)



The GHG emissions from the energy sector account for the emissions released because of fuel combustion activities, as well as the fugitive emissions from the extraction of solid fuels and transmission and distribution of liquid and gaseous fuels. Analysis shows that Transport is the most significant category across all years followed by Manufacturing Industry and Construction (related to fuel consumption). The GHG emissions from the IPPU sector come mainly from two main subsectors:

Mineral Industry and Metal Industry. The Metal Industry experienced a big drop in emissions due to a technology change in the Kurum Elbasan Steel company. Since 2010, it has been operating Electric Arc Furnace technology, which has a low emission factor. The GHG emissions from the agriculture sector have increased by 4.7% between 2009 and 2019. Emissions come from enteric fermentation, manure management and managed soils including the use of fertilizers. The GHG emissions from the LULUCF sector have decreased by 10.2% between 2009 and 2019. There was a large increase in emissions in 2011 and 2012 due to forest fires. The GHG emissions from the waste sector have increased by 42% between 2009 and 2019. In 2019, the highest contribution is that of solid waste disposal followed by wastewater treatment.

The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment), is conducted using Approach 1 in the 2006 IPCC Guidelines. A completeness assessment was carried out to identify any missing categories within the inventory. An uncertainty analysis was carried out to quantify the uncertainty of the compiled estimates and to help prioritise efforts to improve the accuracy of the inventory. The overall uncertainty of the 2009 and 2019 estimates are 2% and 5%, respectively. The overall uncertainty of the 2009-2019 trend is also 5%.

Mitigation actions

In 2019 Albania endorsed the Strategic Document on Climate Change and its Action Plan on Mitigation. Six mitigation strategy priorities (SP) are identified:

- SP.1 Ensure a sustainable economy growth consistent with GHG emission pathways defined in the NDC and move towards an economy-wide target to which all sectors contribute
- SP.2 Establish a monitoring, reporting and verification system of GHG in line with EU requirements
- SP.3 Strengthen the capacity of relevant institutions and inter-institution cooperation to address climate change issues
- SP.4 Streamline climate changes across sectoral strategic planning
- SP.5 Reinforce capacity building and awareness raising on climate change issues
- SP.6 Align with the EU Climate Change framework across sectors.

Albania submitted its first Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2015. It included a commitment to reduce business as usual (BAU) CO_2 emissions by 11.5% by 2030. This represented the country's contribution to the global efforts to address climate change which, as per the Paris Agreement, aim to limit the rise in global temperature to 1.5°C compared to preindustrial times.

As per Article 3 of the Paris Agreement, countries' contributions are expected to be "ambitious" and "represent a progression over time". For this reason, in October 2021, Albania presented its revised NDC with enhanced ambition, but also with a broader scope that encompasses more types of GHGs and more sectors. Albania's revised contribution to mitigation aims to decrease emissions by 3,170 kt CO_2eq. by 2030 compared to the BAU scenario, corresponding to a mitigation impact of -20.9%.

The revised NDC is complemented by its Implementation Plan which lays out the roadmap to operationalize the NDC. It acknowledges that climate change is a cross-cutting issue for all sectors and regions of Albania, and that several policies and strategies have or are being developed to address it in many of these sectors and regions. The Action Plan also builds on the National Climate Change Strategy and Plan (NCCS&P), not only through the integration of the priority actions in the revised NDC, but also by aligning implementation mechanisms and timelines.

- Emissions for the NDC scenario for the energy sector (with mitigation measures) increased from 4430 kt CO_2eq. in 2016 to 6,234 kt CO_2eq. in 2030, which represents a growth of +40.3%. The difference in 2030 with the BAU scenario is -1,963 kt CO_2eq., representing a mitigation impact of -23.9%.
- Emissions for the NDC scenario for the agriculture sector (with mitigation measures) decrease from 2,344 kt CO_2eq. in 2016 to 2,183 kt CO_2eq. in 2030, which represents a change of -6.8%. The difference, in 2030 with the BAU scenario is -114 kt CO_2eq., which represents a limited mitigation impact of -4.8%.
- Emissions for the NDC scenario for the LULUCF sector (with mitigation measures) decrease from 1,430 kt CO_2eq. in 2016 to 326 kt CO_2eq. in 2030, which represents an evolution of -77.2%. The difference of 2030 with the BAU scenario is -1,153 kt CO_2eq., which represents a mitigation impact of -80.6%.
- In the waste sector, emissions for the NDC scenario decreased from 977 kt CO_2eq. in 2016 to 796 kt CO_2eq. in 2030, which represents an evolution of -18%. The difference in 2030 compared to the BAU scenario is -171 kt CO_2eq.

Vulnerability and adaptation assessment

The vulnerability and adaptation (V&A) assessment is focused on the Vjosa River Basin (VRB), which is the second largest water system in Albania. This report provides a research-based analysis on climate vulnerabilities (current and future due to climate changes) for sectors/systems: water resources, agriculture, biodiversity and forests, soils, health, disaster risk, tourism, population and settlements, and gender. It also considers existing adaptive capacities and priority adaptation measures potential to cope with climate changes.

The Vjosa River represents one of the last intact large river systems in Europe, hosting different types of ecosystems. Because the river has not been subjected to large damming or channelling schemes, it is considered one of the rare remaining natural flow regimes in Europe. The Vjosa River Basin (VRB) is the second largest water system in Albania (6784 km^2) and is one of the longest transboundary rivers in the Balkan area.

The annual average temperature for the VRB in 2010 already reached the values projected for 2020. Further analysis shows that since the turn of the century there has been a positive trend of increasing temperature for all seasons. The total number of days with a maximum temperature of 35°C or higher, an indicator of extremely hot days, is higher for the period 1986- 2005 (20 years) compared with the period 1961-90 (30 years). A reverse trend is observed in the number of frost and extremely cold days.

Analysis of the annual precipitation trend for the period 1931-2008 for the Vjosa downstream area indicates different sub periods with a highly wet period during 1935-1945, followed by a wet period between 1951-1980, a dry period between 1981-2000 and since 2000 a period of increasing precipitation. Analysis of seasonal precipitation patterns shows no consistent patterns in variation with periods above and below normal values. The distribution of number of days with precipitation shows a decreasing trend over the years. The 24-hour maximum amount of precipitation is the most important parameter concerning the rainfall intensity, which is expected to increase.

Sea level is projected to rise. As per the worst scenario, the sea level is expected to rise by 27 cm and 80 cm by 2050 and 2100, respectively. These simulations do not consider the tectonic movements.

Climate change will affect the hydrology of the Vjosa watershed and the water resources in the VRB area as summarised in the table below.

Table 1: Expected effects on water resources due to climate changes in VRB area

Factor	Effects/Risks	Effects on water resources
Temperature	• Decreased annual runoff • More rainfall than snow during the winter • Increased evaporation • Increased frequency of droughts.	• Increased demand for water for agriculture, industry, population, tourism • Decreased water in the water supply system • Increased demand for drinking water in the summer with unmet demands during the months of July, August, and the highest unmet demand occurring each year in September.
Precipitation	• Increased occurrence of floods, especially during winter, but also during autumn and spring months.	• Effects on water quality, water infrastructure integrity and increase fluvial erosion.
Sea Level Rise	• Salinization of coastal aquifers • Seawater intrusion into freshwater aquifers in deltaic areas • Increased exposure of coastal areas to floods from storm surges and erosion.	• Decreased availability of freshwater • Destruction of settlements, infrastructure and natural environment from floods and erosion and in coastal part and along the Vjosa Riverbed.

Mediterranean regions are particularly vulnerable to soil erosion because of the highly irregular behaviour of the rainfall regime, both on spatial and temporal scales. The phenomenon of soil erosion in the Vjosa River Basin is projected to continue in the coming years under two climate change scenarios undergoing a gradual increase of the quantity of eroded material.

Agriculture is one of the key sectors of Albanian economy and one of the sectors most vulnerable to climate change, the effects of which are summarised in the table below. In general, an increased water demand for irrigation is expected. Most crops require around twice as much water than is available through rainfall. Grape and olive yields will decrease whilst winter wheat, alfalfa and maize will increase. It is expected that the growing season will be 12-13% longer than the 1986-2005 period. Sheep and cattle will be more affected in lowland areas due to heat stress, water availability, pests, diseases, and forage production. The South highland area is expected to be more affected by diseases as the vectors of their spread affected by global warming is the south-north direction.

Table 2: General effects of climate changes in agriculture

Factor	Effects/Risks	Effects on agriculture
Temperature	• Temperatures higher than 25°C in summer, • Increased evaporation, • Increased frequency of droughts, • Decreased number in frost days, • Extension of the growing season length.	• Increased risk of water stress and increased demand for irrigation • Yields of most agricultural crops are expected to decrease • Damages in maize, tomatoes, perennial plants production • Yield reduction in perennial crops that have a chilling requirement • Some of the crops, like alfalfa, grass and winter wheat, will be positively impacted.
Precipitation	• Increased occurrence of floods due to more frequent and longer heavy rains.	• Intensive flooding of agriculture area and large economic damages.
Sea Level Rise	• Salinization of coastal aquifers.	• Decreased availability of freshwater • Intrusion of salt waters in agriculture lands, loss of lands (coastal erosion).

In general, the impacts of expected climate change on biodiversity are summarized in the table below. Climate change directly affects the spatial distribution of forest ecosystems, reflecting the differences in forest belts, pastures, plant associations and even habitats. Functioning, productivity structure, ecological stability, health status and relationships of species with their environment can become fragile with changes in temperature and precipitation.

Table 3: Expected impact of climate changes in biodiversity

Factor	Effects/Risks	Effects on biodiversity
Temperature, precipitation	• Temperature increase, • Precipitation decreases.	• Habitat fragmentation and vertical displacement of plant associations.
Sea Level Rise	• Seawater diffusion, • Coastal erosion.	• Flooding, land loss, salinization of groundwater and biodiversity loss • Negative impact in marine and coastal ecosystems services • Change in water fauna and flora in favour of species that like more warmth and salinity.

Albania is a disaster-prone country and is exposed to geological hazards (earthquakes, rock falls and landslides) and hydro-meteorological hazards. Floods, flash floods and forest fires are the most frequent disasters caused mainly by the hydrological and meteorological conditions (accounting for more than 90%). Some general effects of climate changes on disaster risk are shown in the table below.

Table 4: Expected disaster risks due to climate changes

Factor	Risks	Effects/disaster risks
Temperature	• Increased frequency of droughts • Strong winds.	• Increased frequency and intensity of forest fires.
Precipitation	• Increased frequency of heavy precipitation.	• Increased occurrence of floods, flash floods especially during winter, but also during fall and spring months • Direct damages (such deaths, missing people, the people directly and indirectly affected) • Destruction of settlements, infrastructure and natural environment.
Sea Level Rise	• Increased exposure of coastal areas to floods from storm surges and erosion.	• Destruction of settlements, infrastructure and natural environment from floods and shoreline regression in low lying coastal areas and riverbeds.

Health vulnerability of communities living in the regions of Vjosa Basin will be influenced not simply by the individual level of exposure of the people there. Health outcomes will be strongly shaped by demographic and societal factors at a larger scale as well as health preconditions. Additionally, governance and organization of specific elements of the health system, including access to basic health care, public health programs and surveillance systems will also play a crucial role in determining health outcomes. Climate change may accentuate the health burdens associated with those worsening trends or may slow or reduce any observed improvement.

Considering the expected changes in climate, increase in maximum temperatures, heat waves and the intensification of droughts, people's living processes are expected to become more difficult and stressful, leading gradually to a deceleration of the rhythm and of the efficiency of social and economic activities, with an unavoidable impact in life quality.

The total number of foreign visitors has increased significantly in recent years, with an increase of 80% in 2016 compared to 2011. The tourism sector should be affected both favourably and unfavourably by projected climate change. The "sun and sea" tourism prevalent in the coastal area currently takes place essentially in the months of July and August, as these present the best temperature and precipitation conditions for this type of tourism. Changes in these variables will favour an extension of the touristic season. Under the conditions of climate changes and in preparation for the country to host a larger number of tourists from developed countries, the cost of the construction of tourist structures will increase, since it must include a 24-hour water and electricity supply, thermo isolation, hydro isolation, energy for heating and cooling, facilities for sports and recreational activities, safe parking etc.

The Shared Socioeconomic Pathways developed by the team from the Organization for Economic Co-operation and Development were used to assess the projected changes in GDP, population, tourism, water demand and agriculture production. Each of the five scenarios provides a different pathway for these indicators.

Adaptation measures and plans

After the identification of expected impacts due to climate changes the vulnerability and adaptation team have proposed a list of measures/actions economic sectors/systems in VRB to cope with the expected changes of climate. An integrated adaptation plan is drafted for the VRB area. These measures relate to policy governance, scientific, technical and social capacity and climate change delivery.

Constraints and Gaps in vulnerability and adaptation assessments

The climate change impact assessment remains one of the main challenges. Issues such as the lack of historical data for different sectors, lack of indicators and data regarding different hazards and disaster events obstruct a comprehensive and a cross cutting vulnerability and risk assessment. It is quite evident that, in Albania, more than 90% of disasters are closely connected with meteorological conditions. Moreover, climate change is expected to increase the frequency and duration of extreme events, and it is still difficult to determine the exact extent of the impact that can be attributed solely to human induced climate change. This requires a multi-disciplinary framework and a cross cutting analyses that will allow to adopt the best adaptation options.

Research and systematic observation

The first organized hydro-meteorological network was established in Albania in the early 1930s. In 1949 the Directorate of Hydro-meteorological Service was created under the jurisdiction of the institute of Sciences, followed by the Hydro-meteorological institute (HMI), under the Albanian Academy of Sciences. Since 2011 the monitoring task has been held by the Institute of Geosciences, Energy, Water and Environment (IGJEUM) under the Polytechnic University of Tirana, which was created through the merger of some research institution.

Research on climate change in Albania is still at its pioneering phase. Even though climate has entered the lexicon of the research community, especially through the education system, research outputs in the field of climate, energy efficiency, and environmental management in general are very limited. The main research institutions in Albania include the Academy of Sciences and Universities (public and private), including their affiliated entities. In addition, national and International NGOs have influenced the establishment of the national innovation, technology transfer and R&D infrastructure through awareness raising in climate change and sustainable development.

Education, awareness raising and information share

The National Strategy on Climate Change (2019) has recognized the need to work towards raising public awareness of climate change. It highlights that climate change still does not get the proper appreciation in public opinion, as climate awareness at all levels remains low and cooperation between all relevant stakeholders requires further strengthening. The approaches foreseen in the strategy aiming at increasing climate change awareness and communication, training and education, call for further major interventions. This includes capacity development activities at the central and local levels, as well as a communication strategy on climate change issues, addressed to the central and local levels, as well as public and private stakeholders. Achieving awareness through educational institutions is considered a priority of the development, outreach, and engagement strategy on climate change. This includes designing educational modules on climate change and introducing campaigns in schools and incorporating knowledge on climate change into relevant curricula.

Gender and climate change

Vulnerability to climate change is differentiated by gender. Albania reports lower gender inequality levels than the world average. However, women still face obstacles for enjoying their equal rights, such as a more limited access to assets, lower paying jobs, less land ownership, and less representation in decision-making instances. In relation to climate change and its impacts, the burden carried by women is much higher. In recent years, with the Albanian ratification of international conventions and agenda in relation to climate change, progress has been made in the design of policy and legal strategic documents for addressing climate change. The National Integrated Energy and Climate strategy was formulated, as an engagement of Albania at the Ministerial Meeting of the Energy Community in 2017. However, policy steps to bring gender mainstreaming into climate change policies are not yet thoroughly addressed by national policies. Consideration must be taken in addressing gender issues when designing programs and projects at community level, especially within the agriculture sector.

National Circumstances

1 National Circumstances

1.1 Governance structure

The Republic of Albania (hereafter referred to as Albania) is a constitutional republic with a democratically elected parliament. The president is the Head of State and has general powers as Commander-in-Chief of the army and Chair of the national Security Council. He is also the head of the High Council of Justice. Legislative power is concentrated in the Albanian Parliament. The system of government is based on the separation and balancing of legislative, executive and judicial powers. Since the early 1990s, Albania has implemented important structural reforms to promote equitable economic growth and improve governance and public service delivery. In a transition from a centrally planned to a market-oriented economy, this has included macroeconomic and fiscal sustainability, financial sector stabilisation, energy reform, social assistance and disability reform, and territorial decentralisation. The legislative power belongs to a single organ, the assembly of Albania. The assembly consists of 140 deputies. The Council of Ministers is created at the beginning of each legislature of the assembly after the legislative election, as well as when the position of the Prime Minister is vacant. The Prime Minister is the main figure of the executive power. The Council of Ministers carries out foreign and domestic policies and directs and controls the activities of the ministries and other state organs. The parliament must approve legislation proposed by cabinet members to come into force.

The Judiciary of Albania interprets and applies the law of Albania. Albania's judicial system is a civil law system divided between courts with regular civil and criminal jurisdiction and administrative courts. It is governed by the High Council of Justice *(Këshilli i Lartë i Drejtësisë)*, and its management is aided by the office of the President of Albania, the Ministry of Justice, and the various courts chairpersons.

Albania is divided into 12 regions (Qark), with limited role, and 61 urban and rural municipalities (bashki and komuna)[1]. Local governments' autonomy has been consecrated by the decentralization laws. According to this principle and legislation, their competences and resources are clearly defined in coherence with a prevailing subsidiarity principle. Local governments have few social sector responsibilities. They share responsibilities with the central government on matters such as social services, health care and education. Their own competences are infrastructure, water supply and sewerage, cleaning and waste removal[2]. The capital of Albania is Tirana.

1.2 Geography

Albania is in south-eastern Europe, in the western part of the Balkan Peninsula. It is located to the north of Greece and to the south of Montenegro and Kosovo. To the west, it borders the Ionian (south) and the Adriatic (north) seas, in the Mediterranean Sea, for 476 km. Albania's land area totals 28,748 km^2. The country's average altitude is 708 m above sea level, as 70% of the territory is mountainous. Albania's coordinates are north: Malësi e Madhe (42°39'55"n 19°43'57"e); south: Sarandë (39°38'54"n 20°12'52"e); west: Sazan island, Vlorë (40°30'35"n 19°16'32"e) and east: Devoll District (40°37'52"n 21°4'6"e). Mountainous and hilly areas are grouped into three regions:

[1] According to the Law No. 115/2014 "On Administrative-Territorial Division of the Local Government Units in the Republic of Albania

[2] https://search.oecd.org/regional/regional-policy/profile-Albania.pdf#:~:text=In%202014%2C%20the%20Law%20No.%20115%2F2014%20%E2%80%9COn%20Administrative-Territorial,as%20constituent%20administrative%20units%20of%20the%20new%20municipalities.

Northern, Central and Southern. Plain lands occur to the West along the Adriatic coast, between Hani Hoti in the North and Vlora in the South.

The geological and climatic characteristics of the country have led to the existence of an extensive network of rivers and lakes; these have mixed flow regimes that are influenced especially by prevailing rainfall and snow. Albania has many natural and artificial lakes.

Albania is a highly biodiverse country. Its territory is comprised of maritime ecosystems, coastal zones, lakes, rivers, evergreen and broadleaf bushes, broadleaf forests, pine forests, alpine and sub-alpine pastures and meadows, and high mountain ecosystems. Albania's flora constitutes 29% of flora in Europe and 47% of flora in the Balkans. Its fauna includes a variety of mammals, birds, and reptiles and sea, lake, and river species. Protected areas occupied a total area of 523,831 ha in 2020, representing 30.0% of the forest fund area and about 18.0% of the total country area. Albania is also well known for its rich and complex hydrographic network of rivers, lakes, wetlands, groundwater and seas. Wetland ecosystems are important migration routes for migratory species of wild fauna (3 Ramsar sites of international importance have been designated- Karavasta Lagoon, Butrinti Lake and Shkodra Lake). Albanian lakes and rivers are also important in terms of their contribution to the biological and landscape diversity of the country. About 247 natural lakes of different types and dimensions, and a considerable number of artificial lakes, are located inside the country. The alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is recognized as a major factor contributing to the loss of biological diversity and ecological function in aquatic ecosystems, including floodplains[3].

Albania is a rich country in water resources. The total annual rate of flow is 39.22 billion m^3/year, where 95 % is discharged into the Adriatic Sea and only 5% into the Ionian Sea. Water resources are an important source of hydropower, producing around 90% of the country's energy and providing irrigation for agriculture. However, water resources have been polluted in populated areas. Albania's natural resources also include metals and oil.

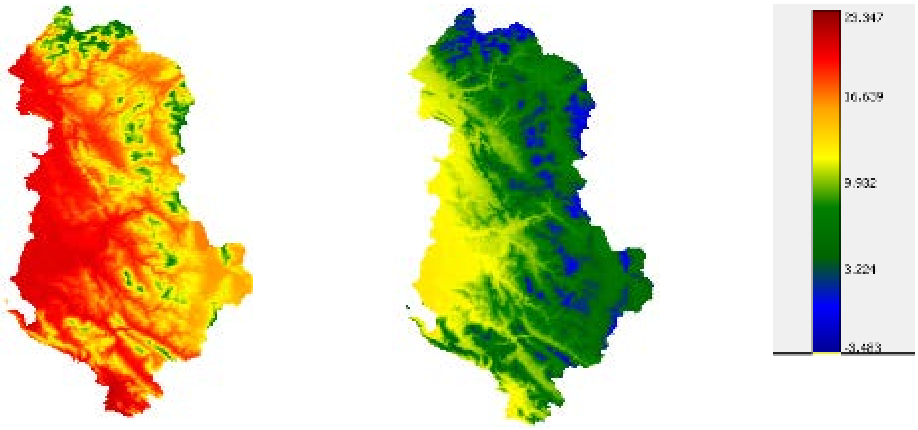
1.3 Climate

Albania has a Mediterranean climate, which involves mild and humid winters and hot and dry summers, with some continental influence in the south-eastern part of the country.

Annual average air temperatures range from 11.3 °C in mountainous areas to 21.8 °C in lowland and coastal areas, while minimum annual average temperatures range from -0.1 °C to 14.6 °C, respectively. The lowest temperatures were recorded in Sheqeras (-25.8 ° C), Voskopoja (-25.6 °C) and Biza (-34.7 °C), while the highest were encountered in Kuçova (43.9 °C), in Roskovec (42.8 °C) and in Çiflig (42.4 °C). Figure 2 shows the distribution of annual average maximum and minimum temperatures.

[3] https://www.cbd.int/countries/profile/?country=al#

Figure 2: Distributions of average maximum temperature (left) and average minimum temperature (right)



The annual average precipitation total is 1430 mm. However, the spatial and seasonal distribution of rainfall varies; 70% of the annual rainfall occurs during the cold half of the year. The most humid areas are the Albanian Alps in the north (Koder Shengjergj with 2935 mm and Boga with 2883 mm annual precipitation) and Kurveleshi in the south (Nivica with 2204 mm annual precipitation). The highest level of precipitation is experienced in November and the lowest during July to August.

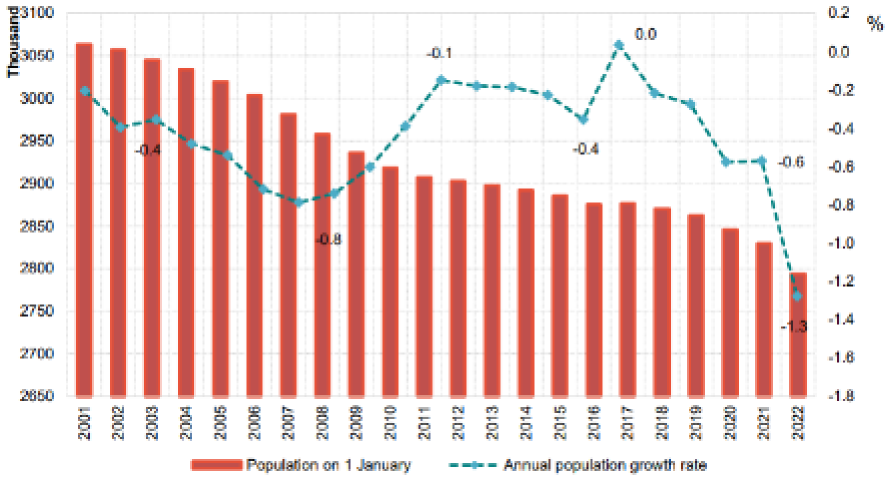
Snowfall occurs in the Albanian Alps, in the mountainous central and southern areas. The average snowfall depth in mountainous areas is 60-120 cm, with the highest snowfall reaching a depth of 2-3 m in Vermosh, Boga, Theth, Valbona, Curraj and Lure. Snow is rare in the West Plains lowlands to the southwestern coast.

Projections for the climate in 2050 include further increases in temperature and heat waves, decreases in total precipitation, increases in frequency and duration of extreme events like floods and droughts, and rising sea levels.

1.4 Population

The population of Albania on January 1st, 2022, is 2,793,592, experiencing a decrease of 1.3%, compared to January 1st, 2021. During 2021, the natural increase of the population (birth – death) was -3,296 inhabitants, marking for the first time a negative natural increase. Recent demographic developments also show that Albania's population is shrinking (Figure 3) and aging. This is due to a low birth rate and more importantly, negative net migration. Most studies project that the demographic decline will continue.

Figure 3: Population on 1st January and annual growth rate



Source: INSTAT

Albania is fairly densely populated. In 2018, the average population density was 99.7 inhabitants per km^2. The urban population has increased from one-third in the early 1990s to an estimate of almost two-thirds (62%) in 2020 and is expected to continue to rise. The largest city is Tirana, the country's capital, which had an estimated population of 421,000 in 2020, with a greater metropolitan population of 764,000. The second-largest metropolitan area in Albania is the ancient city of Durrës, only 30 km from Tirana, with an estimated population of 202,000 in 2020. As of January 1, 2022, Tirana occupies about 32.9% of the total population, continuing to be one of the most populous regions of the country, followed by Durrës and Fier with 10.4% and 10.0% respectively. Other major cities include Vlorë, Elbasan and Shkodër.

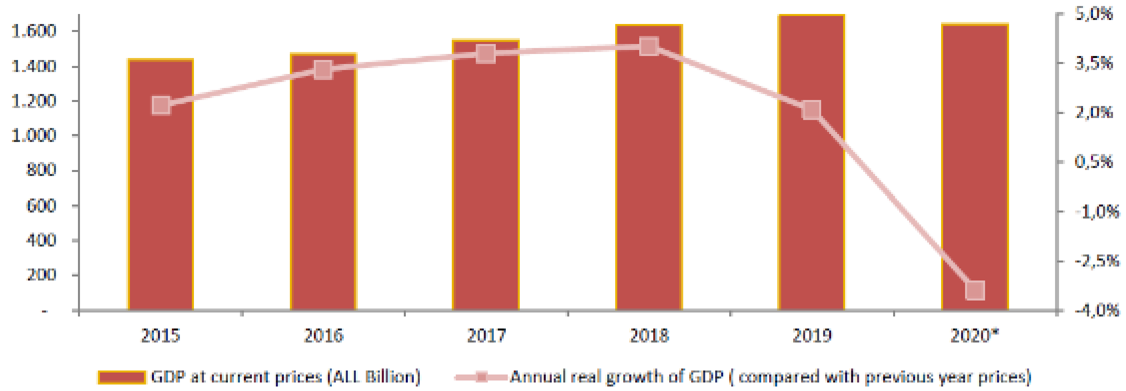
According to the latest Human Development Report, published in 2020 and reflecting data from 2019, Albania placed 69th among 189 countries with a Human Development Index (HDI) value of 0.795. Tirana (0.820), Vlore (0.802) and Durres (0.802) have "very high HDI values", followed by counties like Gjirokaster (0.794), Korce (0.790) with "high HDI values" [4].

1.5 Economic profile

After 50 years of communist rule, Albania has transformed from one of the poorest countries in Europe in the early 1990s to an upper-middle-income country in 2020. As a result of three decades of remarkable economic growth (Figure 4), in 2020, its gross domestic product (GDP) was USD 14.89 billion, and its GDP per capita was USD 5,246.1. In 2022 the GDP is 17.2 billion USD and GDP/capita 6089.5 USD[5]. However, public debt has increased over 65% in 2019 and reached 78.1% in 2021[6].

[4] UNDP. Human Development Report 2020. The next frontier. Human development and the Anthropocene
[5] https://www.worldbank.org/en/country/albania/overview#1)
[6] https://albaniandailynews.com/news/albania-s-public-debt-exceeded-78-in-2021#:~:text=Albania%27s%20public%20debt%20broke%20the%20historical%20record%20in,to%20official%20data%20from%20the%20Ministry%20of%20Finance

Figure 4: GDP and real growth rate from 2015-2020



Note: 2019 Final data, 2020 semi-final data*
Source: INSTAT

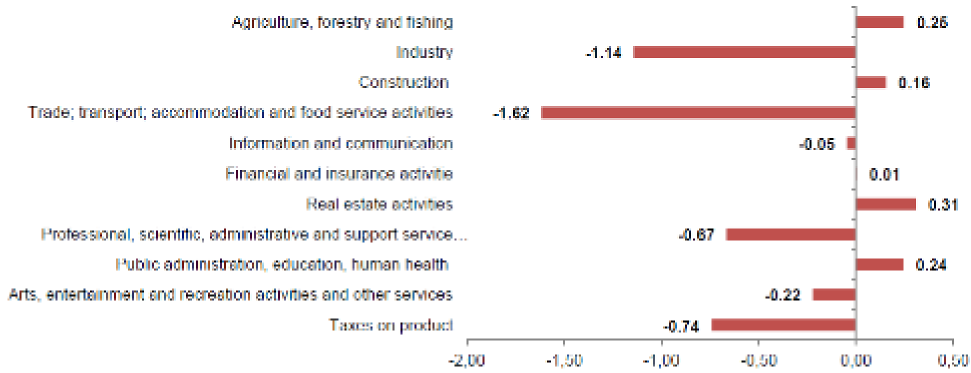
This economic growth has been associated with structural economic changes, with a transition from an economy based on raw materials, agriculture and industry, into a more diverse economy where the service sector plays a leading role. In 2019, the service sector (represented by the subsectors of trade, transport, commercial activities and telecommunication services) constituted about 50% of the GDP of the country. Industry and construction made up about 20% of the GDP and the agriculture sector contributed about 19% of the GDP.

The service sector both public and private, is one of the most important and dynamic sectors of the Albanian economy. While the value generated by the sector contributed 3.2% to the average annual growth of GDP in 2010, nowadays it accounts for more than 60% of total value added. The main economic focus of this sector is commercial activity. According to the Bank of Albania, the biggest part of economic growth over the years has been attributed to the development of this sector and it is evaluated through the index of corporate sales, covering trade companies, hotels and restaurants, transportation, telecommunication and other services. Two main services where foreign direct investment is oriented are telecommunications and financial intermediation, 23% and 33% respectively. Telecommunications is the most dynamic service sector in the Albanian economy.

Figure 5 shows the contribution of the main branches of the economy to real growth rate of GDP in 2019 (%).

The shift in the country's economic structure, from agriculture and the primary sector in general, to the less energy intensive service sector as well as to the production of higher value products, is reflected in the evolution of Albania's energy intensity that was more than twice the EU average in the year 2000 but has been decreasing since then. To a lesser extent, the decrease in energy intensity can be attributed to the improvement of energy efficiency and the application of relevant measures for thermal insulation of building stock, efficient lighting and other energy efficiency measures.

Figure 5: Contribution of the main branches of the economy to real growth rate of GDP in 2019 (%)



Source: INSTAT

Over the last three decades social indicators have improved in Albania. In 2019, Albania's Human Development Index value, which considers life expectancy at birth, education and gross national income per capita, was 0.795 – which put the country in the high human development category – positioning it at 69 out of 189 countries and territories. In 2012, the most recent year with official poverty figures, 14.3% of Albanians lived below the national poverty line[7], while 1.1% lived below the international extreme poverty line and 39.1% lived below the upper middle income poverty line. Unemployment reached a historically low 11.4 percent in Q3 of 2019. The latest Gini index (an indicator representing income or wealth inequality with a value of zero representing perfect equality) is from 2017 and was 33.2[8]. Between 1990 and 2018 life expectancy at birth increased by 6.6 years, mean years of schooling by 2.2 years and expected years of schooling by 3.6 years.

The socio-economic progress of Albania has been recently hampered by two shocks. The country was hit by a devastating earthquake in November 2019. The earthquake, measuring 6.3 on the Richter scale, the strongest in 30 years, caused 51 fatalities, injured at least 913 people and affected over 200,000 people (17,000 people were displaced). It caused extensive damage to physical assets in 11 municipalities, including the two most populous and developed municipalities (Tirana and Durres). Tourism assets and housing were hit the hardest. The earthquake led to losses equivalent to an estimated 7.5% of GDP.

During the reconstruction efforts, the COVID-19 crisis is putting more pressure on the Government's budget and response, and the country's socio-economic progress, as Albania was forced to put key economic sectors in lockdown. The tourism sector, a key driver of growth, was hit especially hard because of containment measures and travel restrictions. In the second quarter of 2020, employment declined by 3.6% year-on-year.

A robust recovery took place in 2021 thanks to a policy stimulus and the resurgence of travel, construction, and extractive activity. Private investment, consumption, and public spending drove growth, while public debt remained high. Rising inflation and the war in Ukraine threaten economic and poverty prospects in 2022[9] . Nevertheless, Albania is working to ensure economic growth through macro-economic and fiscal stability (NSDI II, 2015-2020, Pillar 1). Innovation will become a

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[7] The national poverty line is set at 60% of national median equalised disposable income (after social transfers). The percentage of Albanians living below the poverty line decreased from 25.4% in 2002 to 12.5 in 2008 and then increased to 14.3% in 2012. The international extreme poverty line is set up at US$1.90 per person per day (2011 PPP). The upper middle income country poverty line is set at 5.5 per person per day, 2011 PPP.

[8] https://data.worldbank.org/indicator/SI.POV.GINI?locations=AL

[9] https://www.worldbank.org/en/country/albania/overview#1

key source of growth and value added, even in traditional, relatively low-technology sectors, such as agriculture, food processing, industry, transport, construction and light industries[10].

1.6 Energy

The energy sector is a priority sector for the government. Albania is endowed with a wide variety of energy resources ranging from oil and gas, coal and other fossil fuels, hydropower, natural forest biomass and other renewable energy[11].

The primary energy supply in Albania is dominated by oil products, hydro and net import electricity, fuel wood and a small amount of coal and natural gas. Referring to the final Energy Consumption by energy source for years 2009 and 2016 results that oil products have been reduced from 60.40% (2009) to 58.93% (2016), hydro & net import electricity have increased from 26.69% (2009) to 28.53% and wood has been reduced from 10.04% (2009) to 7.96% (2016). The sectors with the highest Energy Consumption in Albania in 2009 were the transport sector that consumed about 20.2% of the final energy, followed by households (25%) and industry (19%)[12]. Figure 6 and Figure 7 show respectively the energy supply and final energy consumption by energy source for the year 2016 (%).

Figure 6: Energy supply by energy source for the year 2016 (%)

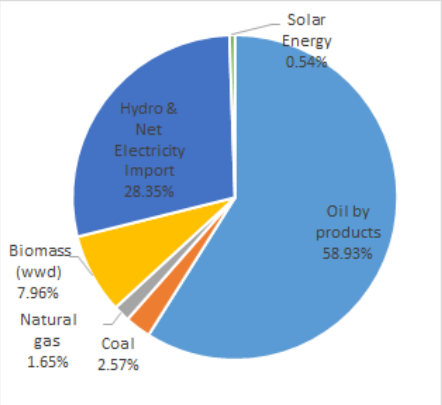
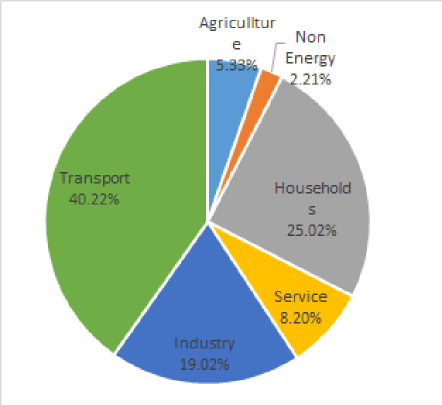


Figure 7: Final energy consumption by energy source for the year 2016 (%)



Source: Albania revised NDC

Figure 8, Figure 9 and Figure 10 present the energy supply trend for Albania for 2009-2019[13]. Analysis shows that crude oil and oil derivatives have the highest contribution with 57.09% followed by hydro and electricity imports with 28.03%.

[10] NSDI II 2015-2020
[11] MoEFWA and UNDP, 2009
[12] Albania Revised NDC
[13] Albanian Yearly Energy Balance prepared by AKBN/MIE and published by INSTAT

Figure 8: Primary energy supply for Albania from 2009-2019 (%)

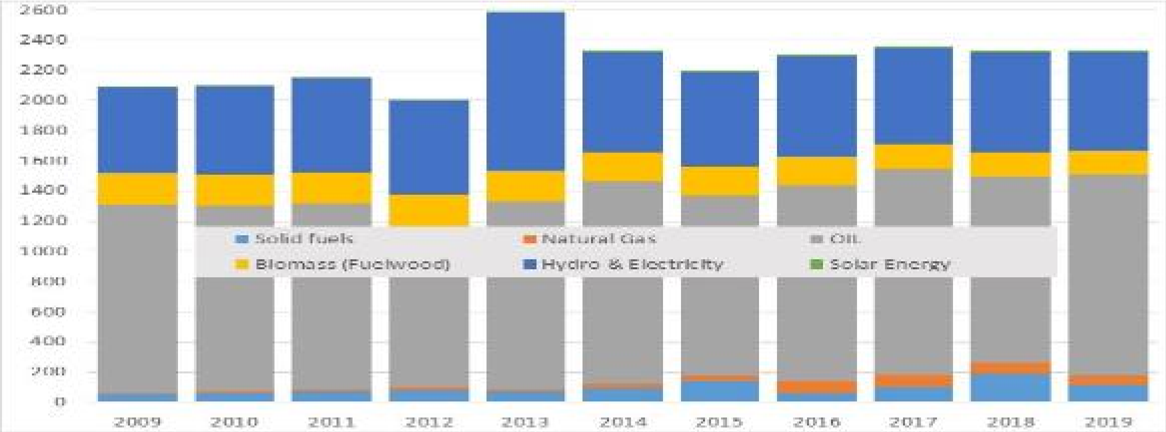


Figure 9: Primary energy supply for Albania in 2019 (%)

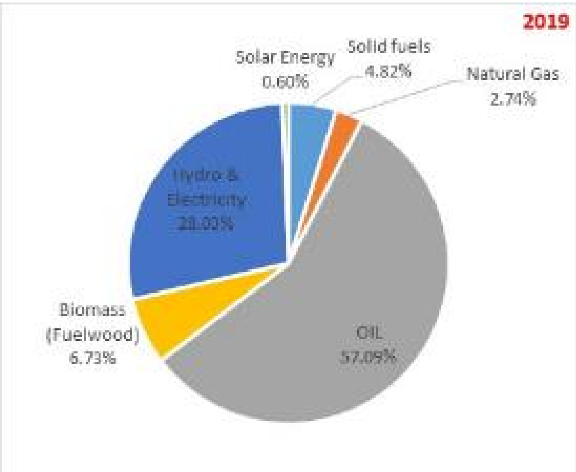


Figure 10: Primary energy supply for Albania in 2009 (%)

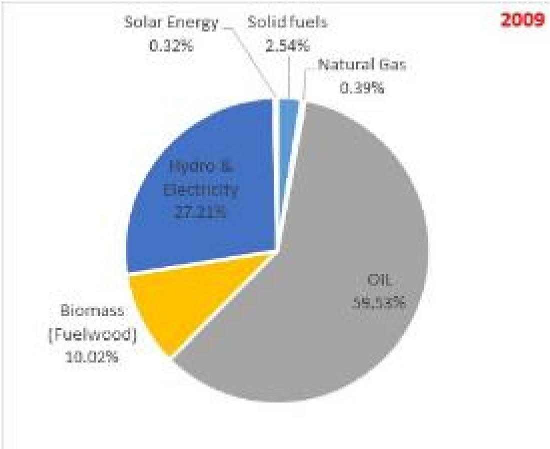


Figure 11, Figure 12 and Figure 13 present energy consumption trends for all sectors in Albania for the from 2009-2019[14]. Analysis shows the transport sector has the highest contribution with 40.46%, followed by the household/residential sector with 23.16%.

[14] Albanian Yearly Energy Balance prepared by AKBN/MIE and published by INSTAT

Figure 11: Energy consumption according to the economic sectors for Albania from 2009-2019 (ktoe)

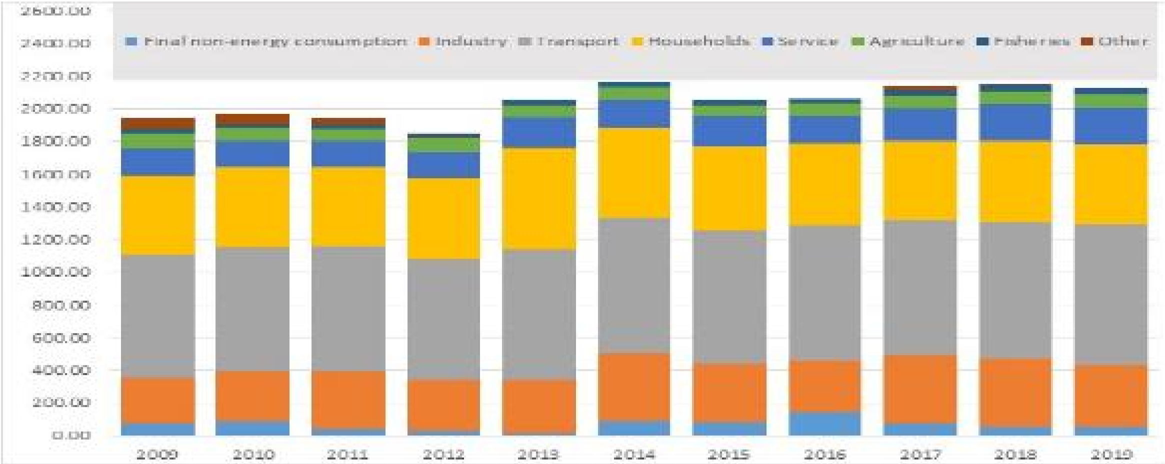


Figure 12: Energy consumption according to the economic sectors for Albania in 2009 (%)

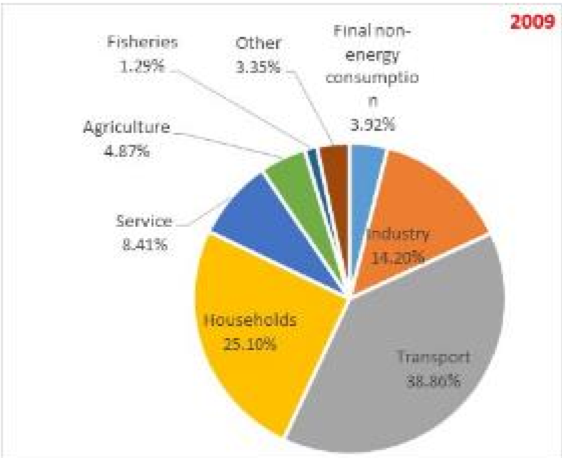
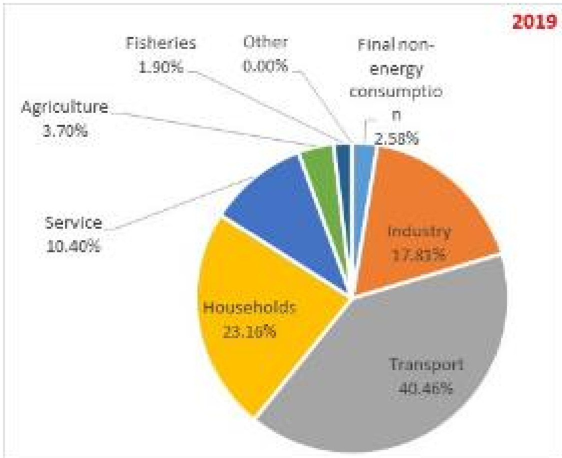


Figure 13: Energy consumption according to the economic sectors for Albania in 2019 (%)



Electricity generation has been historically met almost exclusively by hydropower plants, with a total installed power capacity of 2,011 MW at the end of 2016. The country has exploited approximately 50% of its hydropower potential, and future expansion of hydropower capacity is possible mainly along the Drini, Mati, Devolli, and Bistrica rivers. Because of new investments in small and medium-sized hydro power plants, total installed capacity reached 2,204 MW in 2018, of which 1,448 MW are state owned (1,350 MW hydro and 98 MW thermal), with the remainder private.[15]

To improve the sector production during the last few years, Albania has been working to change its energy efficiency policy by supporting the use of renewable energy sources, making that a part of the country's energy strategy. Due to the fall in technology costs and significant renewable energy potential that the country has, wind and solar PV can be deployed cost-effectively to mitigate the impact on the end-consumer electricity price. By the end of 2018, there were an additional 10 MW of solar PV installed[16], increasing solar generation capacity to 21 MW.[17]

[15] https://legacy.export.gov/article?id=Albania-Energy
[16] the National Energy and Climate Plan of the Republic of Albania

The only thermal power plant, Vlora TPP, is not yet operational, and its conversion to natural gas is foreseen following construction of the Trans Adriatic Pipeline (TAP). Albania imports electricity from neighbouring countries, although imports have progressively dropped in the last ten years following the increase in domestic power generation and the reduction of (technical and non-technical) electricity losses in the distribution system, which have been reduced from 45% in 2013 to 28% by the end of 2016 with a clear investment and management plan to reduce them further to 17% by the end of 2022.

The Albanian Government has reformed and liberalized the electricity market by adopting the Albanian Market Model and regulatory Framework that provides for concessionary agreements for small hydropower plants, oil, and gas, and promoting the construction of energy parks. Electricity generation capacity has improved through the construction and the operation of several small hydropower plants (SHPPs), but the country remains over-dependent on hydro-generation for energy production.

The National Energy Strategy 2018–2030, developed in accordance with the National Strategy for Development and Integration II (NSDI – II), is the main strategic document for the energy sector of the country. It is in line with national efforts to support economic development and to meet commitments under the Energy Community Treaty, the EU integration process and other international agreements, increasing security of energy supply and minimizing environmental impacts with affordable costs for Albanian citizens and all sectors of the economy.

Potential investments related to the implementation of the strategy amount to 2.7 billion euro ($3.3 billion) for the 2018-2030 period. According to the targets set in the strategy, Albania will aim to reduce power distribution losses from 26.4% in 2017 to 10% in 2030. The collection rate of power bill payments will also improve to 98% in 2030, from 90% in 2018. Renewable energy consumption will increase to 42% of the total consumption in 2030, greenhouse gas emissions will be reduced to 11.5% and the penetration of natural gas will reach 20% of the total supply of primary energy sources[18].

1.7 Transportation

The transport sector, consisting of maritime, air, rail, and road transport, has been increasing rapidly since 2000. The number of vehicles on the road has increased as well while transport infrastructure has been improved. Consequently, the total traffic load both for transport of goods and of passengers has increased further. The transport sector has the highest consumption, and it has increased from 754.44 ktoe in 2009 up to 859.77 ktoe in 2019.

In total, according to data processed by Association of Automobiles (ACA), about 435,000 vehicles are registered in Albania. 87% of registered vehicles are of Euro 1, 2 and 3 standards, with production year until 2005. With the Euro 5 and 6 standards there are only 14,000 registered vehicles or 3.3% of the total (according to the 2021 report of INSTAT).

The data is for 2019 and counts the road vehicles that are active or temporarily unregistered. Personal vehicles occupy 79.5% of all means of transport in Albania. Regarding the year of production, the largest share with 64.4% is occupied by those of the years 2000-2010, followed by the older ones with 28.2%.

The three most used brands are topped by Mercedes Benz followed by Volkswagen and Ford. If we take the period 2011-2019 the statistics are 19.1% for Mercedes Benz, VW with 14.1%, Ford 7.7%

[17] https://legacy.export.gov/article?id=Albania-Energy
[18] https://renewablesnow.com/news/albania-to-fully-liberalise-power-market-by-2025-energy-min-606532/

and Audi with 7.1%. For the period 2000-2010 Mercedes Benz leads with 37% followed by VW with 17.5%, Ford 7.6% and Opel with 5.9%. Benz takes most of the population for the years before 2000 where it dominates with 42.1%.

The largest number of cars circulating in our country use "Diesel" (73.3%), followed by cars that use "Gasoline" (19.4%) and vehicles that use combined fuel "Gasoline and Gas" (7.1%). Only 0.2% of vehicles use hybrid or electric systems. As it is known the fuel consumption is dependent on the type of the vehicle, life of vehicle, quality of road, and frequency of usage which is itself expressed by the parameters of passenger-km and ton-km during a year.

The number of vehicles on the road per 1,000 inhabitants increased by 23.9 % from 2015 to 2019. The prefecture of Dibër represents the highest increase in the country (54.8%), while prefecture of Gjirokastër represents the smallest increase (3.1%)[19]. Figure 14 and Figure 15 present the passenger road vehicles and goods road vehicles, respectively, for 2015 and 2019 per 1,000 inhabitants by prefecture.

Figure 14: Change from 2015 to 2019 in passenger road vehicles by prefecture per 1000 inhabitants (%)

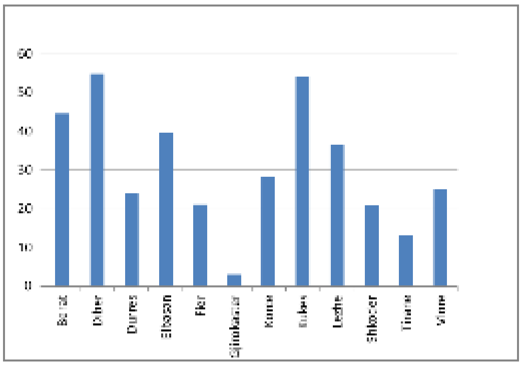
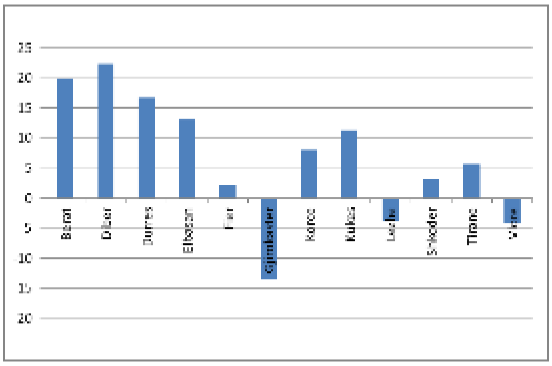


Figure 15: Change from 2015 to 2019 in goods road vehicles by prefecture per 1000 inhabitants (%)



Source: INSTAT Regional Statistical Yearbook 2020

The Transport Sector is the largest energy consuming sector in Albania and plays an important role in the consumption of energy resources. The transport infrastructure has also been improved. Consequently, the total traffic load both for transport of goods and of passengers has increased. Goods road vehicles as well as passenger road vehicles have a geographical distribution in all 12 prefectures of the country. The prefecture of Tiranë makes up 32.5% of the total goods road vehicle for 2019, or 30.0 goods road vehicle per 1,000 inhabitants in 2019. Goods road vehicles number per 1,000 inhabitants in Albania from 2015 to 2019 has increased by 6.4%, with the highest increase being in the prefecture of Dibër with 22.4%, whereas the prefecture of Gjirokastër presents the highest decrease compared with other prefectures with 13.5% (Figure 15).

The Ministry of Infrastructure and Energy is planning to accelerate the integration of the transport system, and to establish an integrated market, consisting of infrastructure and transport by land, sea and inland waterways, to efficiently support the transport development.

- The following major infrastructure projects will have a direct impact on the development of tourism and economic growth in Albania: Vlora Airport, as an international airport
- Saranda Touristic Airport

[19] http://www.instat.gov.al/media/8866/regional-statistical-yearbook.pdf

- New Freight Port in Porto Romano, Durrës
- Touristic Port and Waterfront in Durrës
- Touristic Port in Limjon Saranda
- Adriatic-Ionian Road Corridor[20]

1.8 Industry

The industry sector – including its sub-sectors: metallurgical, chemical, construction materials, mining, food/drinks/tobacco, textile/leather/shoes, wood/paper/printing/mechanic industry, has recorded very positive developments during the last decade, bringing the industrial sector to second in importance, after the service sector. Value added from industry (including construction) reached 26% of GDP in 2020[21].

The positive contribution of industrial production to economic growth is reflected in an increased number of employees in this sector. In 2019, 20.15% of the employees in Albania were active in the industry sector.

The imports of Albania increased from $4.41B in 2015 to $5.42B in 2020. In 2020, the top imports are refined petroleum, cars, medicaments, tanned equine and bovine hides, footwear parts. Imports are mostly from Italy, China, Greece, Turkey and Germany[22].

The exports of Albania have increased from $2.2B in 2015 to $2.62B in 2020. The top exports are leather footwear, footwear parts, non-knit men's suits, crude petroleum, raw iron bars. Exports are mostly to Italy, Serbia, Germany, Spain, and Greece.

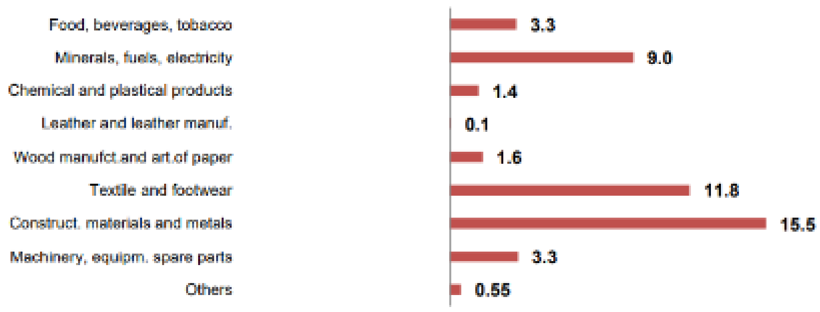
Figure 16 and Figure 17 show the contributions of groups in annual change of exports and imports in April 2022 (%).

Among the objectives under the Pillar 4 of NSDI (Ensuring growth through connectivity, the sustainable use of resources and territorial development) are the development of:

- a sustainable and diversified mining industry, which contributes the wealth of the nation and well-being of its people by offering more and better employment opportunities, ensuring environment protection and preservation, and meeting all EU integration standards
- a recognized and attractive tourism industry, based on the sustainable use of natural, cultural and historic resources, easily accessible from international markets
- The challenge remains the development of capacitates in the oil sector. Thus, regarding oil resources there has been no improved processing of crude oil, resulting in continued very low production of petroleum by-products in the country. Significantly, almost all crude oil produced in the country is exported, while most oil by-products are imported[23].

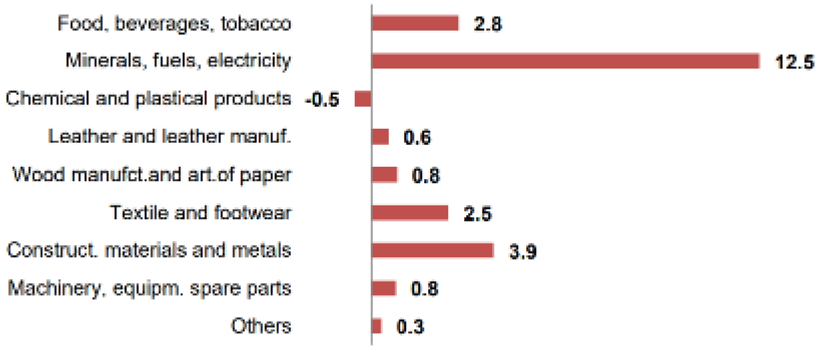
[20] https://www.infrastruktura.gov.al/wp-content/uploads/2021/10/Presentation-of-4th-Monitoring-Report-on-Sectoral-Transport-Strategy-and-Action-Plan-2016-2020_June-2021.pdf
[21] https://data.worldbank.org/indicator/NV.IND.TOTL.KD?locations=AL
[22]https://oec.world/en/profile/country/alb/#:~:text=Exports%20The%20top%20exports%20of%20Albania%20are%20Leather,%28%24236M%29%2C%20Germany%20%28%24165M%29%2C%20Spain%20%28%24152M%29%2C%20and%20Greece%20%28%24141M%29.
[23] NSDI II 2015-2020

Figure 16: Contribution of groups in annual change of exports (%), April 2022.



Source: INSTAT

Figure 17: Contribution of groups in annual change of imports (%), April 2022



Source: INSTAT

1.9 Agriculture

Land use in Albania consists of 42.8% agricultural land **(**42.8%)- (of which 22.3% is arable land 3% is permanent crops, and 17.4% is permanent pasture)-, 28.8% forest and 28.2 % other[24].

Even though the last decade's emigration and urbanisation brought a structural shift away from agriculture and towards industry and service, agriculture remains one of the largest and most important sectors in Albania, contributing to 18.9% of GDP in 2019 (according to INSTAT). 24% of soil is used for agricultural reasons. The total irrigated area in Albania is roughly 79.2 percent of the land under cultivation. Currently, 1 billion cubic meters of water is needed per irrigation season to irrigate 360,000 hectares. The agricultural sector is the main source of employment and income – especially in the country's rural areas accounting for about half of total employment (INSTAT 2013).

There were 351,600 registered farms in Albania, and the total export of agricultural goods was valued at Lek 35,300 million in 2019. The agriculture exports represented 11.8 percent of the country's total exports in 2019, showing a significant increase as compared to only 8.7 percent in 2015 and just less than 3 percent in 2005. Currently, the industry is dominated by small agricultural local producers with an average farm size of 1.2 hectares. Still, the number of enterprises operating

[24] https://www.indexmundi.com/albania/land_use.html (2018 est.)

in agro-business has not changed significantly during the past years, maintaining on average about 2,200 enterprises.

The general level of interest in investing in this sector has been low, mostly due to certain issues faced by the sector such as migration from rural areas, poor marketing of products, underdeveloped irrigation, and drainage systems, poor technological and infrastructure level, weak organization of the farmers, low level of development of the processing industry, etc. However, with the energy and road infrastructure rapidly improving and the interest of foreign investors in the last years, the sector looks promising in the future. [25]

Albania has designed the Inter Sectoral Agricultural and Rural Development Strategy (ISARDS) 2014-2020, according to the "Europe 2020" strategic framework for a rapid, sustainable and inclusive growth and the general strategic objective of Albania for EU membership. The main objective of ISARDS is to define the strategic framework to treat the challenges faced by the agriculture and agro-processing sector, as well as the development of rural areas in a sustainable economic, environmental and social manner, proposing similar policy instruments to the CAP, paying a special attention to the preparation of the sectors, policy instruments and institutional approximation for EU membership, to achieve a sustainable improvement of competition in Albania. The strategy presents the vision for the development of agriculture and rural areas, emphasizing objectives to ensure growth economic and poverty reduction, based on increased competitiveness, utilization of sustainable natural resources and growing comprehensive and balanced territorial in rural areas of Albania.

1.10 Forest

Over the past 20 years, Albania has lost an average of about 1.5 percent of forest area available for timber supply every year. A portion of this loss in the last decade is also due to the changed status of the functions of the forest, where a part of the forest available for supply of timber becomes used for other purposes, such as recreation, protection of biodiversity, etc. Moreover, the more accessible forest stands have been significantly degraded through overharvesting and overgrazing, which has changed the forest age structure, species composition and reduced the forest underwood. For several years tree felling exceeded the net annual increment resulting in a decrease in growing stock.

Other adverse effects from loss of forest are a reduction in the forest's natural water retention capacity, increased threat of forest fires, and the disappearance of wildlife and bird species that require larger undisturbed forest complexes. In 2009 the forestry lands (high forests, low forests/coppices, shrubs and other areas with forest vegetation) encompassed 1,071,880.2 ha, which accounts for 37.28 per cent of the territory of Albania. The total biomass of forest in Albania is estimated to be about 53 million tons, of which 86% originates from high forest. The average biomass per hectare calculated for the entire forest area is about 33 tha^{-1}, which is the lowest in the Western Balkan region.

In 2020, the Forest and Pasture Fund of Albania covered a total area of 1,740,304 ha, 60.5 % of the total area of the country. In 2020, forest covered an area of 1,051,841 ha, representing 60.4 % of the Forest and Pasture Fund. Pastures and meadows have an area of 478,081 ha, 27.5 % of the Forest and Pasture Fund (Figure 18). Areas with forest vegetation and those that are unproductive that are part of the forest have occupied 210,382 ha, 12.1% of this fund. The area of the Forest and Pasture fund in 2020, because of natural phenomena and human activities, decreased by approximately 2.2 ha and 396 ha compared with 2019 and 2016 respectively.

[25] Invest in Agriculture in Albania, https://invest-in-albania.org/industries/agriculture/#:~:text=

Figure 18: Structure of the Forests and Pasture Fund (%) in 2020

Source: INSTAT

In 2020, the total forest volume was 54,845,573 m^3. 94 % of this volume was of public forests and 6 % was private forests. Volume decreased by approximately 1,113 m^3 compared to 2019. In 2020, in the forestry fund by species the largest surface is covered by deciduous with 49.8 % followed by shrubs 35.8 % and conifer 14.3 %[26].

The Ministry of Tourism and Environment (MoTE) is the main governmental institution responsible for the development, legislation and implementation of forestry policies related to the environment, nature protection, waste management, environmental monitoring, forest, water quality, protected areas etc.

Local government units (municipalities and/or communes), through their controlling and inspecting mechanisms, are responsible for communal forests and pastures that currently occupy approximately 60% of the forest and pasture area of the territory of Albania.

To reduce the interventions in the forestry fund, degraded because of over exploitation, and to improve and rehabilitate the fund's conditions, Albania has adopted the Law No. 5/2016 proclaiming the moratorium on forests in the Republic of Albania. The Law will remain into effect for ten years from its entry into force. It prohibits exploitation activities in public and private forest fund throughout the Republic of Albania as well as the trade in forest products, timber exports, construction logs, firewood, and wood coal. Exceptions to the Law include exploitation for firewood for local populations, change in location of the Forestry and Pasture Fund, and exploitation for purposes of regeneration and debris cleaning. The existing exploitation rights are suspended and will be renegotiated only to allow for activities that fall within the exceptions scope.

Recently, the National Agency of Forests was established with the mission of good governance at the national level, forest preservation and development.

1.11 Waste

In Albania in recent years, the amount of waste generation has increased, while the way it is managed needs improvement.

[26] http://www.instat.gov.al/media/8914/njoftim-per-media-statistikat-e-pyjeve-dhe-biodiversitetit-2020-eng.pdf

In addition to household solid waste (HSW) managed by municipalities, the other main sources of wastes is inert material from construction, industry and mining, the agriculture and wood processing industry, packaging waste, end-of-life vehicles and hospital waste[27].

According to INSTAT in 2020 about 1.04 million tons of urban waste were managed, marking a decrease of about 3.5%, compared to 2019. The annual amount of urban waste managed per inhabitant, on a national scale, in 2020 is 369 kg/inhabitant, from 381 kg/inhabitant in the previous year

Albania's waste-management practices are still dominated by a linear collect-and-dispose approach instead of integrated sustainable waste-management. Waste management is performed in all urban areas and to a lesser extent in rural areas. Waste is mainly dumped in landfills designated by the Local Government Units but there are quantities that are dumped in unauthorized places, along roads and near settlements. The waste management service is performed through contracting by the Local Government Units of private enterprises or through their companies. These contracts are usually last 3-5 years.

Recycling has progressed compared to a few years ago, companies have been set up to collect and recycle metals, plastics, paper and glass. For other types of waste, their collection and management has started. To be mentioned are hospital waste, batteries, oils, electrical and electronic equipment. Attempts at source separation of waste have been frequent but without positive results. This is due to the complete lack of infrastructure but also public awareness.

Albania started the construction of 3 incinerators of urban waste in Elbasan, Tirana and Fier. The first one entered in operation in 2017 to perform tests and all the incinerators should be operational in 2023. There is no segregated waste collection system in place yet, which has been required by law for several years now.

In 2013, legislation on waste management was adopted and management plans are being prepared for a number of cities, including Tirana, Lezha and Shkodra. To date, only two sanitary landfills complying with European Union standards exist. The construction of one landfill in Korça is under way. New investments in waste management should focus on waste separation and recycling.

Except for Kavaja and Pogradec wastewater treatment plants, there are no other wastewater treatment facilities in the country. These two facilities are too small to make a difference and almost all used water is discharged untreated to water bodies.

Albania has developed The Strategic Policy Paper (2020 - 2035) with the vision of the "zero waste" concept, it means that waste will be collected and treated as raw material and management will be done in accordance with the concept of circulating economies systems, for the proper use and preservation of raw material resources.

In addition, from June 1st, 2022, plastic bags with a thickness of up to 70 microns on each side and a capacity of up to 10 kilograms will not be allowed to be produced, imported and traded. They are considered one of the biggest polluters of the environment.

1.12 Tourism

Over the years, tourism is crystallizing as one of the main engines of the country's economic development. According to the World Travel and Tourism Economic Impact Report 2018 of the World Travel and Tourism Council (WTTC), during 2017, the tourism sector recorded a direct contribution of

[27] Dokumenti i politikave strategjike dhe plani kombetar i menaxhimit te integruar te mbetjeve 2020-2035

$1.12 billion, accounting for about 8.5% of Gross Domestic Product (GDP). Considering the multiplied indirect effects, the total contribution is almost three times higher at $3.47 billion, accounting for about 26.2% of GDP, positioning this sector as one of the main contributors to the development of the national economy. Meanwhile, for the next 10 years, a significant increase of the contribution of this sector to the economy is predicted, where only in 2-3 years the tourism sector is expected to occupy 8.8% of GDP, while by 2028, the sector could occupy up to 9.3% of GDP. Thus, considering this upward trend, it is foreseen that by 2028 the direct and indirect effect of the tourism sector will approach about 1/3 of the entire Gross Domestic Product of Albania[28].It employed 7.7% of total labour force in 2017, and possibly 8.8% by 2028.

Tourism is however an underdeveloped sector in Albania in view of its potential, hindered by its limited infrastructure and accommodation capacities, standards and quality of services, tourism offer and products, and cooperation and coordination among the players who are or could be an integral part of the industry.

Being dependent from summer tourism (starting from June-July, with a maximum number of visitors achieved in August and with an immediate decline in September), most hotels and accommodations in the coastal areas are faced with seasonal functioning difficulties and as such, the phenomena of seasonal migration of habitants of coastal areas, especially in the South regions, is still evident.

Even though archaeology and cultural heritage is not the main drive to attract foreign or domestic visitors, these are identified as priorities in developing the tourism sector in the country and the coastal zone.

1.13 Development priorities and objectives

The key national planning document currently in place is the National Strategy for Development and Integration 2015-2020 (NSDI-II), which was adopted by the Government of Albania in May 2016. This strategic document reflects the vision, priorities, objectives and means for social and economic development of the country up to 2020. Around 37 sectoral strategies[29] adopted by the Albanian Government (and in three cases, by the Parliament) complement the NSDI-II. The NSDI-II is organised around 13 cross-cutting foundations on good governance, democracy and rule of law, and four main sectoral pillars:

- growth through macroeconomic and fiscal stability
- economic growth through enhanced competitiveness and innovation
- investing in social capital and social cohesion
- growth through sustainable use of natural resources and territorial development.

The overarching goal of NSDI-II is the accession to the EU. After the EU's decision in March 2014 to open accession talks with the country, Albania is advancing the EU integration agenda. As part of the process, the country is transposing and implementing parts of the EU legislation - most national plans or actions, including in the environmental domain, are now designed to consider policies and directives of the EU. Albania is also considering the EU's strategies and plans for the Western Balkans of which Albania is part[30], such as the EU Economic and Investment Plan for the Western Balkans[31],

[28] MTE 'Strategjia Kombëtare për Zhvillimin te Qëndrueshëm të Turizmit 2019 – 2023'
[29] Including for instance the energy strategy (2018-2030), the sustainable transport sector plan of 2015 or the national strategy for sustainable tourism development 2019-2023.
[30] In addition to Albania, for the EU the Western Balkans region includes Kosovo, Serbia, Montenegro, North-Macedonia and Bosnia and Herzegovina
[31] This investment plan, which will mobilise up to €9 billion of funding for the region, aims to spur the long-term economic recovery of the region, support a green and digital transition, foster regional integration and convergence with the EU. 8 This foresees actions around five pillars: (i) climate action, including decarbonisation, energy and mobility, (ii) circular

adopted in October 2020, and the EU Green Deal for the Western Balkans[8], adopted in November 2020, among others.

Besides the EU, Albania is an active participant in multilateral organisations and agreements. Albania is a signatory Party of the United Nations Framework Convention on Climate Change (UNFCCC), which was ratified by the Albanian Parliament in 1994. In April 2016, Albania signed the Paris Agreement. In December 2017, the Albanian Parliament unanimously approved a resolution confirming the country's commitment to Agenda 2030 and achievement of the Sustainable Development Goals.

1.14 Priorities related to mitigation and adaptation of climate action

In line with global and regional commitments and national priorities, Albania has made progress on climate change mitigation and adaptation. In 2014, the Albanian government established the Inter-Ministerial Working Group on Climate Change (IMWGCC), which coordinates all institutions involved in climate change processes and facilitates the integration of climate change into relevant new and existing policies, programs, and activities. In July 2019, Albania approved a National Climate Change Strategy and corresponding national mitigation and adaptation plans. The country has implemented several mitigation and adaptation projects and studies.

There is currently a law "On climate change" which acts as the UNFCCC implementation law in Albania and covers requirements under the EU Emissions Trading System (ETS) Directive. This law requires all relevant ministries to mainstream climate change mitigation and adaptation issues into their legislation. The draft Decision of the Council of Ministers (DCM) "On monitoring and reporting GHG emissions and other information relevant to climate change at the national level" establishes a mechanism for monitoring and reporting on GHGs and other climate change information at the national level, as appropriate for a Non-Annex I party.

There are still areas of national environmental policy that are yet to be implemented effectively. Albania does not have an umbrella policy framework for environmental protection; the recent Environmental Impact Assessment Directive is not always fully enforced, and the national strategy for air quality is yet to be adopted. There is also a need to adopt a climate policy consistent with the EU 2030 framework.

Albania submitted its first Nationally Determined Contribution (NDC) in November 2015, with the commitment to reduce carbon dioxide (CO_2) emissions compared to the baseline scenario in the period of 2016 and 2030 by 11.5%, or 708 kt CO_2 emission reduction in 2030". Suggested mitigation measures include increased use of renewable energy, building insulation, more efficient industrial boilers and increasing biofuel use in transport. The scope was limited in terms of both gases and sectors. The NDC only covered CO_2 - it did not include other relevant gases such as methane (CH_4), nitrous oxide (N_2O), fluorinated gases (F-gases); and it only covered energy and industrial processes sectors – it did not include agriculture, land use, land use change and forestry (LULUCF) and waste sectors. No references to adaptation were included.

The Albania Revised NDC[32] (submitted to the UNFCCC on 12th October 2021) presents the following improvement compared to the First NDC:

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economy, addressing in particular waste, recycling, sustainable production and efficient use of resources, (iii) biodiversity, aiming to protect and restore the natural wealth of the region, (iv) fighting air, water and soil pollution and (v) sustainable food systems and rural areas.

[32]https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Albania%20First/Albania%20Revised%20NDC.pdf

- Covers gases other than CO_2 (i.e. CH_4, N_2O, F-gases), that were not included in the first NDC
- Covers all emission sectors: Energy; Industrial processes; Agriculture, LULUCF, and Waste. The INDC only covered Energy and Industrial processes
- Considers potential ways for enhancing the country's climate ambition, in accordance with the Paris agreement framework and the need of a collective raise of climate pledge to reach the aim to limit global warming to +2°C and even +1.5°C
- Includes climate change adaptation measures especially related to coastal areas and LULUCF sectors, aiming at mainstreaming climate change adaptation into relevant development and sectoral strategies.

As per the revised NDC considering all sectors (including FOLU), emissions for the NDC scenario (with mitigation measures) increase from 10,139 kt CO_2eq. in 2016 to 11,978 kt CO_2eq. in 2030, which represents an increase of 18.1%. The difference, in 2030, with the BAU scenario, is -3,170 kt CO_2eq., which represents a mitigation impact of -20.9%. Overall, the mitigation actions accounted in the NDC scenario could help avoid, in total during the period 2021-2030, 16,828 kt CO_2eq. compared to the BAU scenario.

1.15 Institutional arrangements

In order to ensure sustainability and linkage with climate change enabling activities already implemented in the country, the day-to-day implementation of the project is carried out through UNDP Climate Change Programme Unit established in the frame of Albania's First National Communication to UNFCCC and strengthened in the course of various climate change projects.

The Government provided in-kind suppport to the project through provision of premises for meetings, means of communication and other utilities, as well as information and time of civil servants and governmental officials involved in responsible Unit for Climate Change in the Ministry of Tourism and Environment and the Interministerial Working Group on Climate Change.

The Project Team consisted of Climate Change Programme Team Leader/Manager, Team Leaders for GHG emissions Inventory, Mitigation Analysis & MRV, Vulnerability & Adaptation, and Policy & Legislation, part time Fin/Admin Assistant, and other Project experts. To implement one of the good lessons learned from the previous Nat Coms, the practice of experts' roster is replicated also in the course of the BUR1 and NC4 project.

UNDP acted as the GEF Implementing Agency for the project and played a key role in interaction with participants from the state, private and civil sector and rendered the services to support the project in accordance with UNDP-GEF standard procedures. Partnership with other UNDP projects and programs, as well as with other donors and national institutions in advocacy of incorporation of climate change issues into development agendas has been a good practice already in place. Working in synergy with other GEF climate change or non-climate change projects has been and will be an efficient way of getting efficient results.

The project maintained links to the UNDP-UNEP Global Support Program (GSP) to get regularly updated through UNDP Istanbul Regional Hub for the status of activities and get in the same time technical assistance as required. Technical assistance was also provided by the UNFCCC Secretariat /Consultative Group of Experts (CGE), mainly through the workshops and trainings.

The Project Board (also called Project Steering Committee) is responsible for making by consensus, management decisions when guidance is required by the Project Manager, including recommendation for UNDP/Implementing Partner approval of project plans and revisions.

Specific responsibilities of the Project Board include:

- Provide overall guidance and direction to the project, ensuring it remains within any specified constraints
- Address project issues as raised by the project manager
- Provide guidance on new project risks, and agree on possible countermeasures and management actions to address specific risks
- Agree on project manager's tolerances as required
- Review the project progress, and provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plans
- Appraise the annual project implementation report, including the quality assessment rating report; make recommendations for the workplan
- Provide ad hoc direction and advice for exceptional situations when the project manager's tolerances are exceeded
- Assess and decide to proceed on project changes through appropriate revisions.

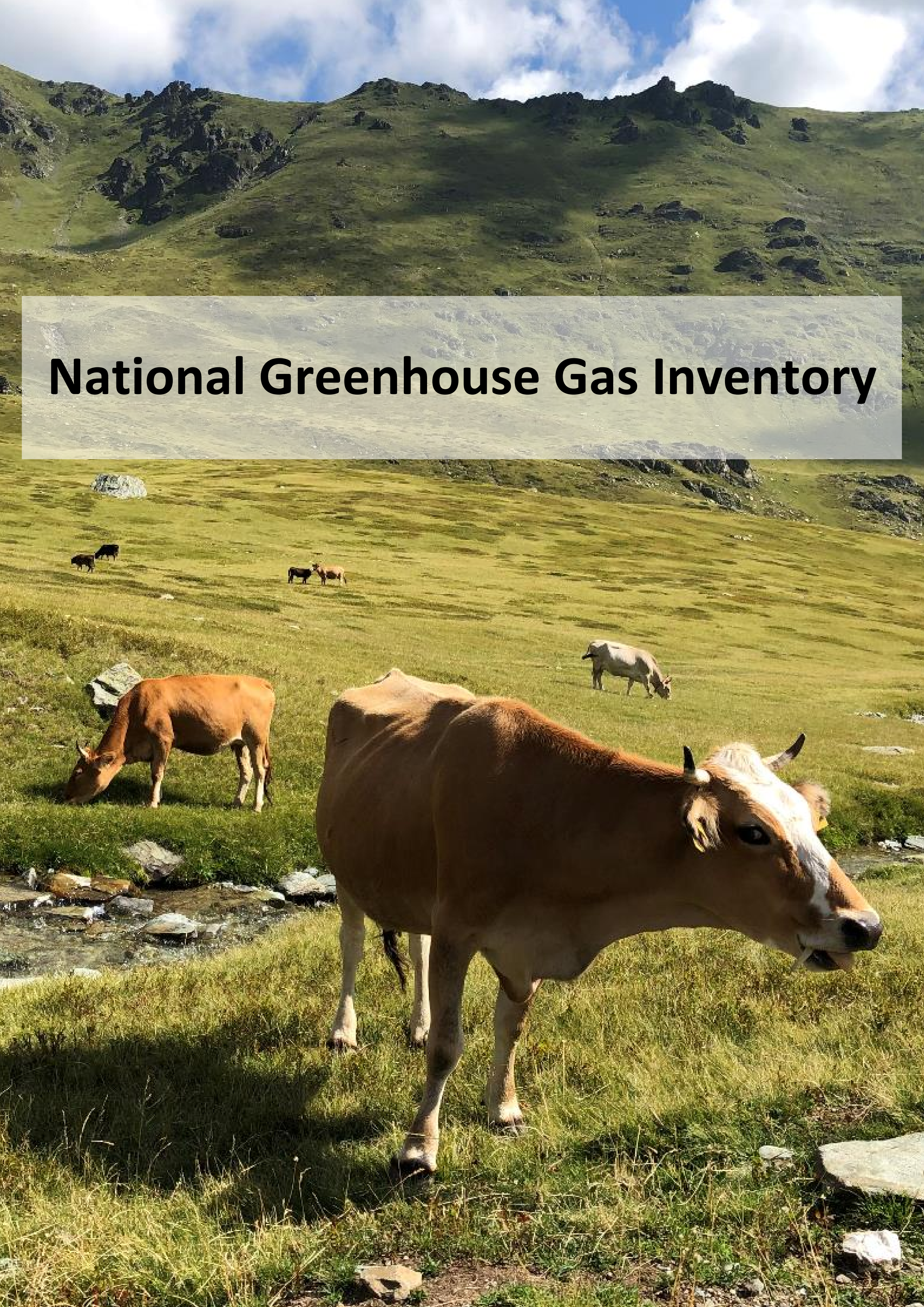
The composition of the Project Steering Committee is as follows:

Executive for the Project is the Ministry for Tourism and Environment which is the GEF Focal Point Agency and oversees the environmental policy-making in Albania. The Ministry of Tourism and Environment is also the UNFCCC Focal Point and oversees the climate change policy-making in Albania.

Other Project's Steering Committee members represent:

- Ministry of Infrastructure and Energy
- Ministry of Agriculture and Rural Development
- Ministry of Defence/Civil Emergency directory
- INSTAT
- Institute of Geosciences, Energy, Water and Environmnet
- Vlora Prefecture
- EDEN (an environmental NGO).

National Greenhouse Gas Inventory



2 National Greenhouse Gas Inventory

2.1 Introduction

Albania, as a Non-Annex I country to the UNFCCC, has been developing an inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs) emitted to or removed from the atmosphere since 1990 as part of its National Communications (NCs) on Climate Change and now as part of this report, Albania's Fourth National Communication.

Estimates of GHG emissions and removals were presented in Albania's First Biennial Update Report (BUR1) submitted in 2021 and the three Albanian National Communications: the First National Communication (NC1) was submitted in 2002; the Second National Communication (NC2) in 2009; and the Third National Communication (NC3) in 2016.

This report includes national GHG inventory for the years 2009-2019. The inventory includes estimates of GHGs from Energy, Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change and Forestry (LULUCF) and Waste, covering the following GHGs: CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), and additional gases for which the GWPs are not available in the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report covered in the 2006 IPPC Guidelines[33]. Estimates of key sources have been provided as well. Aggregated GHG emissions and removals expressed in CO_2 equivalent are also presented.

Albania's NC1 was published in 2002[34] and was the first GHG emission inventory for Albania. According with the 1996 revised IPCC Guidelines, it considered the five main sectors (energy, industrial processes, LULUCF and waste). It included emissions/removals from three direct GHGs (CO_2, CH_4 and N_2O) and three indirect GHGs (carbon monoxide (CO), nitrogen oxides (NO_X), and non-methane volatile organic compounds (NMVOC)). The reference year was 1994, while time series for 1990-1994 were used only for the category of CO_2 emissions from fuel combustion.

Albania's NC2 was published in 2009[35] and covers the period 1990-2000. According with the 1996 revised IPCC Guidelines, it considered the five main sectors (energy, industrial processes, LULUCF and waste). It included emissions/removals from six direct GHGs (CO_2, CH_4, N_2O, HFCs, PFCs and sulphur hexafluoride (SF_6)) and four indirect GHGs (CO, NO_X, sulphur oxides (SO_X) and NMVOC).

Albania's NC3 was published in 2016[36] and covers the refined time series for the period 2000-2009 and provides a deeper analysis than the previous inventory (i.e., more detailed activity levels, data permitting) with a base year of 2005, the last year for which a complete data record was available.

Albania's BUR1 was published in 2021[37] and covers the time series 2010-2016. The entire time series was estimated in line with the 2006 IPCC Guidelines so the year 2009 was recalculated.

The table and figure below show net emissions, including removals from LULUCF, for the years 2009 to 2019 disaggregated by sector and gas.

[33] https://www.ipcc-nggip.iges.or.jp/public/2006gl/
[34] https://unfccc.int/sites/default/files/resource/albnc1.pdf
[35] https://unfccc.int/sites/default/files/resource/albnc2_0.pdf
[36] https://unfccc.int/sites/default/files/resource/Albania%20NC3_13%20October%202016_0.pdf
[37] https://unfccc.int/sites/default/files/resource/First%20Biennial%20Update%20Report%20for%20Albania_EN.pdf

Table 5: National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases

GREENHOUSE GAS EMISSIONS AND REMOVALS	Ref year for NDC	2009 (Base year)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Change from 2009 to latest reported year
	2016		CO_2 equivalents (kt)										%
CO_2 emissions without net CO_2 from LULUCF	5614.3	5508.2	5120.1	5334.3	5105.1	5216.6	5580.9	5618.7	5614.3	6256.0	6457.0	6530.6	18.6%
CO_2 emissions with net CO_2 from LULUCF	7044.8	7100.2	6846.2	9803.5	10549.3	6645.4	6895.0	7004.7	7044.8	7686.4	7887.4	7961.0	12.1%
CH_4 emissions without CH_4 from LULUCF	2369.0	2102.1	2150.3	2185.0	2250.0	2924.4	2380.9	2361.1	2369.0	2380.6	2396.7	2410.1	14.7%
CH_4 emissions with CH_4 from LULUCF	2369.6	2102.8	2151.2	2191.9	2252.9	2924.5	2381.0	2361.4	2369.6	2381.3	2397.4	2410.7	14.6%
N_2O emissions without N_2O from LULUCF	1129.6	1018.2	1009.5	1050.2	1048.1	1183.8	1104.4	1120.0	1129.6	1118.9	1123.5	1119.3	9.9%
N_2O emissions with N_2O from LULUCF	1130.5	1019.1	1010.5	1058.1	1051.7	1184.0	1104.5	1120.5	1130.5	1119.7	1124.3	1120.2	9.9%
HFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
PFCs	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-100.0%
SF_6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
NF_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Total (without LULUCF)	9113.0	8635.5	8279.9	8569.4	8403.3	9324.7	9066.3	9099.8	9113.0	9755.5	9977.2	10060.1	16.5%
Total (with LULUCF)[3]	10544.9	10229.2	10007.9	13053.6	13853.9	10753.9	10380.5	10486.5	10544.9	11187.4	11409.1	11492.0	12.3%
Total (without LULUCF, with indirect)	9113.0	8635.5	8279.9	8569.4	8403.3	9324.7	9066.3	9099.8	9113.0	9755.5	9977.2	10060.1	16.5%
Total (with LULUCF, with indirect)	10544.9	10229.2	10007.9	13053.6	13853.9	10753.9	10380.5	10486.5	10544.9	11187.4	11409.1	11492.0	12.3%

Table 6: GHG emissions and removals by year and sector

GREENHOUSE GAS EMISSIONS AND REMOVALS	Ref year for NDC	2009 (Base year)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Change from 2009 to latest reported year
	2016		CO_2 equivalents (kt)										%
1. Energy	4778.93	4339.02	4346.70	4397.87	4138.85	4913.54	4633.59	4698.04	4778.93	5228.19	5321.95	5373.00	23.8%
2. Industrial Processes and Product Use	1019.89	1364.68	967.32	1124.81	1153.72	1244.83	1193.81	1105.50	1019.89	1209.98	1315.99	1341.65	-1.7%
3. Agriculture	2341.53	2236.31	2225.20	2259.20	2280.60	2296.52	2333.92	2346.72	2341.53	2341.53	2341.53	2341.53	4.7%
4. Land use, land-use change and forestry	1431.89	1593.69	1727.96	4484.11	5450.62	1429.17	1314.26	1386.65	1431.89	1431.89	1431.89	1431.89	-10.2%
5. Waste	838.98	620.90	660.25	705.45	747.13	783.78	801.40	821.05	838.98	854.64	871.47	881.56	42.0%
6. Other	133.65	74.63	80.42	82.12	83.03	86.07	103.53	128.54	133.65	121.21	126.28	122.33	63.9%
Total (including LULUCF)	10544.88	10229.23	10007.86	13053.55	13853.94	10753.91	10380.52	10486.50	10544.88	11187.44	11409.10	11491.95	12.3%

Figure 19: National GHG emissions by sector (2009-2019)

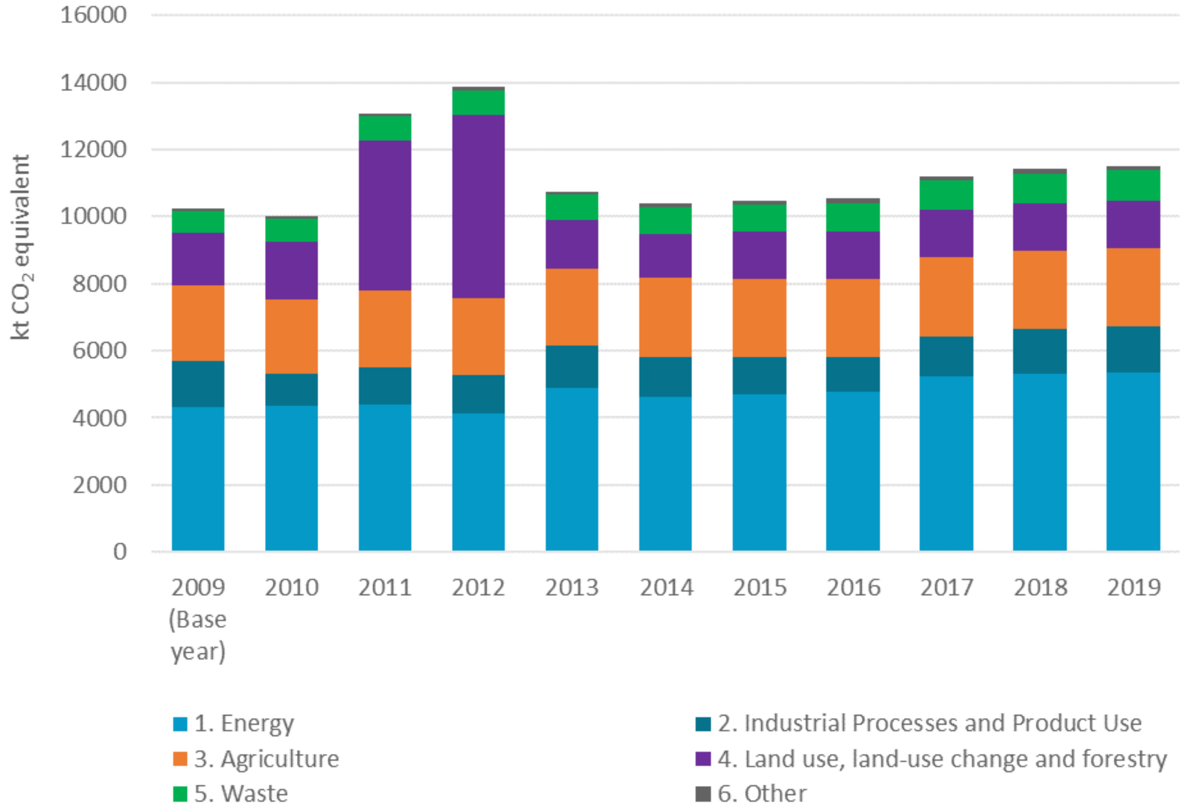
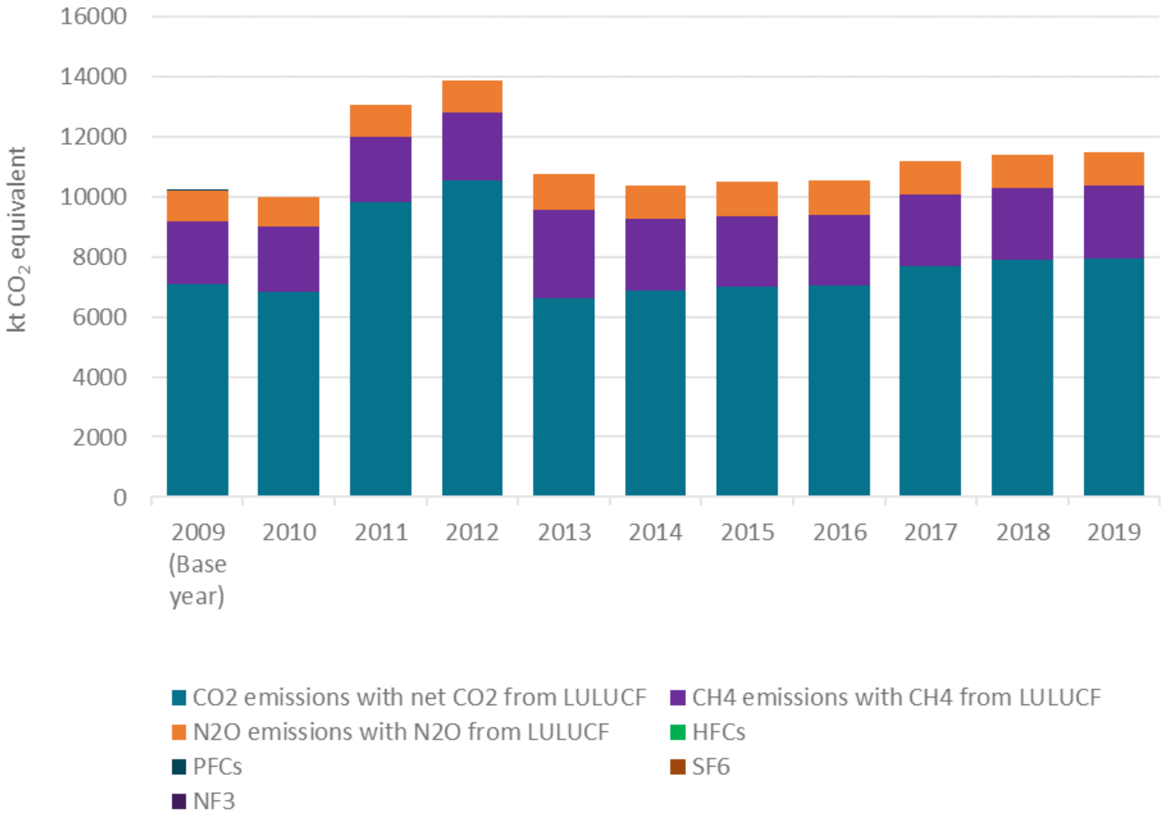


Figure 20: National GHG emissions by gas (2009-2019)



2.2 Institutional arrangements

The GHG inventory was coordinated by the Ministry of Tourism and Environment as the UNFCCC focal point and the central authority in Albania in charge for climate change policy. The preparation of the GHG inventory was project based, supported by the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP). Six professionals were engaged to form the GHG inventory team (each of them responsible for one or more sectors including data collection). The inventory was prepared using the latest IPCC Inventory software version available at the time of the preparing the inventory (IPCC 2006 software - version 2.691[38]) within which the key category analysis and uncertainty assessments were performed.

2.3 Scope and methodology

The national GHG inventory covers the years 2009-2019 and is consistent with the 2006 IPCC Guidelines. Recalculations were not applied to years covered in previous national GHG inventories (2009-2016). During this inventory update, data for the years 2017, 2018, 2019 have been collected. It covers the GHG emissions and removals estimates as divided into the following main sectors as defined by the 2006 IPCC Guidelines: Energy, IPPU, Agriculture, LULUCF and Waste. The Tier 1 methods are applied for all subsectors due to the absence of country specific emission factors.

The national GHG inventory covers the following GHGs: CO_2, CH_4, N_2O, PFCs (perfluorocarbons) and HFCs. To facilitate aggregate reporting of the GHG values, expressed as carbon dioxide equivalents (CO_2 eq.), as indicated in the Decision 17/CP.8, the global warming potentials (GWPs) values provided in the IPCC Second Assessment Report (temporal horizon 100 years) are used.

2.4 Key category analysis

The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment), is conducted using Approach 1 in the 2006 IPCC Guidelines. According to this approach, key categories are those that, when summed together in descending order of magnitude, add up to 95% of the total level/trend. In other words, a key source category is one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs, in terms of the absolute emissions and the trend. The table below provides a summary of the key categories for the level and trend assessments. The full calculations are provided in the Annex: Key Category Analysis. Key categories from the level assessment for 2019 for each sector are identified in the sector summary tables in the sector chapters.

Table 7: Summary of the key category analyses

IPCC Code	IPCC Category	GHG	2009 Level KC	2019 Level KC	2009-2019 Trend KC
1.A.1	Energy Industries - Liquid Fuels	CO_2	Yes	Yes	Yes
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	Yes	Yes	Yes
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO_2	Yes	Yes	Yes
1.A.3.b	Road Transportation	CO_2	Yes	Yes	Yes
1.A.4	Other Sectors - Liquid Fuels	CO_2	Yes	Yes	Yes
1.A.5	Non-Specified - Liquid Fuels	CO_2	Yes	Yes	Yes

[38] https://www.ipcc-nggip.iges.or.jp/software/

1.B.2.a	Oil	CH_4	Yes	Yes	
2.A.1	Cement production	CO_2	Yes	Yes	Yes
2.A.2	Lime production	CO_2	Yes		Yes
2.C.1	Iron and Steel Production	CO_2	Yes		Yes
2.C.2	Ferroalloys Production	CO_2		Yes	Yes
2.H	Other	CO_2		Yes	Yes
3.A.1	Enteric Fermentation	CH_4	Yes	Yes	Yes
3.A.2	Manure Management	CH_4	Yes	Yes	Yes
3.A.2	Manure Management	N_2O	Yes	Yes	
3.B.1.a	Forest land Remaining Forest land	CO_2	Yes	Yes	Yes
3.B.5.b	Land Converted to Settlements	CO_2	Yes	Yes	
3.C.4	Direct N_2O Emissions from managed soils	N_2O	Yes	Yes	Yes
3.C.5	Indirect N_2O Emissions from managed soils	N_2O	Yes	Yes	
4.A	Solid Waste Disposal	CH_4	Yes	Yes	Yes
4.D	Wastewater Treatment and Discharge	CH_4	Yes	Yes	
4.D	Wastewater Treatment and Discharge	N_2O	Yes		Yes
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	N_2O		Yes	Yes

2.5 Completeness

The table below includes all categories that are not included in the inventory. It provides the appropriate notation key for each category and additional comments, as required, to explain the reason that emissions/removals from these categories have not been included. The notation keys used are consistent with those in the 2006 IPCC Guidelines:

- Not estimated (NE): emissions/removals occur but have not been estimated or reported
- Included elsewhere (IE): Emissions/removals for this activity or category are estimated and included in the inventory but not presented separately for this category
- Confidential information (C): Emissions/removals are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information
- Not applicable (NA): The activity or category exists but relevant emissions and removals are considered never to occur.
- Not occurring (NO): An activity or process does not exist within a country

Further discussion regarding these completeness issues is provided in the sector chapters.

Table 8: Completeness assessment

IPCC Code	IPCC Category	GHG	Notation key	Comment
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	NO	
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	NO	
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	NO	
1.A.1	Energy Industries - Peat	CO_2	NO	
1.A.1	Energy Industries - Peat	CH_4	NO	
1.A.1	Energy Industries - Peat	N_2O	NO	
1.A.1	Energy Industries - Biomass	CO_2	NO	

IPCC Code	IPCC Category	GHG	Notation key	Comment
1.A.1	Energy Industries - Biomass	CH_4	NO	
1.A.1	Energy Industries - Biomass	N_2O	NO	
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	NO	
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	NO	
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	NO	
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	NO	
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	NO	
1.A.2	Manufacturing Industries and Construction - Peat	N_2O	NO	
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	NO	
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	NO	
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	NO	
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	NO	
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	NO	
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	NO	
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	NO	
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	NO	
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	NO	
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	NO	
1.A.3.d	Water-borne Navigation - Peat	CO_2	NO	
1.A.3.d	Water-borne Navigation - Peat	CH_4	NO	
1.A.3.d	Water-borne Navigation - Peat	N_2O	NO	
1.A.3.d	Water-borne Navigation - Biomass	CO_2	NO	
1.A.3.d	Water-borne Navigation - Biomass	CH_4	NO	
1.A.3.d	Water-borne Navigation - Biomass	N_2O	NO	
1.A.3.e	Other Transportation	CO_2	NO	
1.A.3.e	Other Transportation	CH_4	NO	
1.A.3.e	Other Transportation	N_2O	NO	
1.A.4	Other Sectors - Solid Fuels	CO_2	NO	
1.A.4	Other Sectors - Solid Fuels	CH_4	NO	
1.A.4	Other Sectors - Solid Fuels	N_2O	NO	
1.A.4	Other Sectors - Gaseous Fuels	CO_2	NO	
1.A.4	Other Sectors - Gaseous Fuels	CH_4	NO	
1.A.4	Other Sectors - Gaseous Fuels	N_2O	NO	
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	NO	
1.A.4	Other Sectors - Other Fossil Fuels	CH_4	NO	
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	NO	
1.A.4	Other Sectors - Peat	CO_2	NO	
1.A.4	Other Sectors - Peat	CH_4	NO	
1.A.4	Other Sectors - Peat	N_2O	NO	
1.A.4	Other Sectors - Biomass	CO_2	NO	

IPCC Code	IPCC Category	GHG	Notation key	Comment
1.A.5	Non-Specified - Solid Fuels	CO_2	NO	
1.A.5	Non-Specified - Solid Fuels	CH_4	NO	
1.A.5	Non-Specified - Solid Fuels	N_2O	NO	
1.A.5	Non-Specified - Gaseous Fuels	CO_2	NO	
1.A.5	Non-Specified - Gaseous Fuels	CH_4	NO	
1.A.5	Non-Specified - Gaseous Fuels	N_2O	NO	
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	NO	
1.A.5	Non-Specified - Other Fossil Fuels	CH_4	NO	
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	NO	
1.A.5	Non-Specified - Peat	CO_2	NO	
1.A.5	Non-Specified - Peat	CH_4	NO	
1.A.5	Non-Specified - Peat	N_2O	NO	
1.A.5	Non-Specified - Biomass	CO_2	NO	
1.A.5	Non-Specified - Biomass	CH_4	NO	
1.A.5	Non-Specified - Biomass	N_2O	NO	
1.B.1	Solid Fuels	N_2O	NO	
1.C	Carbon dioxide Transport and Storage	CO_2	NO	
2.A.3	Glass Production	CO_2	NO	
2.A.4	Other Process Uses of Carbonates	CO_2	NO	
2.B.1	Ammonia Production	CO_2	NO	
2.B.2	Nitric Acid Production	N_2O	NO	
2.B.3	Adipic Acid Production	N_2O	NO	
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	NO	
2.B.5	Carbide Production	CO_2	NO	
2.B.5	Carbide Production	CH_4	NO	
2.B.6	Titanium Dioxide Production	CO_2	NO	
2.B.7	Soda Ash Production	CO_2	NO	
2.B.8	Petrochemical and Carbon Black Production	CO_2	NO	
2.B.8	Petrochemical and Carbon Black Production	CH_4	NO	
2.B.9	Fluorochemical Production	F-Gases	NO	
2.C.1	Iron and Steel Production	CH_4	NO	
2.C.2	Ferroalloys Production	CH_4	NO	
2.C.3	Aluminium production	CO_2	NO	
2.C.3	Aluminium production	PFCs	NO	
2.C.4	Magnesium production	CO_2	NO	
2.C.4	Magnesium production	SF_6	NO	
2.C.6	Zinc Production	CO_2	NO	
2.E	Electronics Industry	F-Gases	NO	
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	IE	Included under 2.H due to issues with IPCC

IPCC Code	IPCC Category	GHG	Notation key	Comment
				Software
2.F.2	Foam Blowing Agents	HFCs	IE	Included under 2.H because F-Gases are aggregated due to lack of detailed activity data
2.F.3	Fire Protection	HFCs, PFCs	IE	
2.F.4	Aerosols	HFCs, PFCs	IE	
2.F.5	Solvents	HFCs, PFCs	NE	Lack of activity data
2.F.6	Other Applications (please specify)	HFCs, PFCs	NO	
2.G	Other Product Manufacture and Use	SF_6, PFCs	NE	Lack of activity data
2.G	Other Product Manufacture and Use	N_2O	NE	Lack of activity data
3.B.1.b	Land Converted to Forest land	CO_2	NE	Lack of activity data
3.B.2.b	Land Converted to Cropland	CO_2	NE	Lack of activity data
3.B.3.a	Grassland Remaining Grassland	CO_2	NE	Lack of activity data
3.B.3.b	Land Converted to Grassland	CO_2	NE	Lack of activity data
3.B.4.a.i	Peatlands remaining peatlands	CO_2	NE	Lack of activity data
3.B.4.a.i	Peatlands remaining peatlands	N_2O	NE	Lack of activity data
3.B.4.b	Land Converted to Wetlands	N_2O	NE	Lack of activity data
3.B.4.b	Land Converted to Wetlands	CO_2	NE	Lack of activity data
3.B.5.a	Settlements Remaining Settlements	CO_2	NE	Lack of activity data
3.B.6.b	Land Converted to Other land	CO_2	NE	Lack of activity data
3.C.2	Liming	CO_2	NE	Lack of activity data
3.C.7	Rice cultivation	CH_4	NO	
3.D.1	Harvested Wood Products	CO_2	NE	Lack of activity data
4.E	Other (please specify)	CO_2	NO	
5.B	Other (please specify)	CO_2	NO	

2.6 Uncertainty analysis

An uncertainty analysis was carried out to quantify the uncertainty of the compiled estimates and to help prioritise efforts to improve the accuracy of the inventory. Uncertainty values for activity data and emission factors were collected and included in the IPCC Inventory software, which calculates uncertainty using the Error Propagation methods (Approach 1). The overall uncertainty of the 2009 and 2019 estimates are 2% and 5%, respectively. The overall uncertainty of the 2009-2019 trend is also 5%. The values for the 2019 uncertainty analysis are provided in the Annex: Uncertainty assessment for GHG inventory. The category-level uncertainties are provided in the sector summary tables in the sector chapters. Further discussion regarding the uncertainties is also provided in these chapters.

2.7 Recalculations

Previous inventory included the years 2009-2016. These years have not been recalculated. Methodologies have not been altered and no concerns regarding time series consistency were raised during data collection or inventory compilation.

2.8 Quality Assurance and Quality Control

The following QA/QC activities have been carried out:

- Compare with information submitted to international agencies
- Compare emissions calculations with use of default net calorific values/emission factors if not used
- Cross-check against Reference approach (Energy sector).

Two approaches have been used for the estimation of the emissions of CO_2, the most significant GHG. According to the first approach, the CO_2 emissions are estimated for each fuel type, based on the total national consumption, and then the values were summarised (top-down approach). According to the second approach, emissions for separate sectors and source categories are estimated and then summarised (bottom-up approach). The use of these two approaches in the Albania's inventory allows a judgement to be made on the fuel spectrum of the CO_2 emissions (top-down), and secondly on the sector distribution (bottom-up). In both approaches the default IPCC emission factors are used for each fuel type. Differences between two methods for energy sector are less than 2%.

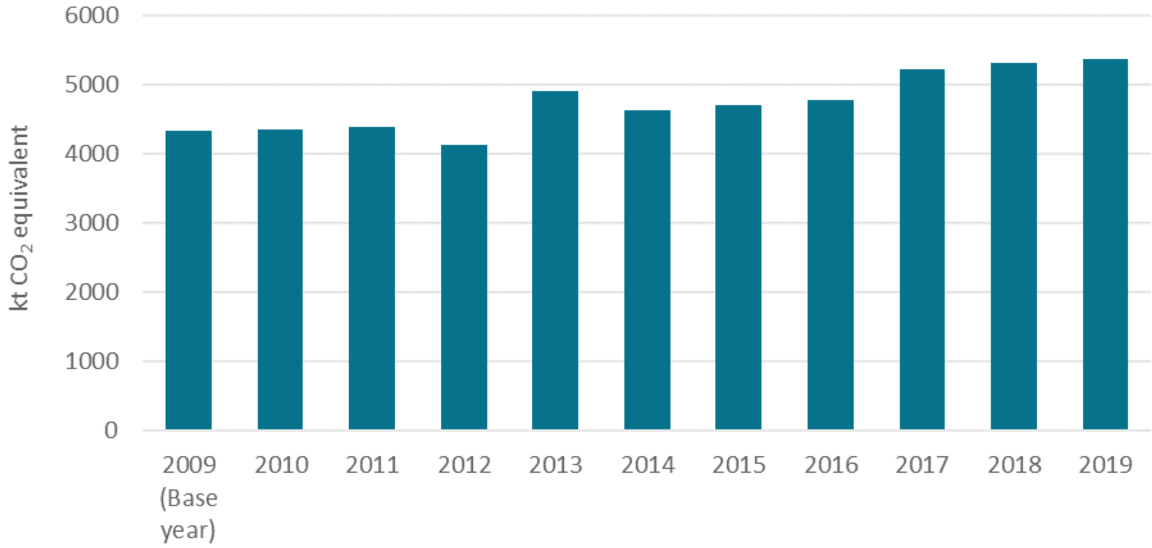
Training materials on GHG inventory preparation have been developed by the GHG inventory team. These materials are country specific and based on personal experience gathered by the team and lessons learnt during the GHG inventory preparation in Albania.

2.9 Energy sector

2.9.1 Overview

The figure below shows GHG emissions from the energy sector for the years 2009 to 2019. Emissions have increased by 23.8% across this period from 4339.02 kt CO_2eq. in 2009 to 5373.00 kt CO_2eq. in 2019.

Figure 21: Energy sector GHG emissions (2009-2019)



The GHG emissions from the energy sector account for the emissions released because of fuel combustion activities, as well as the fugitive emissions from the extraction of solid fuels and transmission and distribution of liquid and gaseous fuels. The emissions are separated into the following categories: Energy Industries, Manufacturing Industries and Construction, Transport, Other sectors (Commercial/Institutional, Residential and Agriculture/Forestry/ Fishing) and Non-Specified. In addition, the fugitive emissions from extraction of lignite and from oil refining related activities have been calculated.

Analysis shows that Transport is the most significant category across all years followed by Manufacturing Industry and Construction (related to fuel consumption). The primary energy supply in Albania is dominated by oil by-products, hydro and net imports of electricity, fuel wood and a small amount of coal and natural gas. The transport sector consumes the most final energy (40.22% in 2019), followed by households (25.02% in 2019) and industry (19.02% in 2019). Oil derivatives consumption from the transport sector for 2019 has been approximately 1 million tons and with a total cost for costumers up to 1.5 Billion Euro and all this amount is imported increasing country trade deficit.

Electricity generation has been historically met almost exclusively by hydropower plants. The country has exploited approximately 50% of its hydropower potential, and future expansion of hydropower capacity is possible mainly along the Drini, Mati, Devolli, and Bistrica rivers. The only thermal power plant, Vlora TPP, is not yet operational, and its conversion to natural gas is foreseen following construction of the Trans Adriatic Pipeline (TAP). Albania imports electricity from neighbouring countries, although imports have progressively dropped in the last ten years following the increase in domestic power generation and the reduction of (technical and non-technical) electricity losses in the distribution system.

2.9.2 Reference and sectoral approach

Two approaches have been used to estimate emissions of carbon dioxide, the most significant greenhouse gas. According to the first approach, CO_2 emissions have been estimated for each fuel type, based on the total national consumption, and then the values were summarized (top-down approach). According to the second approach, emissions for separate sectors and source categories have been estimated and then summarized (bottom-up approach). The use of these two approaches in the Albania's inventory firstly did allows us to judge on the fuel spectrum of the carbon dioxide emissions (top-down), and secondly on the sector distribution (bottom-up). In both approaches have been used the default IPCC emission factors for each fuel type. Preliminary estimation shows that the difference between the two approaches have been less than 2%.

2.9.3 Methodology

The table below presents a summary table of the Energy sector for the year 2019. It summarises the GHGs that have been estimated, the contribution of each Energy sector category to the whole national GHG inventory, which categories are considered key categories (as defined by Approach 1 in the 2006 IPCC Guidelines), the uncertainty value of each category (as defined by Approach 1 in the 2006 IPCC Guidelines) and the methodology tier used to estimate emissions (as defined by the 2006 IPCC Guidelines).

Table 9: Summary table for the Energy sector

1 Energy Greenhouse Gas Source and Sink Categories	Gases included	% Total emissions in 2019	Key category in 2019	Tier/ notation key	Notes
A. Fuel Combustion Activities					
1. Energy Industries					
a. Main Activity Electricity and Heat Production	CO_2, CH_4, N_2O	0.35%	No	T1	
b. Petroleum Refining	CO_2, CH_4, N_2O	2.08%	Yes	T1	
c. Manufacture of Solid Fuels and Other Energy Industries	CO_2, CH_4, N_2O	-	-	NO	
2. Manufacturing Industries and Construction					
a. Iron and Steel	CO_2, CH_4, N_2O	0.97%		T1	
b. Non-Ferrous Metals	CO_2, CH_4, N_2O	1.07%		T1	
c. Chemicals	CO_2, CH_4, N_2O	0.40%		T1	
d. Pulp, Paper and Print	CO_2, CH_4, N_2O	0.05%		T1	
e. Food Processing, Beverages and Tobacco	CO_2, CH_4, N_2O	0.66%		T1	
f. Non-Metallic Minerals	CO_2, CH_4, N_2O	4.19%		T1	
g. Transport Equipment	CO_2, CH_4, N_2O	0.02%	Yes	T1	
h. Machinery	CO_2, CH_4, N_2O	0.08%		T1	
i. Mining	CO_2, CH_4, N_2O	1.27%		T1	
j. Wood and wood products	CO_2, CH_4, N_2O	0.05%		T1	
k. Construction	CO_2, CH_4, N_2O	0.08%		T1	
l. Textile and Leather	CO_2, CH_4, N_2O	0.13%		T1	
m. Non-specified Industry	CO_2, CH_4, N_2O	0.04%		T1	
3. Transport					
a. Domestic Aviation	CO_2, CH_4, N_2O	0.25%	No	T1	
b. Road Transportation	CO_2, CH_4, N_2O	23.02%	Yes	T1	
b.i. Cars	CO_2, CH_4, N_2O	14.07%	Yes	T1	
b.ii. Light duty trucks	CO_2, CH_4, N_2O	6.33%	Yes	T1	
b.iii. Heavy duty trucks and buses	CO_2, CH_4, N_2O	2.19%	Yes	T1	
b.iv. Motorcycles	CO_2, CH_4, N_2O	0.43%	No	T1	

b.v. Other	CO_2, CH_4, N_2O	-	-	NE	No AD
c. Railways	CO_2, CH_4, N_2O	0.06%	No	T1	
d. Water-borne Navigation	CO_2, CH_4, N_2O	0.19%	No	T1	
e. Other Transportation	CO_2, CH_4, N_2O	-	-	NE	No AD
4. Other Sectors					
a. Commercial/Institutional	CO_2, CH_4, N_2O	2.20%	Yes	T1	
b. Residential	CO_2, CH_4, N_2O	2.72%	Yes	T1	
c. Agriculture/Forestry/Fishing/Fish farms	CO_2, CH_4, N_2O	2.18%	Yes	T1	
5. Non-Specified					
a. Stationary	CO_2, CH_4, N_2O	1.81%	Yes	T1	
b. Mobile	CO_2, CH_4, N_2O	2.12%	Yes	T1	
c. Multilateral Operations	-	-		NA	
B. Fugitive emissions from fuels					
1. Solid Fuels					
a. Coal mining and handling	CH_4	0.03%	No	T1	
b. Uncontrolled combustion and burning coal dumps	CH_4	0.00%	No	T1	
c. Fuel transformation	CH_4	-	-	NO	
2. Oil and Natural Gas					
a. Oil	CH_4	0.91%	Yes	T1	
b. Natural Gas Systems	CH_4	0.02%	No	T1	
3. Other emissions from Energy Production					
Other emissions from Energy Production	-	-	-	NO	
C. Carbon dioxide Transport and Storage					
1. Transport of CO_2	-	-	-	NO	
2. Injection and Storage	-	-	-	NO	
3. Other	-	-	-	NO	
Memo items:					
International bunkers					
International aviation	CO_2, CH_4, N_2O	-	No	T1	
Navigation	CO_2, CH_4, N_2O	-	No	T1	
Multilateral operations		-	-	NO	
CO_2 emissions from biomass	CO_2, CH_4, N_2O	-	No	T1	
CO_2 captured	-	-	-	NO	

For the Energy Sector, the Tier 1 methodology and default IPCC emission factors have been used as provided in the 2006 IPCC Guidelines. Emission estimates for all emission sources in the Energy sector relevant to Albania are included in this inventory. The calculations were conducted in the IPCC Software (version 2.691).

For fuel combustion, the following formula was used to calculate emissions:

Emission estimate (Gigagrams GHG/year) = Activity data x Emission factor x Other Factor(s),

where:

- Activity (e.g., ktoe of diesel consumption in the respective year)

- Emission factor (e.g., Gg CH_4 per TJ of diesel)
- Other factor(s) (e.g., factor expressing diesel gassiness, or conversion factors)

To calculate emissions from fugitive sources such as coal mining and hydrocarbon fuel extraction, the amount of extracted fuel has been multiplied with the relevant emission factor, which depends upon the type of coal mining or upon the stage of fuel processing in the oil and gas sector. Nitrous oxide emissions from fossil fuel combustion have been obtained by multiplying the energy content of coal, oil products and gas consumed with the corresponding emission factors, as given in the IPCC Guidelines. Emissions of indirect greenhouse gases such as carbon monoxide and nitrogen oxides have also been calculated according to the IPCC Methodology.

All activity data has been gathered from the National Balance of Energy, prepared by the National Agency of Energy and Ministry of Industry and Energy. The main categories of data collected and their activity data sources are summarised in the following table:

Table 10: Activity data sources for the Energy sector

Code	Main Category	Main Institutions of Activity Data Source
A.	Fuel combustion	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy National Strategy of Energy Yearly Electricity Sector Status published by ERE 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications.
A.I	Energy and Transformation	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy National Strategy of Energy Yearly Electricity Sector Status published by ERE 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications.
A.II	Industry: GHG from final consumption of fuels in industry	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications.
A.III	Transport	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Green Transport Action Plan Other publications.
A.IV	Small Combustion	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications especially prepared by INSTAT, ERE and other International Donors.
A.V	Other	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy

Code	Main Category	Main Institutions of Activity Data Source
		1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications especially prepared by INSTAT, ERE and other International Donors.
A.VI	Traditional biomass burned for energy purposes	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications especially prepared by INSTAT, ERE, the Ministry of Tourism and Environment and other International Donors.
B	Fugitive emissions from fuels	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications especially prepared by ALBPETROL, ARMO, Other Oil and Refinery Companies, the Ministry of Tourism and Environment and other International Donors. Mining Rescue Institute
B.I	Solid Fuels	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy Mining Rescue Institute
B.II	Oil & Natural Gas	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications especially prepared by ALBPETROL, ARMO, Other Oil and Refinery Companies, the Ministry of Tourism and Environment and other International Donors.
B.III	Venting & Flaring	Yearly Energy Balances (2017, 2018, 2019) prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy 1st, 2nd & 3rd National Energy Efficiency Action Plans 1st and 2nd National Renewable Energy Sources Action Plans Other publications especially prepared by ALBPETROL, ARMO, Other Oil and Refinery Companies, the Ministry of Tourism and Environment and other International Donors.

All activity data concerning the above-mentioned categories have been gathered from the Yearly Energy Balance prepared by the National Agency of National Resources and finally approved by the Ministry responsible for Energy. The main problems here have been with energy commodities consumption for each sub-sector. This division has been performed based on analytic analyses and an industrial energy survey that was carried out by AKBN under the Yearly Energy Balances reported for the period 2017, 2018, 2019. Three other very important energy data publications have been: the 1st, 2nd & 3rd National Energy Efficiency Action Plans; the 1st and 2nd National Renewable Energy Sources Action Plans; and the revised NDC, as well as National Energy and Climate Action Plan.

International Bunkers category is comprised of the following subsectors: i) 1.A.3.a.i - International Aviation (International Bunkers); and ii) 1.A.3.d.i - International water-borne navigation (International bunkers). Total GHG emissions in the International Bunkers is 66.269 Gg CO_2 eq. In 2019, 74.30% came from International Aviation and 25.70% from International water-borne navigation.

2.9.4 Uncertainties

The uncertainty of emission estimates has been evaluated. For activity data, an uncertainty value of 5% has been used for categories except liquid fuels, which are considered to have an uncertainty value of 1%. The emission factors are default values from the 2006 IPCC Guidelines, so their corresponding uncertainty values have been used.

2.9.5 Source specific QA/QC

The comparison between the reference and sectoral approach was conducted for all years as a form of verification and QA.

2.9.6 Recalculations

The previous inventory included the years 2009-2016. These years have not been recalculated. Methodologies have not been altered and no concerns regarding time series consistency were raised during data collection or inventory compilation.

2.9.7 Planned improvements

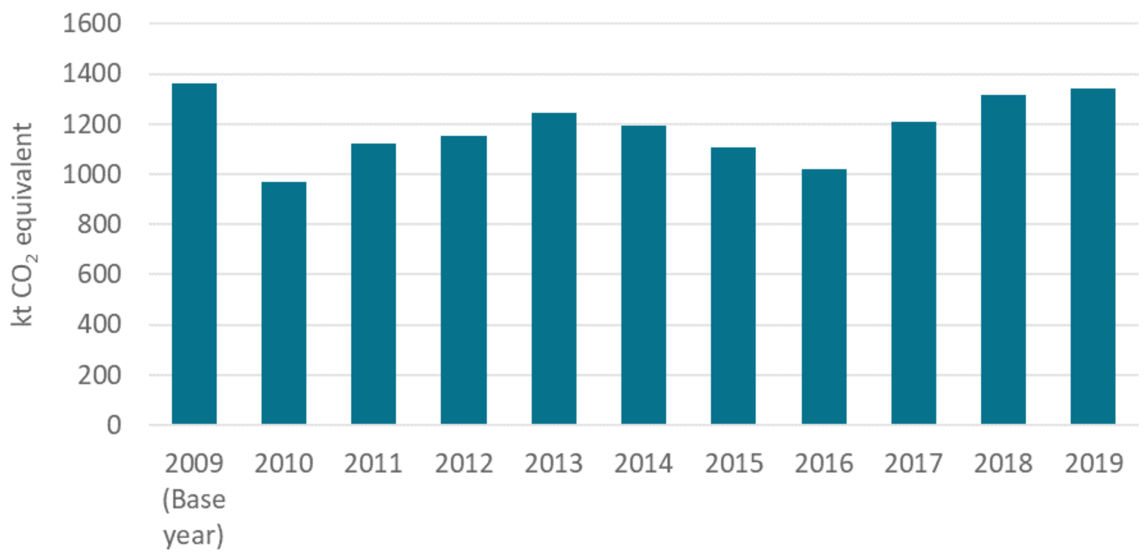
Many categories under the Energy sector are key categories. As such, it is a priority to move towards a Tier 2 methodology using country-specific emission factors particularly for fuel combustion.

2.10 Industrial processes and product use (IPPU) sector

2.10.1 Overview

The figure below shows GHG emissions from the IPPU sector for the years 2009 to 2019. Emissions have decreased by 1.7% across this period from 1364.68 kt CO_2eq. in 2009 to 1341.65 kt CO_2eq. in 2019. The GHG emissions from the IPPU sector come mainly from two main subsectors: Mineral Industry and Metal Industry. The Metal Industry experienced a big drop in emissions due to a technology change in the Kurum Elbasan Steel company. Since 2010, it has been operating Electric Arc Furnace technology, which has a low emission factor.

Figure 22: IPPU sector GHG emissions (2009-2019)



Greenhouse gas emissions are produced from a wide variety of industrial activities. The main emission sources are released from industrial processes that chemically or physically transform materials (for example, the blast furnace in the iron and steel industry and the cement industry are notable examples of industrial processes that release a significant amount of CO_2). During these processes, many different greenhouse gases, including CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), can be produced.

In addition, greenhouse gases often are used in products such as refrigerators, foams or aerosol cans. For example, HFCs are used as alternatives to ozone depleting substances (ODS) in various types of product applications. Similarly, sulphur hexafluoride (SF_6) and N_2O are used in a number of products used in industry (e.g., SF_6 used in electrical equipment, N_2O used as a propellant in aerosol products primarily in food industry) or by end-consumers (e.g., SF_6 used in running-shoes, N_2O used during anaesthesia).

Only process-related emissions are considered in the IPPU sector. Energy-related emissions from these industries are accounted for in the Energy Sector and there is no double-counting of emissions between the Energy and IPPU sectors.

2.10.2 Methodology

The table below presents a summary table of the IPPU sector for the year 2019. It summarises the GHGs that have been estimated, the contribution of each IPPU sector category to the whole national GHG inventory, which categories are considered key categories (as defined by Approach 1 in the 2006 IPCC Guidelines), the uncertainty value of each category (as defined by Approach 1 in the 2006 IPCC Guidelines) and the methodology tier used to estimate emissions (as defined by the 2006 IPCC Guidelines).

Table 11: Summary table for the IPPU sector

2 IPPU Greenhouse Gas Source and Sink Categories	Gases Included	% Total Emissions*	Key Categories	Tier/ Notation key	Notes
A. Mineral Industry					
1. Cement production	CO_2	8.73%	Yes	T1	
2. Lime production	CO_2	0.16%	No	T1	
3. Glass Production	CO_2	-	-	T1	
4. Other Process Uses of Carbonates	CO_2	-	-	T1	
5. Other	CO_2	-	-	T1	
B. Chemical Industry					
1. Ammonia Production	CO_2	-	-	NO	
2. Nitric Acid Production	N_2O	-	-	NO	
3. Adipic Acid Production	N_2O	-	-	NO	
4. Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	-	-	NO	
5. Carbide Production	CO_2, CH_4	-	-	NO	
6. Titanium Dioxide Production	CO_2	-	-	NO	

7. Soda Ash Production	CO_2	-	-	NO	
8. Petrochemical and Carbon Black Production	CO_2, CH_4	-	-	NO	
9. Fluorochemical Production	HFCs, PFCs, SF_6	-	-	NO	
10. Other		-	-	NO	
C. Metal Industry					
1. Iron and Steel Production	CO_2, CH_4	0.54%	No	T1	
2. Ferroalloys Production	CO_2, CH_4	0.75%	No	T1	
3. Aluminium Production	CO_2, CH_4	-	-	NO	
4. Magnesium Production	CO_2, SF_6	-	-	NO	
5. Lead Production	CO_2	0,004%	No	T1	
6. Zinc Production	CO_2	-	-	NO	
7. Other		-	-	NO	
D. Non-Energy Products from Fuels and Solvent Use					
1. Lubricant Use	CO_2	0.11%	No	T1	
2. Paraffin Wax Use	CO_2	-	-	NE	
3. Solvent Use	NMVOC	-	-	NE	
4. Other		-	-	NE	
E. Electronics Industry					
1. Integrated Circuit or Semiconductor	PFCs	-	-	NO	
2. TFT Flat Panel Display	PFCs	-	-	NO	
3. Photovoltaics	PFCs	-	-	NO	
4. Heat Transfer Fluid	PFCs	-	-	NO	
5. Other		-	-	NO	
F. Product Uses as Substitutes for Ozone Depleting Substances					
1. Refrigeration and Air Conditioning	HFC	-	-	IE	2.H.3
2. Foam Blowing Agents	HFC	-	-	IE	2.H.3
3. Fire Protection	HFC	-	-	IE	2.H.3
4. Aerosols	HFC	-	-	IE	2.H.3
5. Solvents	HFCs, PFCs	-	-	NE	Lack of AD
6. Other Applications	HFCs, PFCs, SF_6	-	-	NO	
G. Other Product Manufacture and Use					
1. Electrical Equipment	HFCs, PFCs, SF_6	-	-	NE	Lack of AD
2. SF_6 and PFCs from Other Product Uses	HFCs, PFCs, SF_6	-	-	NE	Lack of AD
3. N_2O from Product Uses	N_2O	-	-	NE	Lack of AD
4. Other		-	-	NO	
H. Other					
1. Pulp and Paper Industry	CO_2	-	-	NO	
2. Food and Beverages Industry	NMVOC	-	-	NO	
3. Other	HFCs, PFCs	1.37%	Yes	T1	Emissions for 2.F

For the IPPU Sector, the Tier 1 methodology and default IPCC emission factors have been used as provided in the 2006 IPCC Guidelines. Emission estimates from the production of cement, lime, steel, ferrochromium, aluminium and lead, and emission estimates from the use of lubricants and fluorinated gases are included in this inventory. Emission estimates from the use of paraffin wax, solvents with fluorinated gases, electrical equipment, and the consumption of N_2O and F-Gases in products are not included in this inventory due to a lack of activity data. The calculations were conducted in the IPCC Software (version 2.691). Emissions from fluorinated gases were included under 2.H.3 due to an issue adding the data to the IPCC Software.

The data for preparation of the greenhouse gases inventory for the IPPU sector are collected from the main sources as provided in the table below.

Table 12: Data sources for the IPPU sector

No.	Description
1	The State statistics - INSTAT
2	Ministry of Industry and Energy - MIE
3	National Agency for Natural Resources - NANR
4	National Environment Agency - NEA
5	Ministry of Tourism and Environment - MTE
6	[https://www.globalcement.com/magazine/articles/1107-fushe-kruje-cement-factory-a-hybrid-plant]
7	[http://www.anteacement.com/_home/product/]
8	[https://www.colacem.com/al/en]
9	[https://www.see-industry.com/en/energy-efficiency-improvement-in-steel-factory-in-elbasan-albania/2/590/]
10	[https://ozone.unep.org/countries/data-table]
11	National Ozone Unit

Emission factors and other parameters with background documentation or technical references were derived from the IPCC Emission Factor Database (EFDB), which contains the IPCC default data and the 2006 IPCC Guidelines. The emission factors are presented in the table below.

Table 13: Emission factors for the IPPU sector

No.	Category	Technology / Specification	Emission Factor	Unit
1	2.A.1 - Cement production	n/a	0.52	[ton CO_2/ton clinker]
2	2.A.2 - Lime production	n/a	0.753	[ton CO_2/ton lime]
3	2.C.1 - Iron and Steel Production	Electric Arc Furnace (EAF)	0.08	[ton CO_2/ton produced]
4	2.C.1 - Iron and Steel Production	Open Hearth Furnace (OHF)	1.72	[ton CO_2/ton produced]
5	2.C.1 - Iron and Steel Production	Iron Production	1.35	[ton CO_2/ton produced]
6	2.C.2 - Ferroalloy production	Ferro-chromium	1.3	[ton CO_2/ton produced]
7	2.C.3 - Aluminium production	Prebake	1.6	[ton CO_2/ton produced]
8	2.C.3 - Aluminium production	Söderberg	1.7	[ton CO_2/ton produced]
9	2.C.5 - Lead Production	From Treatment of Secondary Raw Materials	0.2	[ton CO_2/ton produced]

Cement production

In cement manufacture, CO_2 is produced during the production of clinker. Dust may be generated at various points in the kiln line apparatus used to make clinker.

Carbon dioxide emissions from cement production were calculated by applying Tier 1 approach, as the only data available from all the companies are regarding the yearly production and export. /the Tier 1 approach is based on EF for CO_2 emitted per unit mass of raw material or product manufactured. In the Tier 1 method, emissions are based on clinker production estimates inferred from cement production data, correcting for imports and exports of clinker.

Table 14: Cement production in Albania (2009-2019)

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Antea Cement (Titan)												
Production	[ton/year]	na	761,638	1,040,000	1,062,000	1,098,000	710,000	675,250	652,600	1,013,982	1,100,000	1,020,000
Export	[ton/year]	na	334,600	435,000	548,000	477,000	419,034	218,650	146,155	385,432	360,000	350,000
Consumption	[ton/year]	na	427,038	605,000	514,000	621,000	290,966	456,600	506,445	628,550	740,000	670,000
Fushe - Kruje Cement												
Production	[ton/year]	na	900,000	910,000	1,018,000	980,000	1,087,000	955,000	850,000	790,600	750,000	1,100,000
Export	[ton/year]	na	275,000	275,935	545,000	485,000	585,000	453,878	460,800	297,700	310,000	360,000
Consumption	[ton/year]	na	625,000	634,065	473,000	495,000	502,000	501,122	389,200	492,900	440,000	740,000
Elbasani Cement												
Production	[ton/year]	na	200,000	220,000	230,000	215,000	290,000	235,000	202,000	230,000	150,000	0
Export	[ton/year]	na	145,000	154,000	125,000	130,000	100,000	161,054	86,955	95,000	80,000	0
Consumption	[ton/year]	na	55,000	66,000	105,000	85,000	190,000	73,946	115,045	135,000	70,000	0
Colachem, Balldren, Lezhe												
Production	[ton/year]	0	0	0	0	215,000	235,000	255,000	252,000	253,000	250,000	110,000
Export	[ton/year]	0	0	0	0	55,000	53,000	62,000	58,000	60,000	62,000	67,000
Consumption	[ton/year]	0	0	0	0	160,000	182,000	193,000	194,000	193,000	188,000	43,000
Total production	[ton/year]	1,300,000	1,861,638	2,170,000	2,310,000	2,508,000	2,322,000	2,120,250	1,956,600	2,287,582	2,250,000	2,230,000
Total Export	[ton/year]	na	754,600	864,935	1,218,000	1,147,000	1,157,034	895,582	751,910	838,132	812,000	777,000
Consumption	[ton/year]	na	1,107,038	1,305,065	1,092,000	1,361,000	1,164,966	1,224,668	1,204,690	1,449,450	1,438,000	1,453,000

The following information was used to estimate the amount of clinker produced using cement production statistics:

- Fushe-Kruja Cement Factory[39] & Elbasani Cement Factory produces five CE-certified cements, packed in 10 different combinations, and distributed either in bulk or in 1.95t or 1.75t pallet configuration
- Titan Cement[40] produces three different types of cement:
  - CEM I / 42.5 R - Portland Cement with the main constituents 95 – 100% Clinker and minor additional constituents 0 – 5% Gypsum
  - CEM II / A-LL 42.5 R - Portland Limestone Cement with the main constituents 80 - 94% Clinker, 6 – 20% Limestone and minor additional constituents 0 – 5% Gypsum
  - CEM II / B-LL 32.5 R - Portland Limestone Cement with the main constituents 65 - 79% Clinker, 21 – 35% Limestone and minor additional constituents 0 – 5% Gypsum.
- Colacem Factory[41] is producing two different types of cement:
  - CEM II/A-LL 42,5 R – PORTLAND with the main constituents 80 – 94% Clinker, 6 – 20% Limestone and minor additional constituents 0 – 5%
  - CEM II/B-LL 32,5 R – PORTLAND with the main constituents 65 – 79% Clinker, 21 – 35% Limestone and minor additional constituents 0 – 5%

[39] https://www.globalcement.com/magazine/articles/1107-fushe-kruje-cement-factory-a-hybrid-plant
[40] http://www.anteacement.com/_home/product/
[41] https://www.colacem.com/al/en

Considering the variety of the cement products from all the factories and not having data regarding the amount of each product, the clinker fraction in the calculations of the emissions is considered 0.9.

Lime production

Calcium oxide (CaO or quicklime) is formed by heating limestone to decompose the carbonates. This is usually done in shaft or rotary kilns at high temperatures and the process releases CO_2. As is the case for emissions from cement production, there are three basic methodologies for estimating emissions from lime production: an output-based approach that uses default values (Tier 1), an output-based approach that estimates emissions from CaO and CaO·MgO production and country-specific information for correction factors (Tier 2) and an input-based carbonate approach (Tier 3).

The table below provides the production data used to estimate emissions from lime production. Using the Tier 1 approach, the EF is considered as 0.753.

Table 15: Lime production in Albania (2009-2019)

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Lime Production	[ton/year]	114,802	46,039	46,320	23,096	23,007	26,700	26,800	18,300	22,830	27,650	24,937

Iron and steel production

The category Iron and steel production is a key category for CO_2 emissions in terms of emissions level. In Albania there is only one factory to produce iron and steel, Kurum factory in Elbasani, which produces i) Billets; ii) Reinforcing bars (Rebars); iii) Ribbed wire rods; iv) Smooth wire rods; and v) Spooler.

The Tier 1 approach for emissions from iron and steel production is to multiply default emission factors by national production data. Because emissions per unit of steel production vary widely depending on the method of steel production, it is good practice to determine the share of steel produced in different types of steelmaking processes, calculate emissions for each process, and then sum the estimates. The IPCC 2006 guidelines offer Emission Factors according to the Process or Steelmaking method.

According to the article on "Energy Efficiency Improvement in Steel Factory in Elbasan, Albania",[42] the Kurum Elbasan Steel operates with Electric Arc Furnace (EAF) technology, smelting ferrous metal scrap. Steel production data from Kurum Steel Factory in Elbasan is provided in the table below.

Table 16: Steel production in Kurum Steel Factory in Elbasan (2009-2019)

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Steel ingots	[ton/year]	na	390,850	463,620	381,692	312,789	433,735	239,300	111,072	270,224	392,000	400,584
Katanke steel	[ton/year]	na	235,882	295,393	248,327	249,476	272,541	234,200	121,161	260,558	366,000	379,041
Iron & Steel Production	**[ton/year]**	**435,003**	**626,732**	**759,013**	**630,019**	**562,265**	**706,276**	**473,500**	**232,233**	**530,782**	**758,000**	**779,625**

[42] https://www.see-industry.com/en/energy-efficiency-improvement-in-steel-factory-in-elbasan-albania/2/590/

Ferroalloys production

Ferroalloy is the term used to describe concentrated alloys of iron and one or more metals such as silicon, manganese, chromium, molybdenum, vanadium and tungsten. In Albania there is only Ferro-Chromium production. Ferroalloy production involves a metallurgical reduction process that results in significant carbon dioxide emissions. The IPCC Guidelines outline several approaches for calculating CO_2 emissions from ferroalloy production. The Tier 1 method calculates emissions from general emission factors applied to a country's total ferroalloy production and is used in this inventory. The table below provides the production data used to estimate emissions from ferro-chromium production.

Table 17: Ferro-Chromium production in Albania (2009-2019)

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ferro-Chromium Production	[ton/year]	27,267	22,518	28,502	24,018	24,700	34,897	43,669	44,551	50,199	92,851	66,402

Aluminium production

All the process-related CO_2 and PFCs gases are released from the production of ingots – primary aluminium production. In Albania, there is no primary aluminium production (ingot production) but there are companies that uses ingots for producing different aluminium frames and recycling companies – secondary aluminium production. There are no process-related emissions associated with secondary aluminium production. The amount of secondary aluminium production is presented below.

Table 18: Secondary aluminium production in Albania (2009-2019)

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aluminium production	[ton/year]	na	20,332	20,550	19,842	21,530	16,516	17,110	21,840	27,047	25,167	23,771
Aluminium production from recycling	[ton/year]	500	2,605	3,309	1,940	4,124	1,345	9,152	10,747	2,910	3,850	12,700
Total Aluminium Production	**[ton/year]**	**500**	**22,937**	**23,859**	**21,782**	**25,654**	**17,861**	**26,262**	**32,587**	**29,957**	**29,017**	**36,471**

Lead production

Lead production is either considered primary production where rough lead bullion is made from lead concentrates or secondary production where lead is recycled for reuse. In Albania, secondary lead production takes place, which has a lower default emission factor than primary lead production. The default IPCC emission factor is multiplied by the national production of lead from recycling (provided in the table below) to estimate emissions of CO_2 from this source category.

Table 19: Secondary lead production in Albania (2009-2019)

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Lead Production (recycling)	[ton/year]	na	3109	3,351	2,372	2,078	2,603	2,091	1,638	2,210	1,864	2,478

Fluorinated gases (F-Gases)

Hydrofluorocarbons (HFCs) and, to a very limited extent, perfluorocarbons (PFCs), are serving as alternatives to ozone depleting substances (ODS) being phased out under the Montreal Protocol. the use of HFCs and PFCs in some applications, specifically rigid foam (typically closed-cell foam), refrigeration and fire suppression, can lead to the development of *long-lived banks of material*. The emission patterns from these uses can be particularly complex and methods employing disaggregated data sets are essential to generate accurate emissions estimates. Other applications, such as aerosols and solvent cleaning may have short-term inventories of stock but, in the context of emission estimation, can still be considered as sources of prompt emission.

As CFCs, halons, carbon tetrachloride, methyl chloroform, and, ultimately, HCFCs are being finally phased out, HFCs are being selectively used as replacements. PFCs are also being used, but only to a limited extent. Even though up to 75 percent of previous application of CFC may now be covered by non-fluorocarbon technologies, HFC use is expected to continue to grow at least in the short term.

According to the information received from the UNIDO project in Albania, the country consumption/import of F-gases for the period 2017-2019, is presented as following.

Table 20: Imports of HFCs in Albania (2012-2019)

COUNTRY IMPORT OF HFCs [ton] (Source File: Database Report UNIDO)											
F-GASES				2012	2013	2014	2015	2016	2017	2018	2019
R-134a	HFC	Tetrafluoroethane	CF3CH2F	16.750	18.610	20.850	20.852	45.298	131.731	202.146	271.564
R-227ea	HFC	Heptafluoropropane	C3HF7	n/a	n/a	n/a	n/a	n/a	0.000	0.000	0.000
R-404A	HFC	Blend	R125 + R143a + R134a (%: 44/52/4)	6.400	10.460	11.730	28.819	46.238	58.081	78.282	116.829
R-407C	HFC	Blend	R32 + R125 + R134 (%: 23/25/52)	1.990	1.290	17.460	2.476	2.597	5.808	12.048	33.341
R-410A	HFC	Blend	R32 + R125 (%: 50/50)	8.860	10.200	21.360	15.980	30.256	60.350	123.897	87.423
R-507A	HFC	Blend	R125 + R143 (% 50/50)	0.862	2.600	0.000	0.056	0.875	1.447	8.172	17.120
R-32	HFC	Difluoromethane	CH2F2				0.530	1.582	1.708	5.875	6.165
R-245fa	HFC	Pentafluoropropane	C3H3F5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R-422B	HFC	Blend	R125 + R134a + R600	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL HFC				34.862	43.160	71.400	68.713	126.846	259.125	430.420	532.442

It should be noted that the following period 2017-2019 is aligned with the previous period used in the BUR report. The emissions from all fluorinated gases are considered altogether within the total amount of F-gases, except for consumption within solvents which is not included in the inventory due to a lack of activity data. This is reported under category 2.H.3 Other due to restrictions within the IPCC Software.

2.10.3 Uncertainties

The uncertainty of emission estimates has been evaluated for all categories. For activity data, the uncertainty value differs between the categories. Cement, steel, lead production and lubricant and fluorinated gas consumption have an AD uncertainty value of 10%; lime production has an AD uncertainty of 6%, magnesium production of 5%, ferroalloy production of 4% and aluminium production of 1%. These are based on the IPCC Guidelines. The emission factors are default values from the 2006 IPCC Guidelines, so their corresponding uncertainty values have been used.

2.10.4 Source specific QA/QC

The general QA/QC procedures documented in the section above: Quality Assurance and Quality Control have been applied to this sector. No source specific QA/QC activities have been conducted.

2.10.5 Recalculations

The previous inventory included the years 2009-2016. These years have not been recalculated. Methodologies have not been altered and no concerns regarding time series consistency were raised during data collection or inventory compilation.

2.10.6 Planned improvements

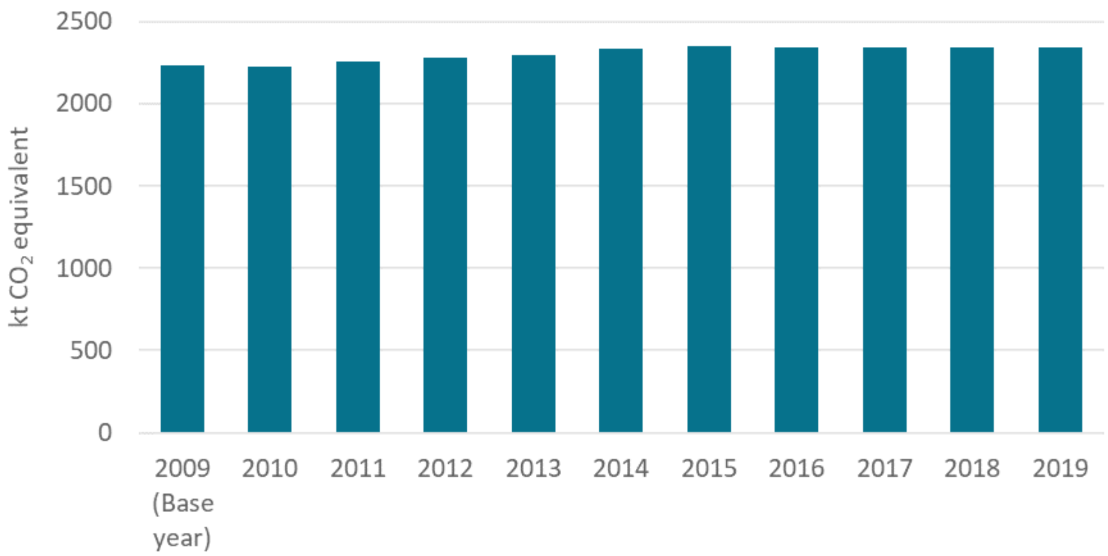
Some categories under the IPPU sector are key categories. As such, it is a priority to move towards a Tier 2 methodology, particularly for cement production. Further analysis is also required for the F-Gas inventory to ensure comparability by splitting emissions by sub-category and completeness by assessing the import/export of pre-charged units and fluorinated gases used for maintenance in neighbouring countries.

2.11 Agriculture sector

2.11.1 Overview

The figure below shows GHG emissions from the agriculture sector for the years 2009 to 2019. Emissions have increased by 4.7% across this period from 2236.31 kt CO_2eq. in 2009 to 2341.53 kt CO_2eq. in 2019.

Figure 23: Agriculture sector GHG emissions (2009-2019)



Agriculture is one of the key sectors of Albanian economy, playing a significant but varying role contributing about 19.3% of GDP (2020)[43]. Agriculture provides the income basis for most of the population and serves as an employment safety net. The rural population is estimated to comprise about 45 percent of the total population while about 40 percent of the labour force works in agriculture and related fields. It seems obvious that any significant change in climate on a global scale will impact local agriculture. However, due to growth in other sectors of the Albanian economy the contribution of agriculture in GDP has been decreasing. The sector is still the main source of employment for more than a half of population

Albania is divided into four main agroecological areas, with the largest amount of agricultural land and higher quality land laying in the first two agroecological zones:

1. The southern part of the coastal plain is characterized by a relatively dry Mediterranean climate, hot summers with an average temperature of 26 °C. Winter is mild and wet with an average temperature of 9.8 °C. The average annual rainfall amounts to 800-1300 mm, but

[43] https://ata.gov.al/2021/04/19/kontributi-i-bujqesise-ne-pbb-u-rrit-19-3-ne-vitin-2020/

only 12 percent of the total falls in the period June-September. In this region many crops are grown (cereals, industrial crops, vegetables, forages etc.), also citrus and olive trees.

2. The central and northern part of the coastal plain. It also has a Mediterranean climate with hot and dry summers. The average summer temperature is 23-24 °C. Winter is wet with the possibility of frost. Rainfall is higher especially in the North where it can be as much as 2000 mm. Climatic conditions are suitable for crops such as maize, vegetables, forages, vines and fruit trees.

3. The hilly zone extends from north to south and lies 600 m above sea level. River valleys extend from east to west through the area. The average temperature is 3-4 °C lower than in coastal zones, with frequent frosts. It is suitable for growing wheat, potatoes, sunflower, tobacco, sugar beet, vegetables, vineyards and fruit.

4. The mountain zone, is characterized by a continental climate with rainfall of up to 600-1000 mm. The northern part of this zone, in the Dinaric Alps, has the highest rainfall values varying between1500-2500 mm. The highest temperature in July is about 25 °C; minimal temperatures in winter are to –20 °C. Forests and pastures cover most of the area. Areas of wheat, forages, vegetables, potatoes and fruit have expanded. Soil quality, slope, access to water, climate conditions etc., are different on each region.

During the last decade, the sector has experienced moderate growth, starting from 2006. However, the development of the sector is highly affected by several structural problems. The relatively underdeveloped infrastructure in rural areas holds back the emergence of agricultural products on the market. Agricultural land fragmentation hinders the effective organization of production, reduces productivity and increases the cost of using agricultural mechanics. Meanwhile, agricultural land is not utilized at full capacity, because of the phenomenon of external and internal migration of population. This phenomenon, together with ownership problems, has limited the continuing investment in the agricultural sector.

Despite the general expansion of credit to the economy during the period 2000-2008, agriculture activities crediting remained at low levels. However, the expansion of the sector during 2005-2013 is believed to have contributed to the general economic performance of the country. In addition, the increase of agricultural prices on world markets conveys proper incentives for long-term production growth of this branch of the Albanian economy. On the other hand, developments and structural reforms (aimed at increasing efficiency in agricultural production, facilitating access of local agricultural products in domestic and foreign markets, as well as financially supporting businesses and farms of this sector) has been a priority of future economic policies.

Livestock

Generally, livestock production is seen as a backbone of Albania's agriculture. Livestock products constitute a main source of food, thus being the most important sector of agriculture. Yet the intensity of production is low compared to European standards. The dairy industry, along with it the milk collection system, are still modernizing structures and technologies. In the late 1990s, the first private milk processing plants were established in different regions of the country. Most small processing units use traditional craftsmanship technologies until today.

The number of livestock is almost constant since the year 2000. However, the poultry sector is the only that recognizes continuous increase from year to year. The number of livestock from the year 2010 to 2016 is given in the figure below.

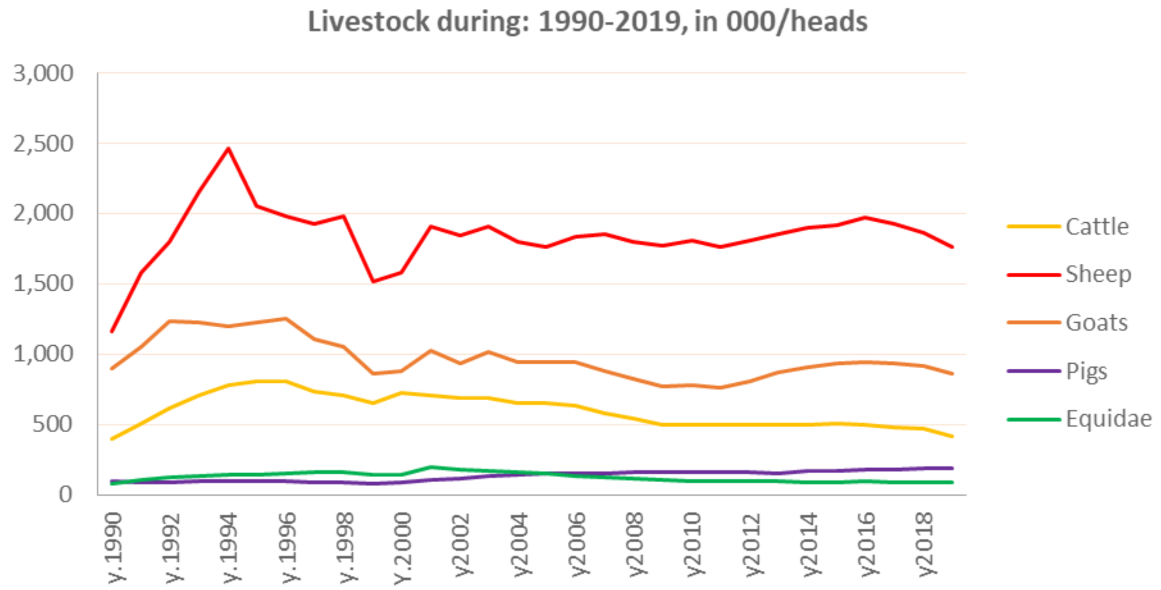


Figure 24: Livestock number during the period 2001-2016

As it is evidenced in the figure, number of pigs and equidae is almost same with very small changes year by year. Number of sheep has a trend to increase, while number of cattle is decreasing year by year.

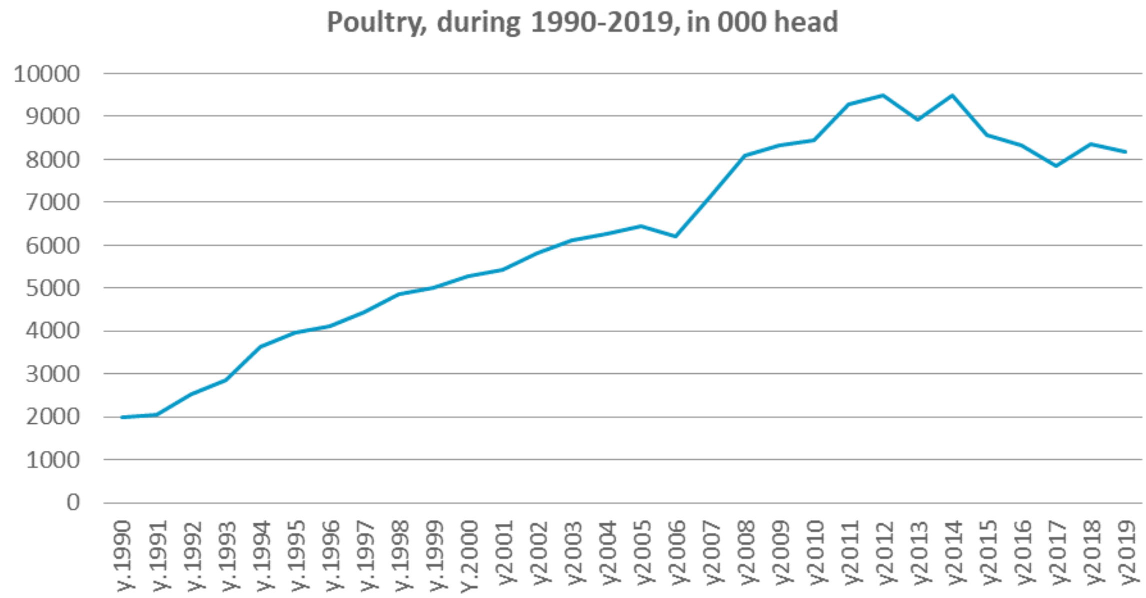


Figure 25: Poultry number during 1990-2019

On the other hand, despite some small changes, the number of poultry is increased year by year until 2011. After that year a slight decrease in their number has been observed.

GHG emissions from livestock depend largely on the number, structure and composition of animals. Another important factor is the manure management according to each category.

Enteric fermentation

Enteric fermentation refers to the fermentation of feed as part of the normal digestive processes of livestock. In ruminant animals (principally cattle, sheep, and goats), a significant amount of fermentation takes place in the rumen, resulting in relatively large methane emissions per unit of feed energy consumed. Pseudo-ruminant animals (e.g., horses) and monogastric animals (e.g., pigs) do not support the same level of feed fermentation, and consequently emissions from these animals are relatively low. Therefore, indicators of methane emissions from enteric fermentation focus primarily on ruminant animals.

What makes ruminant animals unique is their "fore-stomach" or rumen, a large, muscular organ. The rumen is characterized as a large fermentation vat where approximately 200 species and strains of micro-organisms are present. The microbes ferment the plant material consumed by the animal through a process known as enteric fermentation. The products of this fermentation provide the animal with the nutrients it needs to survive, enabling ruminant animals to subsist on coarse plant material. Methane is produced as a by-product of the fermentation and is expelled.

Around 83% of the CH_4 is emitted during the enteric fermentation processes.

"Monogastric" animals produce small amounts of methane as the result of incidental fermentation that takes place during the digestion process. "Non-ruminant herbivores" produce methane at a rate that is between monogastric and ruminant animals. Although these animals do not have a rumen, significant fermentation takes place in the large intestine, allowing significant digestion and use of plant material. Emission factors are based on animal and feed characteristics data. Specifically, the emissions factors are based on the average energy requirement of the animal, the average feed intake to satisfy the energy requirements, and the quality of the feed consumed.

Data on GHG emissions from enteric fermentation is given in the table below; GHGs emissions by enteric fermentation in Gg CO_2 eq. by years.

Table 21: GHGs emissions from enteric fermentation (2009-2019)

Livestock category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cattle	905.63	906.13	904.05	914.80	913.08	916.75	921.25	904.91	879.04	865.35	777.55
Dairy Cows	733.89	738.05	735.97	744.28	740.12	744.28	742.20	738.05	725.57	713.10	656.96
Other Cattle	171.74	168.08	168.08	170.52	172.96	172.47	179.05	166.87	153.47	152.25	120.58
Buffalo	0.00	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Sheep	185.64	189.63	184.59	189.95	194.88	199.08	201.39	207.06	202.23	195.72	184.59
Goats	81.06	81.38	79.70	85.05	91.04	94.92	97.86	98.81	97.97	96.29	90.62
Horses	13.23	14.36	13.23	12.85	13.23	12.10	11.72	12.10	12.10	12.10	12.10
Mules and Asses	13.44	13.23	13.44	13.23	12.18	12.39	12.60	13.02	11.97	11.76	11.55
Swine	3.36	3.44	3.42	3.34	3.19	3.61	3.59	3.80	3.78	3.86	3.86
TOTAL	**1202.36**	**1208.31**	**1198.57**	**1219.36**	**1227.74**	**1238.99**	**1248.55**	**1239.84**	**1207.22**	**1185.22**	**1080.41**

In this case, cattle are the main emitters of GHGs in about 74% of total under the livestock category. Other livestock categories contributing in significant way are sheep with 15% and goats with 7.3%.

Livestock are produced throughout the world and are a significant source of global CH_4 emissions. The amount of methane emitted is driven primarily by the number of animals, the type of digestive system, and the type and amount of feed consumed. Regarding the enteric fermentation, the situation for 2019 is presented in the figure below.

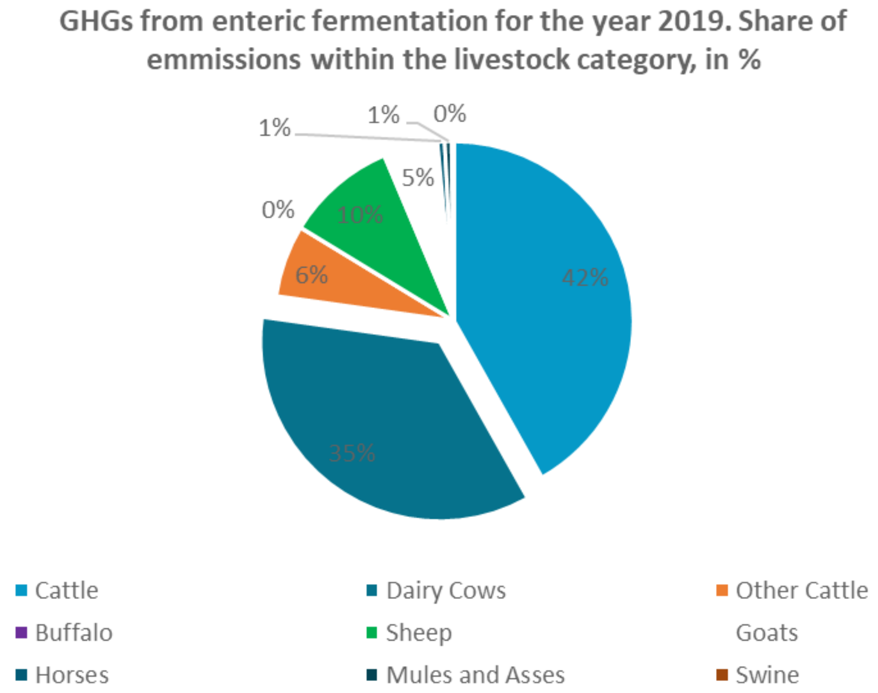


Figure 26: Share of GHGs emissions from enteric fermentation for 2019

Around 62.7% of emissions from enteric fermentations is coming from the cattle.

Manure management

Manure management refers to capture, storage, treatment, and utilization of animal manures in an environmentally sustainable manner. It can be retained in various holding facilities. Animal manure (also referred to as animal waste) can occur in a liquid, slurry, or solid form. It is utilized by distribution on fields in amounts that enrich soils without causing water pollution or unacceptably high levels of nutrient enrichment. Manure management is a component of nutrient management. Emissions from manure management represent about 17% of the total GHGs from livestock.

Livestock manure emits CH_4 emissions from enteric fermentation and both CH_4 and N_2O under anaerobic (oxygen-less) conditions. This is because the organic material within the manure begins to be decomposed by anaerobic bacteria; the results of this decomposition include methane, carbon dioxide, and stabilized organic material. Both the amount of manure produced and the amount of manure that decompose anaerobically are central to determining methane emissions. Factors that influence these two considerations are the type of manure management system and the climate. Cattle are an important source of CH_4 because of their large population and high CH_4 emission rate due to their ruminant digestive system. Nitrous oxide emissions from manure management vary significantly between the types of management system used and can also result in indirect emissions due to other forms of nitrogen loss from the system.

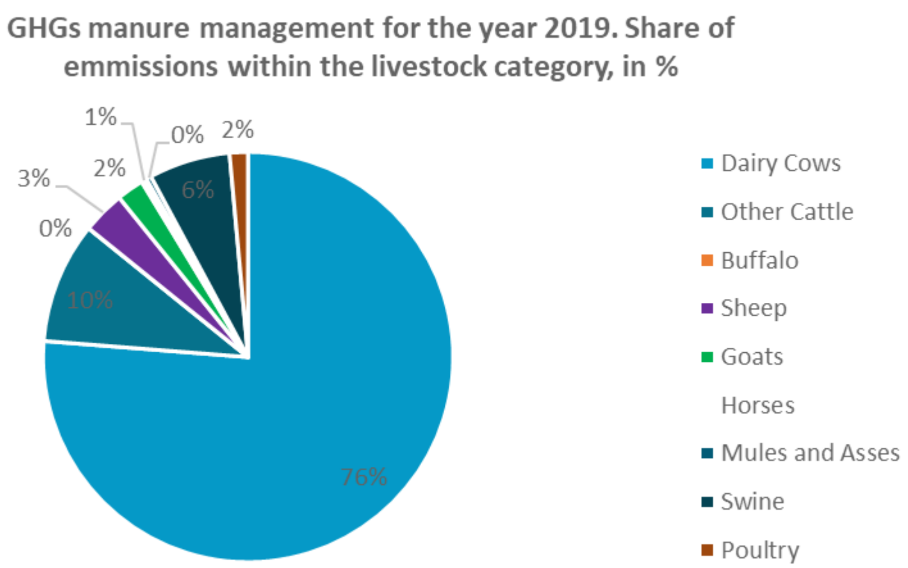
Manure management systems can be broadly classified as either liquid or dry. Dry systems included activities such as spreading the manure daily, dry feedlots, solid storage, and unmanaged manure from pasture livestock. Liquid systems are often found in intensive livestock management systems; it occurs through manure practices using tanks or lagoons to store. These systems create ideal anaerobic conditions. The most substantial manure emissions are associated with confined animal management operations, where manure is handled in liquid-based systems.

Production of N_2O during storage and treatment of animal wastes can occur via combined nitrification – de-nitrification of nitrogen contained in the wastes. The amount of N_2O released depends on the system and duration of waste management. Because N_2O production requires an initial aerobic reaction and then an anaerobic process, it is theorized that dry, aerobic management systems may provide an environment more conducive for N_2O production.

Table 22: GHGs emissions by manure management in Gg CO_2 eq. by years

Livestock category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cattle	249.44	249.82	249.23	252.16	251.51	252.60	253.47	249.55	242.97	239.11	215.89
Dairy Cows	211.09	212.28	211.69	214.08	212.88	214.08	213.48	212.28	208.70	205.11	188.96
Other Cattle	38.35	37.54	37.54	38.08	38.63	38.52	39.99	37.27	34.27	34.00	26.93
Buffalo	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Sheep	9.53	9.74	9.48	9.75	10.00	10.22	10.34	10.63	10.38	10.05	9.48
Goats	5.39	5.41	5.30	5.66	6.06	6.31	6.51	6.57	6.52	6.40	6.03
Horses	1.32	1.43	1.32	1.28	1.32	1.20	1.17	1.20	1.20	1.20	1.20
Mules and Asses	1.32	1.30	1.32	1.30	1.20	1.22	1.24	1.28	1.18	1.16	1.13
Swine	15.71	16.10	16.00	15.61	14.92	16.89	16.79	17.77	17.67	18.07	18.07
Poultry	4.15	4.21	4.63	4.73	4.45	4.73	4.27	4.15	3.91	4.17	4.08
TOTAL	**286.86**	**288.05**	**287.31**	**290.53**	**289.50**	**293.21**	**293.81**	**291.20**	**283.87**	**280.20**	**255.92**

For the year 2019 the situation regaling GHGs emissions from this process are presented in the graph below.



In this case, cattle contribute with 85% of the emissions (or 215.89 Gg CO_2 eq.)

Direct N_2O emissions

Nitrous oxide is a gaseous intermediate in the reaction sequence of denitrification and a by-product of nitrification that leaks from microbial cells into the soil and ultimately into the atmosphere. In most soils, an increase in available 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 or change of land-use and/or management practices that mineralise soil organic N.

The following N sources which are estimated under this inventory as direct N_2O emissions from managed soils are:

- Synthetic N fertilizers
- Organic N applied as fertilizer
- 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 mineralization associated with loss of soil organic matter resulting from change of land use or management of mineral soils
- Drainage/management of organic soils.

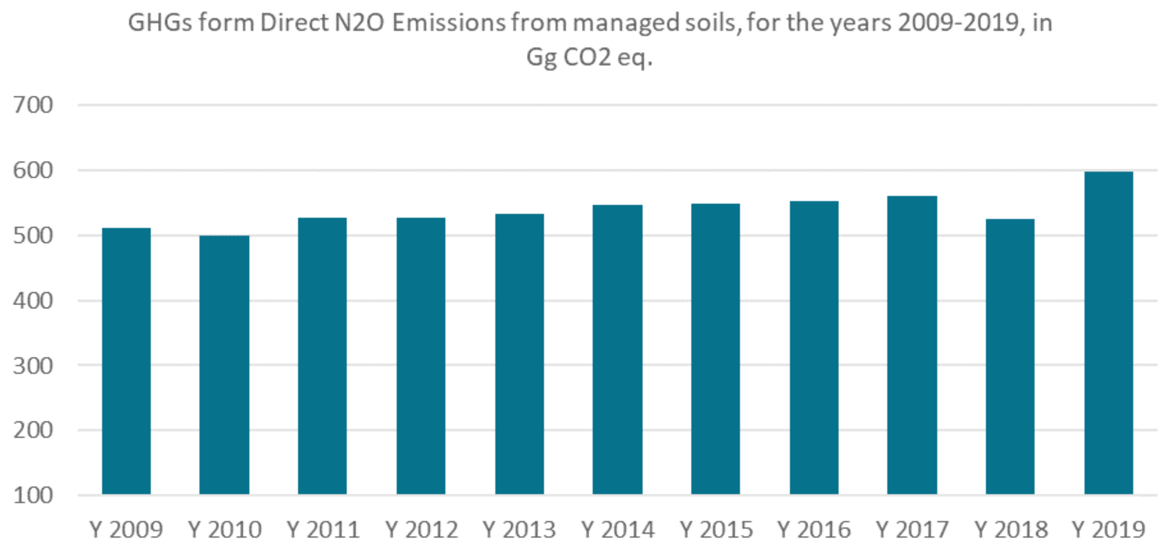


Figure 27 GHGs form Direct N_2O Emissions from managed soils in kt CO_2eq.

Regarding Direct N_2O emissions, most of important sources are N excretion from MMs which depends on number and the livestock categories, manure management systems, organic N applied to managed soils, direct N_2O emissions from managed soils (N in synthetic fertilizers, N in animal manure, N in mineral soils). The trend of GHGs emissions is slightly increasing by 11% (or 1% per year) from the year 2009 compare with 2019.

Indirect N_2O emissions

Despite the direct emissions of N_2O from managed soils that occur through a direct pathway, emissions of N_2O also take place through indirect pathways:

- Volatilisation of N as NH_3 and oxides of N (NO_X), deposition of these gases and their products NH_4 and NO_3 into soils and the surface of water resources.
- Leaching and runoff from 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. This may take place in the groundwater below the land to which the N was applied, or in riparian zones receiving drain or runoff water, or in the ditches, streams, rivers and estuaries (and their sediments) into which the land drainage water eventually flows.

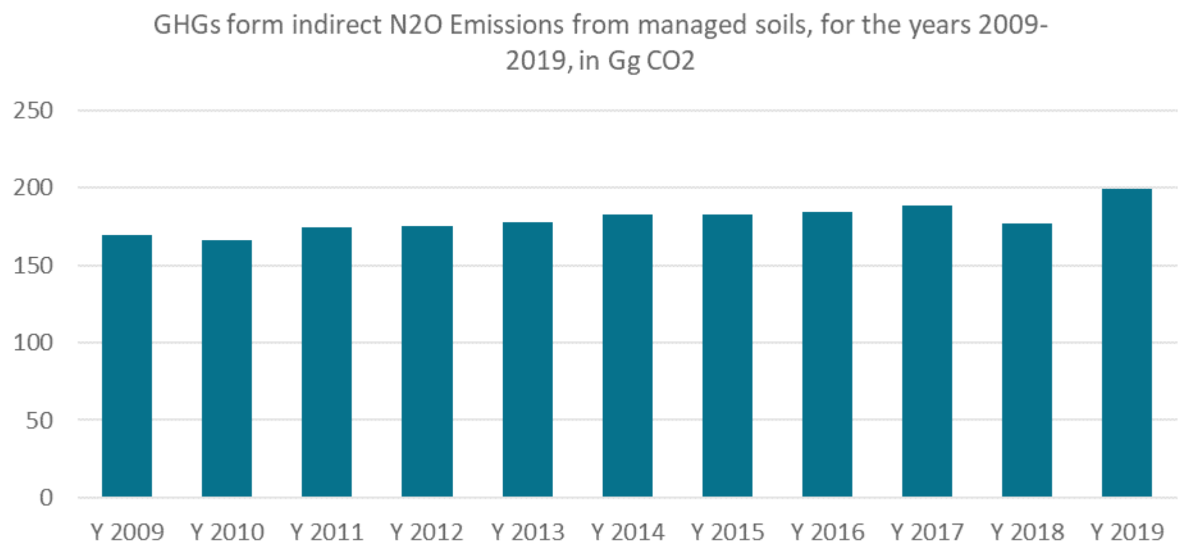


Figure 28: GHGs form indirect N_2O Emissions from managed soils

Here, N sources of indirect N_2O emissions from managed soils are:

- Synthetic N fertilisers used during inventory period
- Organic N applied as fertiliser (applied animal manure, compost, sewage sludge and other organic amendments)
- Urine and dung N deposited on pasture, range and paddock by grazing animals
- N in crop residues (above- and below-ground), including N-fixing crops and forage/pasture renewal returned to soils etc.

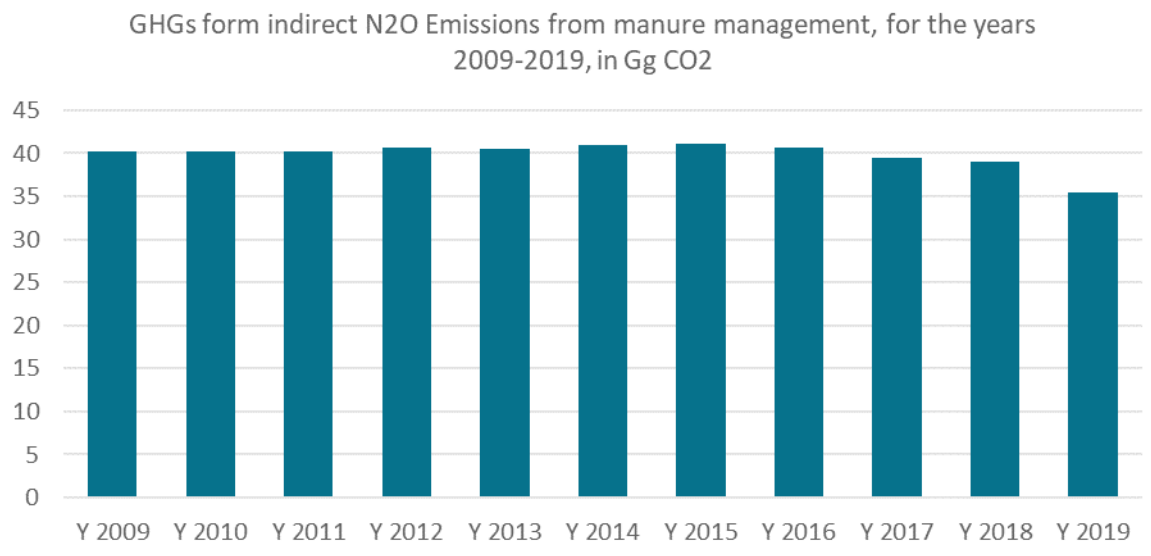


Figure 29: GHGs form indirect N_2O Emissions from manure management

Most important N emissions here are from manure nitrogen that volatilized from manure management systems, amount/fraction of manure nitrogen which is loss due to leaching/runoff and indirect N_2O emissions due to leaching and runoff from manure management. There is no obvious trend in the GHGs emissions from this category.

Urea application

Since the application of urea affects the direct or indirect in N_2O emissions, the following is a summary of the contribution of this fertilizer to GHGs emissions in Albania during the inventory period.

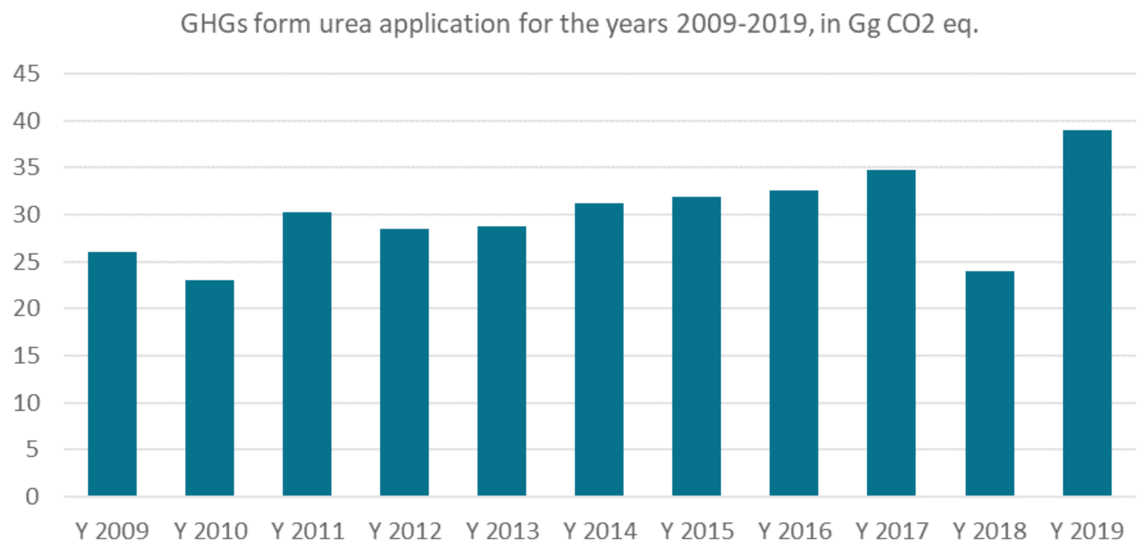


Figure 30: GHGs form indirect N_2O Emissions from manure management

The amount of Urea application over the years varies, but there is a growing trend in the use of this fertilizer in the country by 32% from the year 2009 to 2019. As with other agricultural situations, farmers continue to buy nutrients without proper information/advice for plant requirements or soil analysis. This remains an ongoing challenge, where the agricultural extension service and research and scientific institutions must be at the forefront of sustainable agriculture in the country.

2.11.2 Methodology

The table below presents a summary table of the Agriculture sector for the year 2019. It summarises the GHGs that have been estimated, the contribution of each Agriculture sector category to the whole national GHG inventory, which categories are considered key categories (as defined by Approach 1 in the 2006 IPCC Guidelines), the uncertainty value of each category (as defined by Approach 1 in the 2006 IPCC Guidelines) and the methodology tier used to estimate emissions (as defined by the 2006 IPCC Guidelines).

Table 23: Summary table for the Agriculture sector

3 Agriculture Greenhouse Gas Source and Sink Categories	Gases included	% Total emissions in 2019	Key category in 2019	Tier/ notation key	Notes
A. Livestock					
1. Enteric Fermentation					
a.i. Dairy cattle	CH_4	6.42%	Yes	T1	
a.ii. Other cattle	CH_4	1.45%	Yes	T1	
b. Buffalo	CH_4	0.00%	No	T1	
c. Sheep	CH_4	1.80%	Yes	T1	
d. Goats	CH_4	0.86%	Yes	T1	
e. Camels	CH_4	0.00%	-	NO	
f. Horses	CH_4	0.11%	No	T1	
g. Mules and Asses	CH_4	0.11%	No	T1	
h. Swine breeding	CH_4	0.03%	-	NO	
h. Market swine	CH_4		No	T1	
j. Other	-	-	-	NO	
2. Manure Management					
a.i. Dairy cattle	CH_4	1.85%	Yes	T1	
a.ii. Other cattle	CH_4	0.32%	Yes	T1	
b. Buffalo	CH_4	0.00%	No	T1	
c. Sheep	CH_4	0.09%	No	T1	
d. Goats	CH_4	0.06%	No	T1	
e. Camels	CH_4	-	-	NO	
f. Horses	CH_4	0.01%	No	T1	
g. Mules and Asses	CH_4	0.01%	No	T1	
h. Swine breeding	CH_4	0.15%	No	T1	
i. Poultry	CH_4	0.04%	No	T1	
j. Other	-	-	-	NO	
C. Aggregate sources and non-CO_2 emissions sources on land					
2. Liming	CO_2	-	-	NE	No AD
3. Urea application	CO_2	0.28%	No	T1	
4. Direct N_2O emissions from managed soils	N_2O	4.81%	Yes	T1	

5. Indirect N_2O emissions from managed soils	N_2O	1.61%	Yes	T1	
6. Indirect N_2O emissions from manure management	N_2O	0.35%	Yes	T1	
7. Rice Cultivations	CH_4	-	-	NO	
8. Other	-	-	-	NO	

For the Agriculture sector, the Tier 1 methodology and default IPCC emission factors have been used as provided in the 2006 IPCC Guidelines considering national circumstances and geographical location of Albania. Emission estimates for all emission sources in the Agriculture sector relevant to Albania are included in this inventory. The calculations were conducted in the IPCC Software (version 2.691), which integrates Agriculture and LUUCF into one sector. Livestock numbers and categories were sourced from INSTAT. The dairy cow population is estimated separately from other cattle. Dairy cows are defined as mature cows that are producing milk.

Table 24: Emission factors used for the Agriculture sector

Description	EF used	Unit	LULUCF Sub-category	Activity data
Dairy cows	99	Kg CH_4 / head year	Livestock	Enteric fermentation
Other cattle	58	Kg CH_4 / head year	Livestock	Enteric fermentation
Buffalo	55	Kg CH_4 / head year	Livestock	Enteric fermentation
Sheep	5	Kg CH_4 / head year	Livestock	Enteric fermentation
Goats	5	Kg CH_4 / head year	Livestock	Enteric fermentation
Horses	18	Kg CH_4 / head year	Livestock	Enteric fermentation
Mules and asses	10	Kg CH_4 / head year	Livestock	Enteric fermentation
Swine	1	Kg CH_4 / head year	Livestock	Enteric fermentation
Dairy cows	20	Kg CH_4 / head year	Livestock	Manure management
Other cattle	9	Kg CH_4 / head year	Livestock	Manure management
Buffalo	7	Kg CH_4 / head year	Livestock	Manure management
Sheep	0.15	Kg CH_4 / head year	Livestock	Manure management
Goats	0.17	Kg CH_4 / head year	Livestock	Manure management
Horses	1.64	Kg CH_4 / head year	Livestock	Manure management
Mules and asses	0.9	Kg CH_4 / head year	Livestock	Manure management
Swine	4	Kg CH_4 / head year	Livestock	Manure management
Poultry	0.02	Kg CH_4 / head year	Livestock	Manure management
Urea content in synthetic fertilizer	%	46	A.S& non-CO_2 emissions	

2.11.3 Uncertainties

The uncertainty of CH_4 emission estimates has been evaluated for enteric fermentation and manure management. For livestock population (activity data), an uncertainty value of 5% has been used. The emission factors are default values from the 2006 IPCC Guidelines, so their corresponding uncertainty values have been used. The uncertainty of emission estimates has not been evaluated for liming, urea production, direct and indirect N_2O emissions from managed soils and manure management.

2.11.4 Source specific QA/QC

The general QA/QC procedures documented in the section above: Quality Assurance and Quality Control have been applied to this sector. No source specific QA/QC activities have been conducted.

2.11.5 Recalculations

The previous inventory included the years 2009-2016. These years have not been recalculated. Methodologies have not been altered and no concerns regarding time series consistency were raised during data collection or inventory compilation.

2.11.6 Planned improvements

Many categories under the Agriculture sector are key categories. As such, it is a priority to move towards a Tier 2 methodology. Collect data for the cultivation of organic soils, which will improve the accuracy of calculations of the direct N_2O emissions from the process of ploughing and cultivation of those soils. Collect data on the production of non-N-fixing crops, which is currently a gap in the calculations of nitrogen input from crop residues. Undertake further elaboration of the analyses of agricultural elements (yield, areas, crops, inputs etc.) based on agroecological zones to have a much more real approach to GHG calculation, abatement measures and mitigation options.

2.12 Land use, land use change and forestry (LULUCF) sector

2.12.1 Overview

The figure below shows GHG emissions from the LULUCF sector for the years 2009 to 2019. Emissions have decreased by 10.2% across this period from 1,593.69 kt CO_2eq. in 2009 to 1,431.89 kt CO_2eq. in 2019. There was a large increase in emissions in 2011 and 2012 due to forest fires.

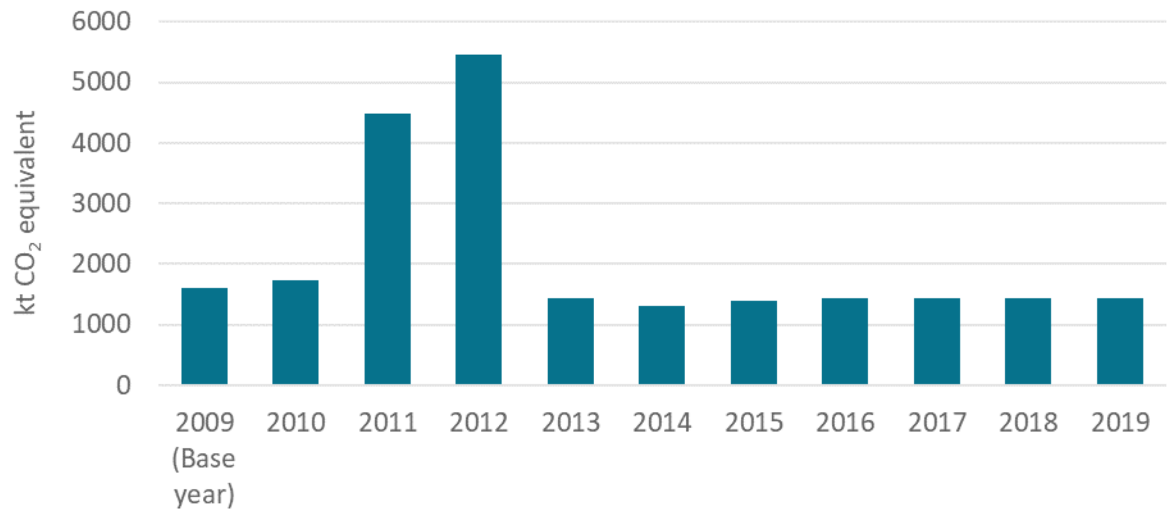


Figure 31: GHG emissions from the LULUCF sector for the years 2009 to 2019

Forest land

The figure below shows the GHG emissions/sinks from the forest land category for the years 2009 to 2019. Considering the ratio between the increase of forest biomass and its removal from deforestation and forest fires, in total it turns out that forests have been GHGs emitters during 2009-

2017. Due to mismanagement of forests and their degradation from cuttings and fires, CO_2 remains the main gas emitted by this sector, and forests remain the main source of GHGs emissions.

During 2018-2019 the forests started to become GHGs absorbers due to reduction in forest loss biomass during those two years.

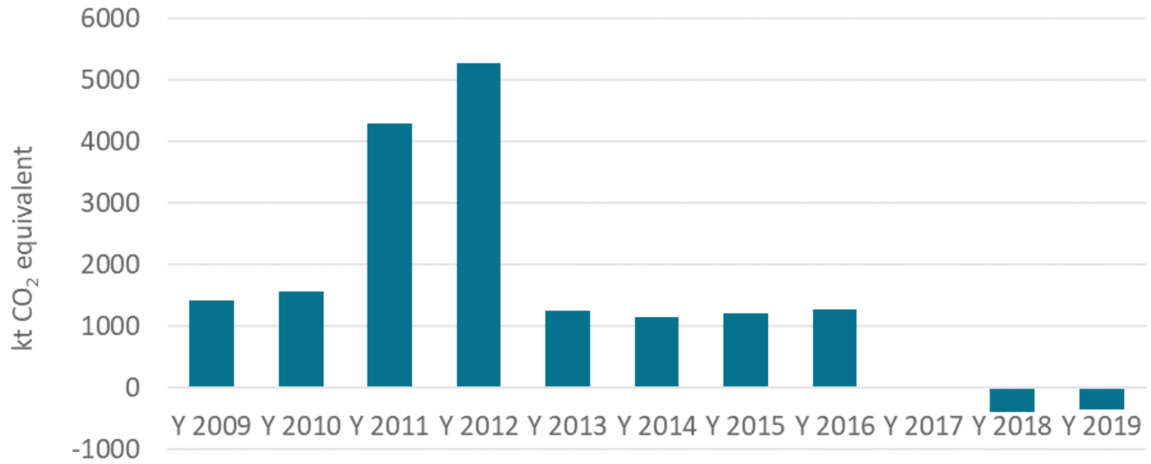


Figure 32: GHGs inventory for forest land category for the years 2009-2019

Forests are absorbers of GHGs due to the growth of their biomass. Throughout the inventory period, forests have absorbed CO_2 from the atmosphere. The average annual growth is only 1.4 m^3/ha/year. This causes the amount of CO_2 that accumulates to be limited as well. In other hand, due to forest fires and forest cutting, the forests can be GHGs emitters.

Forests cover around 36% of the land area of Albania. Some areas of other wooded land are included in the calculations of forest cover, half of them is classified as coppice and coppice with standards, the other half being high forest. Nearly four-fifths of the growing stock consists of broad-leaved species, predominantly species of deciduous and evergreen oak and of beech.

Forest resource policies in Albania have changed significantly in recent years. In 2016, the Government of Albania transferred forest management (except for protected areas) to 61 LGUs and implemented a moratorium on harvesting with the goal of reducing the unsustainable harvesting of wood in the country. Exceptions to the 2016 moratorium permit LGUs to harvest fuelwood to meet local needs of households and large users.

Over the last 60 years, Albanian forestry has suffered significant changes, as a result of which the forest area has been reduced by more than 300,000 ha mostly due to clearance for agriculture[44]. Except the deforestation for agriculture, the reduction of the forest fund is due to degradation from cutting, forest fires and overgrazing, which has changed the forest age structure and species composition, and the volume stock. For many years and decades the forest exploitation has exceeded the annual increment, which has resulted in a decrease in the forest growing stock.

[44] UNECE, 2012

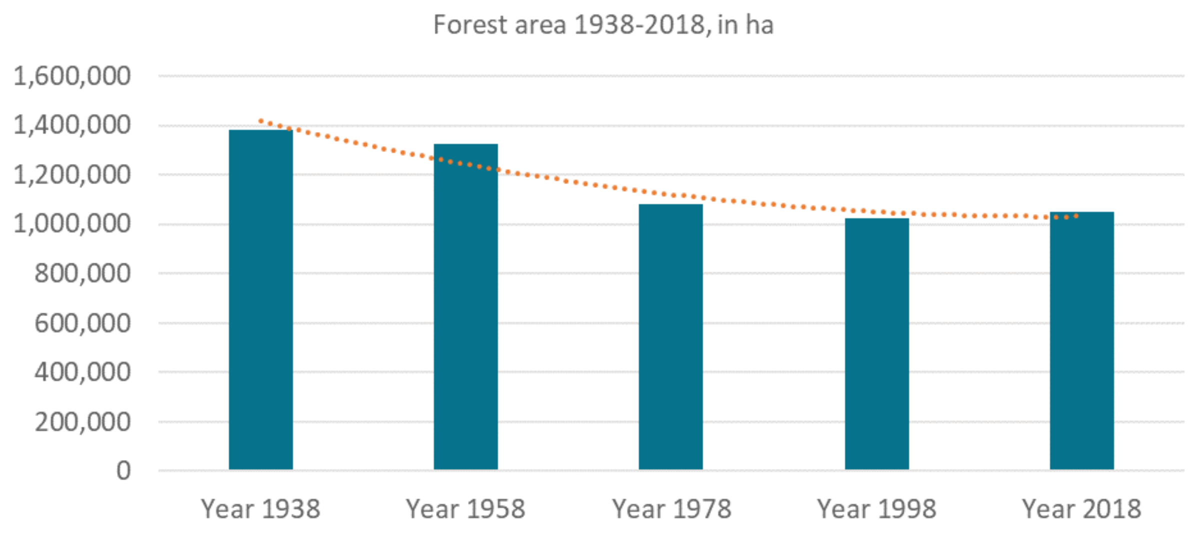


Figure 33: Forest fund during decades

Forests cover around 36% of the land area of Albania. Some areas of other wooded land are included in the calculations of forest cover. Some data on forest area and forest volume by forest regimes are given in the figures below.

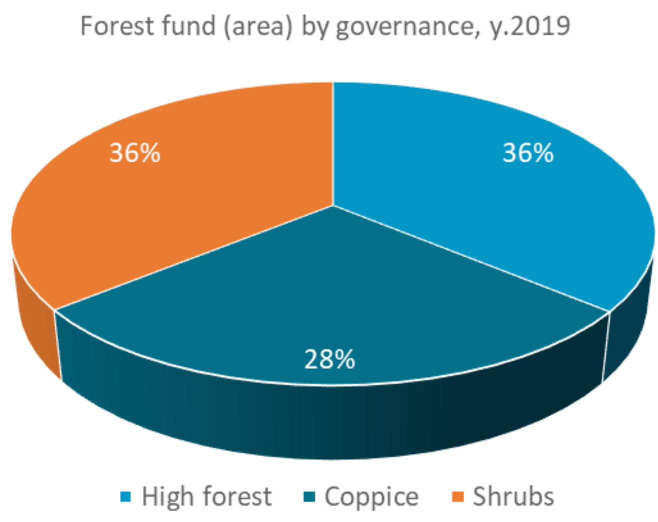


Figure 34: Forest fund by governance

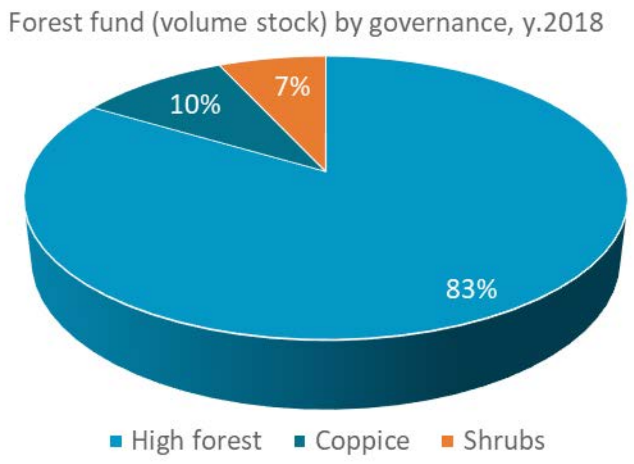


Figure 35: Volume of forest fund

The most qualitative forests in Albania are high forests, which cover around 36% of the forest fund's area and 83% of the volume stock.

Currently 96% of the forest is owned by the state (municipalities and National Agency of Protected Areas), and about 4% is under private ownership. There are efforts to increase the area of protected forest to preserve the biodiversity and the landscape. From the year 2004 to the year 2018, the area of Albanian protected areas is increased close to four times. During the 1990s, and even though forest management was particularly affected by the sudden demise of the former economy, the forestry sector did not receive sufficient assistance.

All over Albania, especially in the mountainous zones, forest serves as a source of livelihood, goods and income. Firewood is an important commodity for Albania because it is used for heating by most households, and in rural areas it is also used for cooking. It accounts today 36% of energy demands for heating and 12% of energy for cooking. This means that firewood is still a main energy source, and it will continue to be important. The largest groups of consumers for firewood are households, but public institutions (schools, public administration, kindergartens etc.), charcoal and lime producers also consume significant volumes of firewood.

In the figures below is given the data on forest area and volume during 2009-2019.

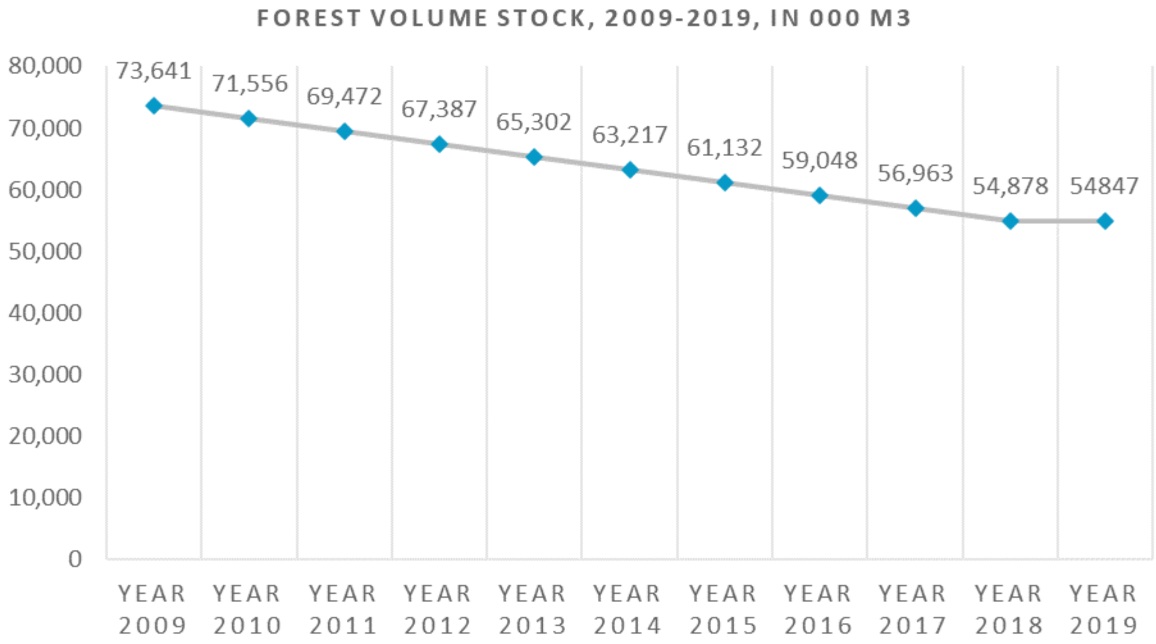


Figure 36: Forest volume stock during years during 2009-2019

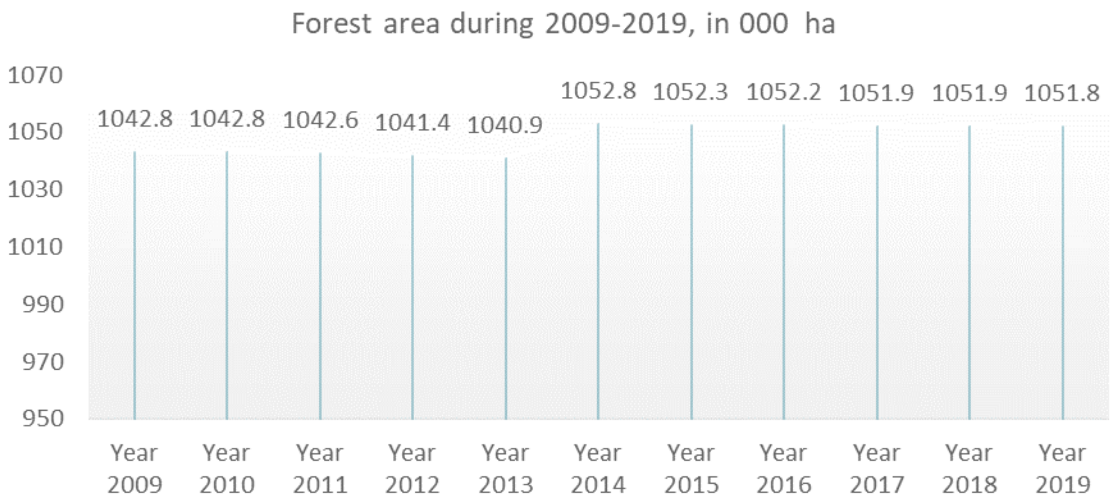


Figure 37: Forest area, 2009-2019

The volume stock per hectare of forest has decreased rapidly in a period of 10 years (2009-2019) by about 18 m^3/ha, or about 26% of it.

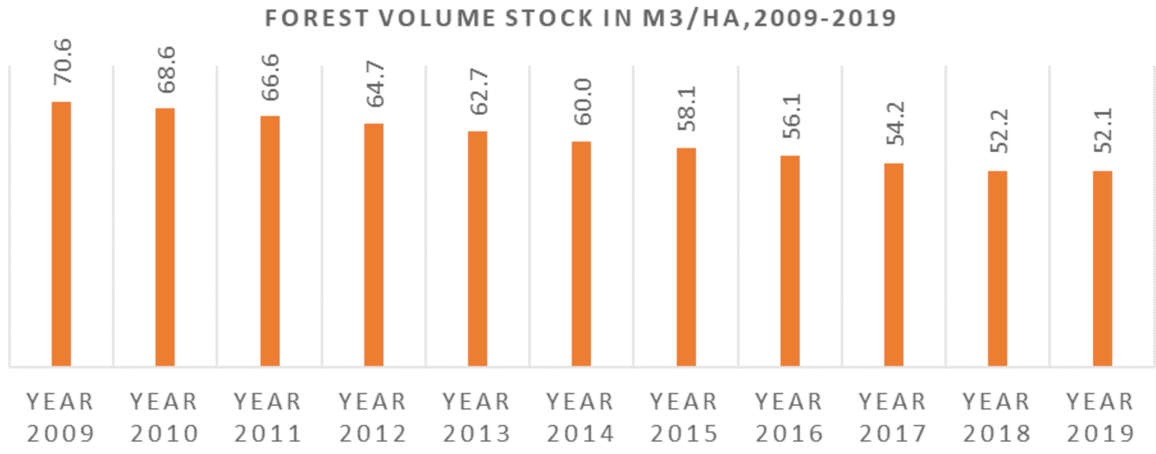


Figure 38: Forest volume stock per hectare during years

The last national forest inventory in 2004 set the annual allowable cut (AAC) at 1.15million m^3, where the AAC in High Forest is 675,000 m^3, AAC in Coppice is 462,000 m^3, and AAC in shrubs is 15,000 m^3.

The study "Wood fuel consumption in Albania" (FAO, 2017) evidenced that the level of use fuel wood in Albania is about 2.4 million m^3, or more than two times than annual increment of forest fund is.

Another study, "Albania fuel wood demand assessment and analysis report" (the World Bank 2018) evidenced that annual the total gross demand for fuel wood supply from the forests in 2016 was 3.035 million m^3 wood consisting of 2.176 million m^3 wood of household demand, 100,295m^3 wood of large user demand), and 758,765m^3 wood of harvesting loss. Fuelwood is predominantly a rural energy source – 76% of fuelwood-using households are rural. These households consumed 86% of all fuelwood used by households in Albania.

Another issue related to forest degradation in Albania have been forest fires.

Based on data provided by European Forest Fire Information System (EFFIS), it comes that during period 2007-2018 there are burned about 326,353 ha or about 31% of the national forest fund.

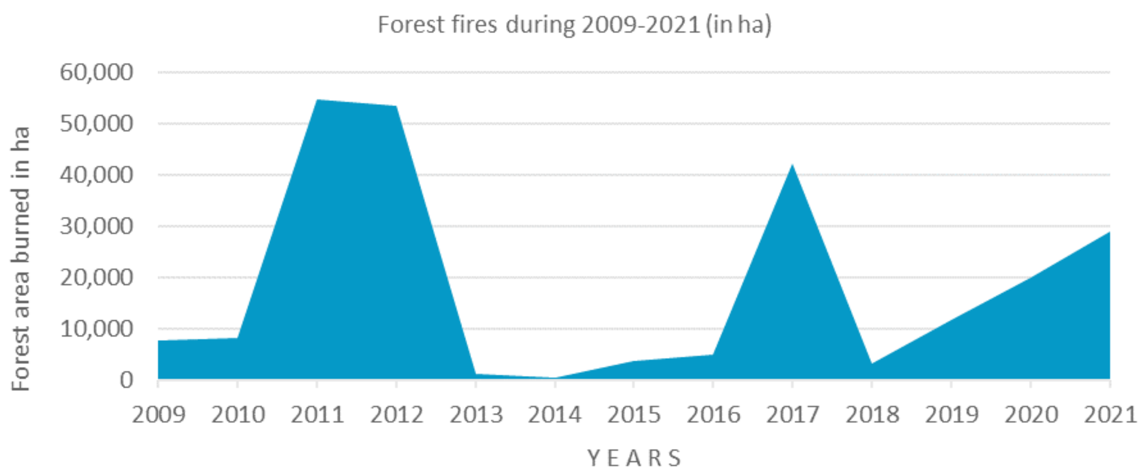


Figure 39: Forest fires in Albania during 2009-2021

These data are only for areas burden with more than 30 hectares. Fires less than 30 hectares are not part of the statistics. This means that the Albanian forest fund remain in very difficult situation. This is due to several reasons:

- High rate of informality in forestry sector
- Qualitative forests are cut over the years, from legal and illegal logging
- A significant part of the forest is damaged by fires
- Lack of significant investments in forestry sector during decades
- Energy policies are at the disadvantage of forests
- A large majority of the country's forests are at a young age, where wood stock volume is low.
- Continuous grazing in forests also affects the growth rate and wood volume per unit.

However, the forest sector has the potential to be restored to play an important role for rural employment, industrial development, environmental protection and climate change mitigation for the country.

Cropland

Cropland includes arable and tillable land, all annual and perennial crops as well as temporary fallow land. Annual crops include cereals, oils seeds, vegetables, root crops and forages. Perennial crops include trees and shrubs, in combination with herbaceous crops (e.g., agroforestry) orchards, vineyards and plantations with nuts. Arable land, which is normally used for cultivation of annual crops, but which is temporarily used for forage crops or grazing as part of an annual crop-pasture rotation (mixed system) is included under cropland. The amount of carbon stored in and emitted or removed from permanent cropland depends on crop type, management practices, and soil and climate variables.

During the inventory period, orchards are evidenced as GHGs absorbers, in a minimum rate. The figure below illustrates the removals from croplands.

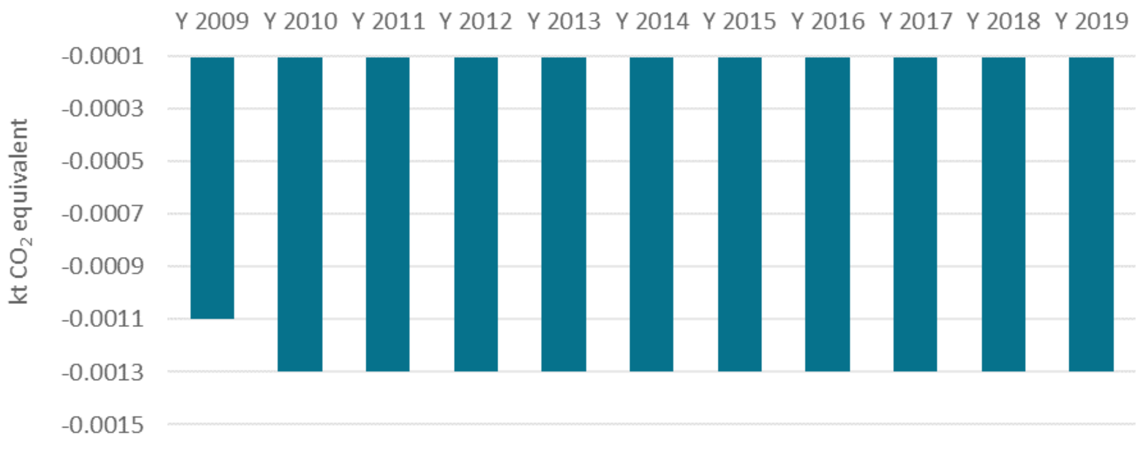


Figure 40: GHG removals from the cropland for the years 2005, 2009 and 2010-2016 (in kt CO_2 eq.)

Grassland

In Albania grasslands occur mostly in mountainous areas of the country, above 800-1000 m elevation, from north to south, excluding as such the western part of the country where pastures occurred in the hilly areas and less in the plain areas of the country. The largest pastures are located above the forest belt (over 1600 m above sea level). But in some cases, the pastures are also found inside the forests. Many agricultural lands are also used as pastures, as they have not been cultivated for years.

Around 68% of the grassland area is used as supper pastureland while 32% of it is considered as winter pasture lands and mostly located in hilly and western part of the country. Carbon stocks in permanent grassland are influenced by human activities and natural disturbances, including harvesting of woody biomass, rangeland degradation, grazing, fires, pasture rehabilitation, pasture management, etc.

Annual production of biomass in grassland can be large, but due to rapid turnover and losses through grazing and fire, and annual senescence of herbaceous vegetation, standing stock of above-ground biomass rarely exceeds a few tonnes per hectare. Larger amounts can accumulate in the woody component of vegetation, in root biomass and in soils. The extent to which carbon stocks increase or decrease in each of these pools is affected by management practices such as those described above. The amount of carbon stored in and emitted or removed from permanent cropland depends on crop type, management practices, and soil and climate variables.

Wetlands

Wetlands include any land that is covered or saturated by water for all or part of the year, and that does not fall into the Forest Land, Cropland, or Grassland categories. Managed wetlands will be restricted to wetlands where the water table is artificially changed (e.g., drained or raised) or those created through human activity.

Settlements

Settlements are defined as including all developed land i.e., residential, transportation, commercial, and production (commercial, manufacturing) infrastructure of any size, unless it is already included under other land-use categories. The land-use category Settlements includes soils, herbaceous perennial vegetation such as turf grass and garden plants, trees in rural settlements, homestead gardens and urban areas. Examples of settlements include land along streets, in residential (rural and urban) and commercial lawns, in public and private gardens, in golf courses and athletic fields, and in parks, provided such land is functionally or administratively associated with particular cities, villages or other settlement types and is not accounted for in another land-use category.

Other land

The category "Other Land" includes bare soil, rock, ice, and all land areas that do not fall into any of the other five land-use categories treated in the 2006 IPCC guidelines for National GHGs inventories.

2.12.2 Methodology

The table below presents a summary table of the LULUCF sector for the year 2019. It summarises the GHGs that have been estimated, the contribution of each LULUCF sector category to the whole national GHG inventory, which categories are considered key categories (as defined by Approach 1 in the 2006 IPCC Guidelines), the uncertainty value of each category (as defined by Approach 1 in the 2006 IPCC Guidelines) and the methodology tier used to estimate emissions (as defined by the 2006 IPCC Guidelines).

Table 25: Summary table for the LULUCF sector

3 LULUCF Greenhouse Gas Source and Sink Categories	Gases included	% Total emissions in 2019	Key category in 2019	Tier/ notation key	Notes
B. Land					
1. Forest Land					
a. Forest land Remaining Forest land	CO_2	11.00%	Yes	T1	
b. Land Converted to Forest land	CO_2	-	-	NE	No AD
2. Cropland					
a. Cropland Remaining Cropland land	CO_2	0.63%	Yes	T1	
b. Land Converted to Cropland	CO_2	-	-	NE	No AD
3. Grassland					
a. Grassland Remaining Grassland	CO_2	-	-	NE	No AD
b. Land Converted to Grassland	CO_2	-	-	NE	No AD
4. Wetlands					
a. Wetlands Remaining Wetlands	CO_2	-	-	NE	No AD
b. Land Converted to Wetlands	CO_2	-	-	NE	No AD
5. Settlements					
a. Settlements Remaining Settlements	CO_2	-	-	NE	No AD
b. Land Converted to Settlements	CO_2	0.81%	Yes	T1	
6. Other land					
a. Other land Remaining Other land	CO_2	-	-	NE	No AD
b. Land Converted to Other land	CO_2	-	-	NE	No AD
C. Aggregate sources and non-CO_2 emissions sources on land					
1. GHG emissions from biomass burning	CH_4	0.01%	No	T1	
D. Other					
1. Harvested Wood Products	CO_2	-	-	NE	No AD
2. Other	-	-	-	NO	

For the LULUCF Sector, the Tier 1 methodology and default IPCC emission factors have been used as provided in the 2006 IPCC Guidelines. Emission estimates for land use and forestry are included in this inventory. Emission estimates from land use change, unmanaged wetlands and harvested wood products are not included in this inventory due to a lack of activity data. The calculations were conducted in the IPCC Software (version 2.691).

Based on 2006 IPCC Guidelines, the biomass gain-loss method is applicable for all tiers although the stock-difference method is more suited to Tiers 2 and 3. Tier 2 can be used in countries where country-specific estimates of activity data and emission/removal factors are available or can be gathered at reasonable cost. Tier 3 approach for biomass carbon stock change estimation allows for a variety of methods, including process-based models. Because no detailed data as Tier 2 and Tier 3 require, the Tier 1 method (Biomass Gain-Loss Method) has been used.

Table 26: Emission factors used for the LULUCF sector

Description	EF used	Unit	LULUCF Sub-category	Activity data
BEF	1	Ratio	Forestry	Forest management
BCEF	0.58	t/m^3 volume	Forestry	Forest management
Growing stock level	41-100	m^3/ha	Forestry	Forest management
Age classes	Years	>20 years	Forestry	Forest management
Wood density	Number	0.58	Forestry	Forest management
Carbon fraction	Number	0.5	Forestry	Forest management

Forest land

Tier 1 is feasible even when country-specific estimates of activity data and emission/removal factors are not available and works when changes of the carbon pool in biomass on Forest Land Remaining Forest Land are relatively small. The method requires the biomass carbon loss to be subtracted from the biomass carbon gain. This method (Tier 1) is used for the time series.

The methodology for calculating GHGs was Gain-Loss Method based on estimates of annual change in biomass from estimates of biomass gain and loss on; (i) Forest Land Remaining Forest Land into forest types of different climatic or ecological zones, as adopted by the country. (ii) Estimation the annual biomass gain in Forest Land Remaining Forest Land. (iii) Estimation the annual carbon loss due to wood removals (iv) Estimate annual carbon loss due to wood fuel removal. (v) Estimate annual carbon loss due to disturbance (vi) Estimate the annual decrease in carbon stocks due to biomass losses (vii) Estimate the annual change in carbon stocks in biomass. Carbon fraction is considered =0.5 based on the document 'Assisted Natural Regeneration of Degraded Lands in Albania', a CDM project registered to UNFCCC. Wood fuel consumption is considered based on the report: Wood Fuel Consumption in Albania, FAO 2017.

One of the main problems of the forest sector is the lack of accurate data regarding forest fund (increase, decrease of its area and volume etc.). Forest cadaster continues to not reflect the real situation of the national forest. On the other hand, there isn't any cadaster for the whole country, in which is evidenced/reflected relevant changes by the land use of the territory.

Problems associated with data used in the inventory and their accuracy:

- There is no data on land use change for different categories as inventory for whole country
- Lack of accurate data on forests for the period 1990-2019
- There is no accurate data on the use of agricultural land for that period
- Data of forest cadaster are not accurate, and they do not provide data based on ecological strata, but only at national level
- The changes in forest fund are not argued from relevant responsible agencies
- The data on forest fires are almost missing at all
- There is no accurate data on pasture areas (surface)
- There is no evidence for surface planted with orchards (there are data on number of trees, but not the planted area)
- Lack of data on different land uses such; settlements, inland water areas, organic soils, wetlands, abandoned lands, agriculture land occupied by settlements, etc.

Data used under this inventory are provided from the following sources:

Table 27: The data sources for the LULUCF sector

Data	Source of data
Forest area	INSTAT
Forest volume	INSTAT
Carbon fraction	Assisted Natural Regeneration of Degraded Lands in Albania
BEF	Assisted Natural Regeneration of Degraded Lands in Albania
Wood fuel consumption	report; Wood Fuel Consumption in Albania, FAO 2017
Other parameters	IPCC software 2006 (default factors/parameters)

BEF during the inventory period covering 2009-2019 is considered 1 for all different type of forest species broadleaved and for conifers) as they were reported from the forest cadaster on that time. For this inventory, the BEF is considered 1, but wood density is taken 0.58 since the broadleaved species are predominant in Albania and because there is no detailed data on forest species composition during this time span.

Croplands

Based on data provided by INSTAT the area of pasture lands is given in the table below. In addition to the area of pastures provided by INSTAT, there is no other data on the use of pastures, the increase or decrease of biomass in them, new fires, changes in the destination of the pastureland, etc. During the inventory period, it turns out that the pasture fund has been reduced by about 27,000 ha, but there is no data on how and what has been done with that pasture area.

To estimate emissions/removals from this category, the area of perennial woody cropland was multiplied by a net estimate of biomass accumulation from growth and losses associated with harvest or gathering or disturbance were subtracted. Losses were estimated by multiplying a carbon stock value by the area of cropland on which perennial woody crops are harvested.

Table 28: Pastures in Albania (in ha)

Year	Area, in hectare
2009	505,290
2010	505,290
2011	555,290
2012	505,284
2013	491,011
2014	478,292
2015	478,188
2016	478,188
2017	478,081
2018	478,081
2019	478,081

Wetlands

Methodologies are provided for:

- Peatlands cleared and drained for production of peat for energy, horticultural and other uses. The estimation methodology includes emissions from the use of horticultural peat.
- Reservoirs or impoundments, for energy production, irrigation, navigation, or recreation. The scope of the assessment includes CO_2 emissions from all lands converted to permanently Flooded Lands. Flooded Lands exclude regulated lakes and rivers unless a substantial increase in water area has occurred.

Emissions from unmanaged wetlands are not estimated. There is no data on the surface of wetlands in Albania, or how this surface has changed during the inventory period. In previous national communications it was said that the area of wetlands is 120 thousand hectares.

The rates of C uptake and decay losses were calculated based on the local factors for climate, nutrient availability, water saturation or oxygen availability.

Settlements

Currently there are no data from national cadaster where the categories of land use are identified and how they change over the years.

Other land

Other unmanaged Land, and in that case changes in carbon stocks and non-CO_2 emissions and removals are not estimated. Guidance is provided for the case of Land Converted to Other Land. This is because the conversion is associated with changes in carbon stocks or non-CO_2 emissions, most importantly those associated with conversions from Forest Land.

Inclusion also enables checking the overall consistency of land area and tracking conversions to and from Other Land.

The methodology requires estimates of carbon in biomass stocks prior to conversion, based on estimates of the areas of land converted during the period between land-use surveys. As a result of conversion to Other Land, it is assumed that the dominant vegetation is removed entirely, resulting in no carbon remaining in biomass after conversion.

The difference between initial and final biomass carbon pools is used to calculate change in carbon stocks due to land-use conversion. In subsequent years, accumulations and losses in living biomass in Other Land is considered to be zero.

Currently there are no data from national cadaster where the categories of land use are identified and how they change over the years.

2.12.3 Uncertainties

The uncertainty of emission estimates has been evaluated for forest land and croplands with an AD uncertainty value of 30% and 10%, respectively. The emission factors are default values from the 2006 IPCC Guidelines, so their corresponding uncertainty values have been used. The uncertainty of emission estimates has not been evaluated for settlements or biomass burning.

2.12.4 Source specific QA/QC

The general QA/QC procedures documented in the section above: Quality Assurance and Quality Control have been applied to this sector. No source specific QA/QC activities have been conducted.

2.12.5 Recalculations

The previous inventory included the years 2009-2016. These years have not been recalculated. Methodologies have not been altered and no concerns regarding time series consistency were raised during data collection or inventory compilation.

2.12.6 Planned improvements

There are limited data on forestry sector formatted as per the needs for the calculation of GHGs emissions/removals, therefore there is a need for more and better accurate data especially for those reflecting for any change occurring in the forestry sector, like forestation/afforestation, forest improvement, forest species composition, forest fires and damages affected by them, etc. There is also a need for a detailed study to assess the state of abandoned land across the country. There is lack of national cadastre to reflect all types of land use (agricultural land, forest, pastures, abandoned lands, water areas, urban area, etc.) and annual changes.

2.13 Waste sector

2.13.1 Overview

The figure below shows GHG emissions from the waste sector for the years 2009 to 2019. Emissions have increased by 42% across this period from 620.90 kt CO_2eq. in 2009 to 881.56 kt CO_2eq. in 2019.

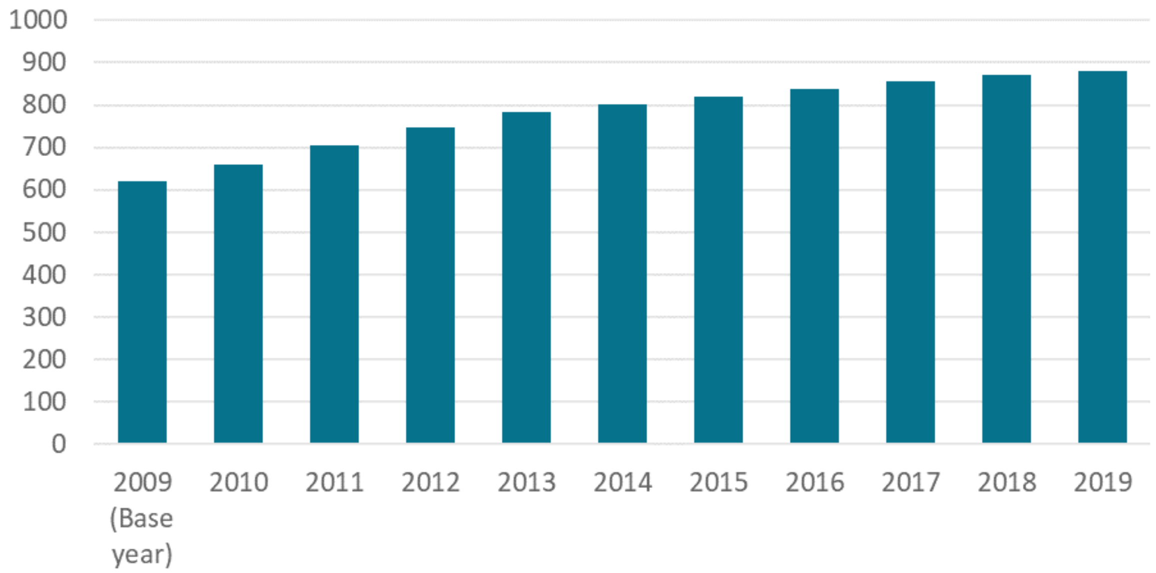


Figure 41: Waste sector GHG emissions (2009-2019)

The GHG emissions that the Waste sector covers are split into the following categories: Solid waste Disposal, Biological Treatment of Solid waste, Incineration and Open Burning of Waste and Wastewater Treatment and Discharge. Systems for the collection of urban solid waste are provided in most cities and towns. Very little recycling of waste is undertaken. There are no collection systems in rural areas and small towns. Most of the waste from these areas is disposed of by dumping in ditches, ravines, or at the side of roads where it is washed and blown onto other land and ultimately into water courses. Emissions from the Waste sector have increased year on year. In 2019, the highest contribution is that of solid waste disposal followed by wastewater treatment.

Urban Waste management in Albania has been thoroughly revamped in recent years with the introduction of Incineration Technology. Construction has been started on three incinerators, with the one in Elbasan having been functioning since 2017. The other two are planned to be in Fier and in Tirana. The one in Fier is currently under construction and the one in Tirana is still at the announcement stage. The combined capacity of the three incinerators is estimated to exceed the total generation of urban waste in the country. For the period covered by this inventory only the incinerator at Elbasan is functional.

There is no system for the safe management of hazardous waste (household or commercial), and waste recycling remains at low levels. The usual method of waste treatment in towns is dumping and sites that it is dumped at do not have due engineering construction (i.e. these are not landfills), thus leading to a perpetual environment pollution.

The problems of waste generation and management are many and various. The greatest amounts of waste generated (by weight) tend to be inert substances, construction waste in particular, but the greatest risks are associated with smaller volumes of (mainly industrial) hazardous wastes. Municipal wastes need extensive and expensive collection, transport and disposal arrangements. Special conditions should apply to particular categories, such as clinical wastes.

The sector presents some of the most significant challenges facing Albania., with the 'State of the Environment' report for this period summarising these issues as follows:

- Systems for collection and removal of waste are inadequate and inefficient
- Informed decisions about collection and disposal choices cannot be made in the absence of reliable information
- There is no tradition of proper waste treatment and disposal
- Financial and technical resources are insufficient
- Public awareness of the damage caused by poor waste management is lacking.

Wastewater management currently just consists of conveying used water to ditches and then rivers. There are no finished treatment plants currently in the country. There are however several projects to construct wastewater treatment plants, the only one already under construction being Kavaja wastewater treatment plant. At its peak it will serve 100,000 people.

Solid waste management plans are in force over some of the period this inventory covers, but they are poorly implemented. Dumpsites remain the main treatment practice of urban solid waste. There are some landfill sites that have been functioning since 2010 (Tirana and Shkoder Region, Sarande and Korce), and there are currently several projects for the construction of new landfills (Pogradec, Vlore, Durres). The Albanian legal waste framework has almost entirely approximated the EU directives. There is not yet any segregated collection system in place, although it has been required by law for several years now. Some waste recycling industries, mainly for plastics and metals, are established in the country.

2.13.2 Methodology

The table below presents a summary table of the Waste sector for the year 2019. It summarises the GHGs that have been estimated, the contribution of each Waste sector category to the whole national GHG inventory, which categories are considered key categories (as defined by Approach 1 in the 2006 IPCC Guidelines), the uncertainty value of each category (as defined by Approach 1 in the

2006 IPCC Guidelines) and the methodology tier used to estimate emissions (as defined by the 2006 IPCC Guidelines).

Table 29: Summary table for the Waste sector

4 Waste Greenhouse Gas Source and Sink Categories	Gases included	% Total emissions in 2019	Key category in 2019	Tier/ notation key	Notes
A. Solid Waste Disposal					
1. Managed Waste Disposal Sites	CH_4	6.08%	Yes	T1	
2. Unmanaged Waste Disposal Sites	-	-	-	NO	
3. Uncategorised Waste Disposal Sites	-	-	-	NO	
B. Biological Treatment of Solid Waste					
1. Composting	CH_4, N_2O	0.06%	No	T1	
2. Anaerobic digestion at biogas facilities	-	-	-	NO	
C. Incineration and Open Burning of Waste					
1. Waste Incineration	CH_4, N_2O, CO_2	0.00%	No	T1	
2. Open Burning of Waste	CH_4, N_2O, CO_2	0.10%	No	T1	
D. Wastewater Treatment and Discharge					
1. Domestic Wastewater	CH_4, N_2O	1.27%	Yes	T1	
2. Industrial Wastewater	CH_4	0.16%	No	T1	
3. Other	-	-	-	NO	
E. Other					
Other	-	-	-	NO	

For the Waste sector, the Tier 1 methodology and default IPCC emission factors have been used as provided in the 2006 IPCC Guidelines. Emission estimates for all emission sources in the Waste sector relevant to Albania are included in this inventory. The calculations were conducted in the IPCC Software (version 2.691).

The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (1996 Guidelines, IPCC, 1997) and the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (GPG2000, IPCC, 2000) describes two methods for estimating CH_4 emissions from Solid Waste Disposal Sites (SWDS): the mass balance method (Tier 1) and the First Order Decay (FOD) method (Tier 2). In the 2006 IPCC Guidelines, the use of the mass balance method is strongly discouraged as it produces results that are not comparable with the FOD method, which produces more accurate estimates of annual emissions. Instead of the mass balance method, the new FOD method provides a Tier 1 version including a simple spreadsheet model with step-by-step guidance and improved default data. With this guidance, the FOD method is implemented.

The Tier 1 method requires detailed datasets for waste and wastewater which were very challenging to obtain from the relevant institutions. The core data are the amounts and fractions of waste and wastewater, treatment technology with its relevant characteristics and historic data, which are almost non-existent in the country.

The official data[45] for waste and wastewater handling were used for the time series 2017 to 2019. These data were published in the official annual report "State of the Environment in Albania". The emission factors were the default values from the 2006 IPCC Guidelines.

2.13.3 Uncertainties

The uncertainty of emission estimates has been evaluated. For activity data, an uncertainty value of 5% has been used for all categories except the biological treatment of solid waste, which is considered to have an uncertainty value of 30%. The emission factors are default values from the 2006 IPCC Guidelines, so their corresponding uncertainty values have been used.

2.13.4 Source specific QA/QC

The general QA/QC procedures documented in the section above: Quality Assurance and Quality Control have been applied to this sector. No source specific QA/QC activities have been conducted.

2.13.5 Recalculations

The previous inventory included the years 2009-2016. These years have not been recalculated. Methodologies have not been altered and no concerns regarding time series consistency were raised during data collection or inventory compilation.

2.13.6 Planned improvements

Solid waste disposal is a key category and should, therefore, be calculated using a Tier 2 methodology. The information needed to do this is not yet available. Work and efforts are directed into advising the relevant institutions on establishing the necessary data flow for future inventories.

2.14 Precursors and Indirect Emissions

Although they are not included in global warming potential-weighted greenhouse gas emissions totals, emissions of carbon monoxide (CO), oxides of nitrogen (NO_X), non-methane volatile organic compounds (NMVOCs), and sulphur dioxide (SO_2) are reported in greenhouse gas inventories. CO, NO_X and NMVOCs in the presence of sunlight contribute to the formation of the greenhouse gas Ozone (O_3) in the troposphere and are therefore often called "ozone precursors". Furthermore, NO_X emission plays an important role in the earth's nitrogen cycle. SO_2 emissions lead to formation of sulphate particles, which also plays a role in climate change. Ammonia (NH_3) is an aerosol precursor but is less important for aerosol formation than SO_2.

The most recent 2006 IPCC Guidelines for National Greenhouse Gas Inventories, chapter 7 "Precursors and Indirect Emissions" introduces ways to adopt methodologies to calculate the non-GHG emissions by providing a link to relevant methodology chapters in the EMEP/CORINAIR Emission Inventory Guidebook.

Emissions of NO_X, CO, NMVOCs and SO_2 were added, in a consistent, complete and comparable manner for the entire inventory period 2009-2019. Unfortunately, the IPCC Inventory Software does not contain a module that supports calculation of the precursors, and the estimation of the emissions of these gases was done in separate Excel files, based on the reports Albania provided under the UNECE/1979 Convention on Long-Range Transboundary Air Pollution (LRTAP). Nitrous oxide is produced in soils through the biological processes of nitrification and denitrification. N_2O emissions will also be enhanced of nitrogen deposited in the ocean or lakes. For this reason, the 2006

[45] http://www.akm.gov.al/cilësia-e-mjedisit.html#raporte_publikime

Guidelines include guidance for estimating N_2O emissions resulting from nitrogen deposition of all anthropogenic sources of NO_X and NH_3.

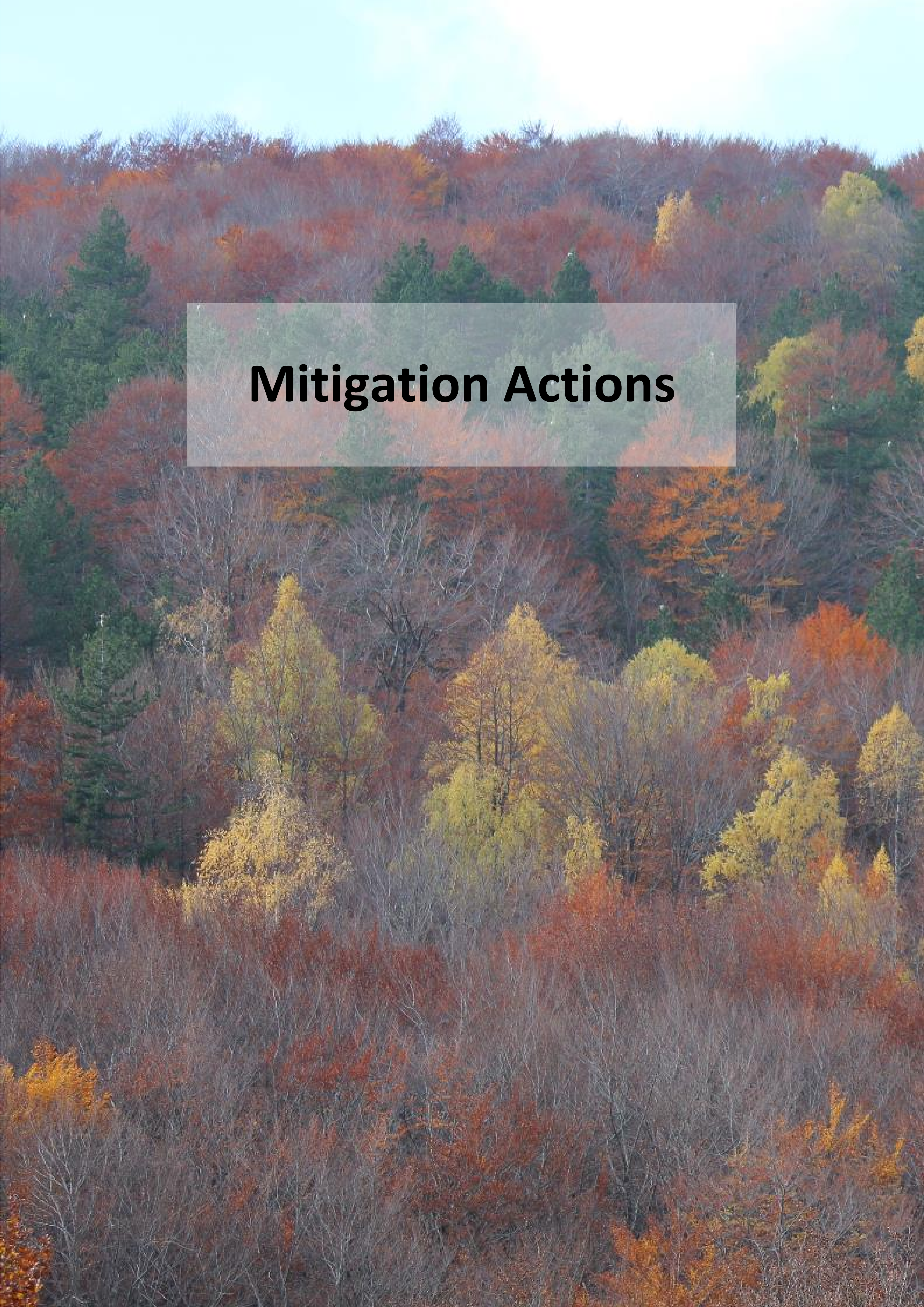
Table 2.14 : Summary of the NOx emissions from all sectors (Gg)

NO_X, Categories	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1-Energy	23.828	25.656	26.183	26.526	27.401	32.834	33.063	39.200	39.220	39.244	39.255
2-IPPU	0.259	0.055	0.063	0.049	0.011	0.06	0.000	0.010	0.000	0.000	0.000
3-LULUCF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4-Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**24.087**	**25.711**	**26.246**	**26.575**	**27.412**	**32.894**	**33.063**	**39.210**	**39.220**	**39.244**	**39.255**

The values of precursor gases emissions, provided under the UNECE/1979 Convention on Long-Range Transboundary Air Pollution (LRTAP), are inserted in the IPCC GHG calculation programme multiplied by the corresponding EF. Analysis shows that transport sector is contributing almost 65-75% of total precursor gases for each year. The indirect NO_2 emissions from the IPPU sector are coming from Cement production and Iron & Steel production subcategories. The precursors and other gases (CO, NO_X, NMVOCs and SO_2) are mainly coming from Cement production and Iron & Steel production subcategories as well as from the Aluminium use, Pulp and Paper Industry and Food and Beverages Industry. These data are also taken from LRTAP and are inserted in the final Excel file of the IPPU sector.

The indirect sources of N_2O emissions from LULUCF sector are related to the volatilisation of N as NH_3 and oxides of N (NO_X), and the deposition of these gases and their products NH_4 + and NO_3 in soils and waters. The sources of N as NH_3 and NO_X are mostly from agricultural synthetic and organic fertilisers, leaching and runoff from land of N from fertilizers, crop residues, mineralisation of N, urine and dung deposition from grazing animals as well form biomass burning. The indirect NO_2 emissions from the waste sector are generated in the solid waste disposal on land category as a result of NH_3 depositions. These depositions are reported in line with the UNECE/1979 Convention on Long-Range Transboundary Air Pollution. The resulting indirect NO_2 emissions are very small. These emissions are NMVOCs for the categories solid waste disposal and biological treatment of solid waste.

Mitigation Actions



3 Mitigation Actions

3.1 Overview

In 2019 Albania endorsed the Strategic Document on Climate Change and its Action Plan on Mitigation[46]. The document was developed as a single document in accordance with decision 1/CP16 of the UNFCCC and decision 525/2013/EU for the mitigation part, also considering recommendations of several Progress Reports of the EC and trying to mainstream climate change into other sectors.

Six mitigation strategy priorities (SP) are identified:

- **SP.1 Ensure a sustainable economy growth** consistent with GHG emission pathways defined in the NDC and move towards an economy-wide target to which all sectors contribute
- **SP.2 Establish a monitoring, reporting and verification system of GHG** in line with EU requirements
- **SP.3 Strengthen the capacity of relevant institutions and inter-institution cooperation** to address climate change issues
- **SP.4 Streamline climate changes across sectoral strategic planning**
- **SP.5 Reinforce capacity building and awareness raising** on climate change issues
- **SP.6 Align with the EU Climate Change framework** across sectors.

The plan includes:

- Direct measures: those with a direct impact on climate change mitigation
- Indirect measures: those having a positive impact on climate change mitigation
- Enabling measures: those that are functional to the achievement of the necessary conditions that allow for the application of direct/indirect measures leading to mitigation of climate change.

In the Mitigation Plan, 222 measures are identified, mainly focused to a short-term period (up to 2020), and some targeted to the medium (2030) and long (2050) terms. A major part of the measures derives from the existing strategies and plans, few of them are newly proposed by the document of the National Climate Change Strategy and Plan (NCCS&P) for addressing gaps or synergies.

Most of the measures are in the energy sector (77) and in the transport sector (71), followed by LULUCF (53) and Agriculture (17) with four measures that are cross sectorial. Particular attention is given to the measuring, monitoring and reporting system in Albania. Robust, standard and transparent estimation, reporting and accounting of GHG emissions and removals is crucial to track progress towards the achievement of targets, assess the performance of policies and measures and, at an international level, assess the success of aggregated efforts to mitigate climate change.

Albania submitted its first Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2015. It included a commitment to reduce business as usual (BAU) CO_2 emissions by 11.5% by 2030. This represents the country's contribution to the global efforts to address climate change which, as per the Paris Agreement, aim to limit the rise in global temperature to 1.5°C compared to preindustrial times. As per Article 3 of the Paris Agreement, countries' contributions are expected to be "ambitious" and "represent a progression over time".

[46] Approved by DCM No. 466, dated 3.7.2019

For this reason, in October 2021, with the support of the UNDP Climate Promise and other developing agencies, coordinated by the NDC Partnership, Albania presented its revised NDC with enhanced ambition, but also with a broader scope that encompasses more types of greenhouse gases (GHGs) and more sectors. Albania's revised contribution to mitigation aims to decrease emissions by 3,170 kt CO_2eq. by 2030 compared to the BAU scenario, corresponding to a mitigation impact of -20.9%. Furthermore, a section has been added to include adaptation measures, specifically regarding (i) settlements, population and tourism in coastal areas and (ii) agriculture.

The revised NDC is complemented by its Implementation Plan which lays out the roadmap to operationalize the NDC. It acknowledges that climate change is a cross-cutting issue for all sectors and regions of Albania, and that several policies and strategies have or are being developed to address it in many of these sectors and regions. The Action Plan also builds on the National Climate Change Strategy and Plan (NCCS&P), not only through the integration of the priority actions in the revised NDC, but also by aligning implementation mechanisms and timelines.

Taking into consideration the proposed approach, the following cross-cutting strategies, plans and laws have been considered and analysed:

- INDC under UNFCCC (2015-2030)
- Draft Environmental Cross-cutting Strategy (ECCS) (2015-2020)
- National Strategy on Development Integration (NSDI-II) (2015-2020)
- Law on Climate Change[47] (from the entry into force to its revision)
- National Territorial Plan (NTP) (2015-2030)[48]
- Revised NDC (2016-2030) and its Implementation Plan

Energy sector:

- Strategy of Energy for the period 2016-2030 (approved by the Albanian Council of Ministers)
- Nationally appropriate mitigation action (NAMA) – Replacing fossil fuels with non-hazardous waste in the Albanian cement industry (2015-2020)
- NAMA – Financing mechanism for energy efficiency in buildings (2015-2020)
- 1st National Action Plan for Energy Efficiency, 2009-2020
- National Action Plan for Natural Gas Penetration to the Albanian Economy, 2018-2030
- National Action Plan for Renewable Energy Sources 2018-2020
- Law 124/2015 on Energy Efficiency (from the entry into force to its revision)
- Law 7/2017 "On the promotion of the use of renewable energy sources"
- Law 116/2016 "On energy performance of buildings"
- DCM No. 709, dated 1.12.2017 on the 2nd&3rd National Energy Efficiency Plan 2017-2020.
- National Energy and Climate Action Plan

Transport sector:

- Transport Sector Strategy and Action Plan (TSSAP) (2016-2020)
- Sustainable Transport Plan (STP) – Background document (2016-2020).

Agriculture and LULUCF:

- Inter-sectoral strategy for Agriculture and rural development in Albania (ISARD) (2014-2020)

[47] Law on Climate ChangeNo.15/2020

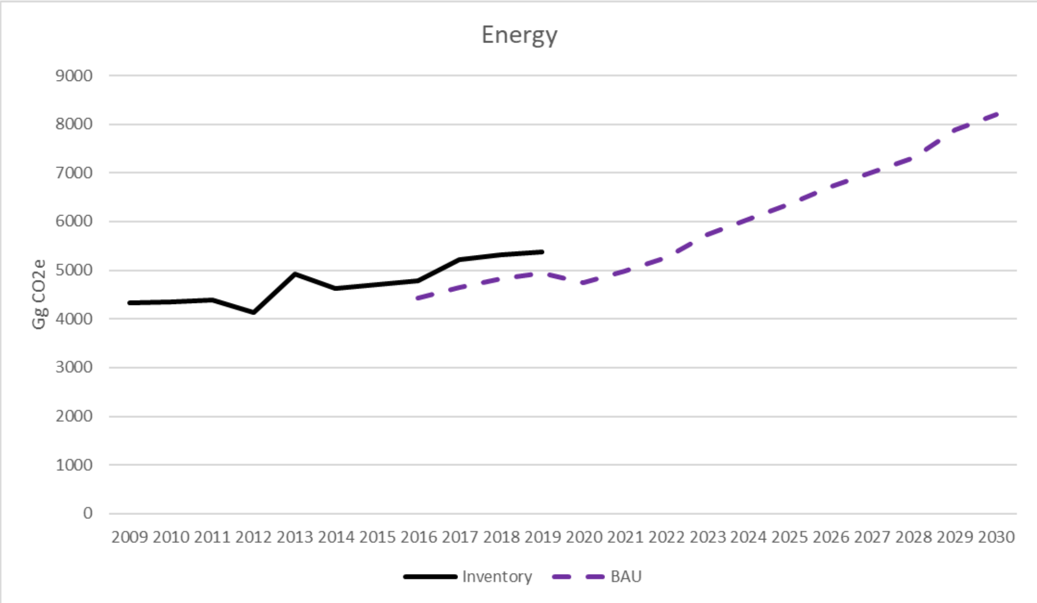
[48] DCM No. 881, date 14.12.2016, For the approval of the general national plan of the territory.

- Rural Development Programme 2014-2020 under the Instrument for Pre-Accession Assistance (IPARD) (2014-2020)
- Strategic Policy Document for the Protection of Biodiversity (SPDBP) (2016-2020)
- Draft Law on the Administration of the National Forest and Pasture Fund in Albania (from the entry into force to its revision).

3.2 Energy

In the **Energy sector BAU scenario**, consumption is expected to increase rapidly according to economic development based on current technologies. GHG emissions for the BAU scenario are expected to increase from 4,640 kt CO_2eq. in 2016 to 8,197 kt CO_2eq. in 2030, which represents an increase of +85.0%, as shown in the figure below.

Figure 42: Projected BAU energy-related emissions



The BAU scenario is based on the most likely evolution of the Albanian energy sector according to the baseline scenario of the National Strategy of Energy approved by the Albanian Government through the Council of Ministers Decision number 480 on July 31, 2018, and with no further policy interventions. It was developed according to the National Energy Strategy considering the new set of macro-economic drivers such as GDP and population. The Low Emissions Analysis Platform (LEAP)[49] energy model was used for energy demand forecasts for the BAU and other scenarios, using 2015 as the base year and assessing annual energy demand until 2030.

The BAU scenario has not been updated for this report. The NDC targets for CO_2 reduction for each economic sector including energy and transport sector are defined by this scenario. The GHG inventory for the years 2015-2019 is higher than the initial BAU because the NDC and Action Plan for Implementation of NDC were approved in October 2021. The BAU scenario is planned to be updated in 2024 – 3 years after the previous assessment.

Establishment of the **NDC scenario for the Energy Sector** was based mainly on Albania's Energy Sector Strategy, which is harmonised in terms of goals, details and timeline, with a number of other strategic and legal documents that are in force adopted or drafted in the same time frame as this document. Building on and complementing these documents has led to synergies in the prioritisation

[49] https://leap.sei.org/default.asp

of policies and programs and in the development of strategic recommendations. The following long-term strategic objectives were identified to implement the Guiding Principles and the current commitments that have been undertaken by the Albanian government:

- Improving the reliability and security of energy supply
- Developing domestic primary energy sources in a sustainable and competitive manner
- Improving the cost-effectiveness of energy supply systems
- Achieving renewable energy sources (RES) and energy efficiency (EE) targets established in the second National Energy Efficiency Action Plans and the National Renewable Energy Action Plan
- Developing least cost and sustainable policy for residential heating and cooling
- Integrating the Albanian power and natural gas markets with regional Energy Community and European markets
- Achieving the NDC targets for GHG emission reductions.

To understand the costs and benefits of these possible policies, the following four other scenarios were developed and analysed using the Albania-LEAP model:

- **Energy efficiency**: This scenario assumes that Albania meets its Energy Community Treaty commitments by implementing the second National Energy Efficiency Action Plan and enforces the Law on Energy Efficiency (together with improvement of the Law to transpose EE requirements) and the Law on Energy Performance in Buildings. EE target for 2030 is defined to be 15% of the national final energy demand.
- **Renewable energy sources:** This scenario assumes that Albania meets its Energy Community Treaty commitments of reaching a 38% renewable energy target in 2020 by implementing the Albanian National Renewable Energy Action Plan. RES target for 2030 is defined to be 42.5% of the national final energy demand.
- **Natural gas promotion**: This scenario assumes maximum possible penetration of natural gas in line with the Gas Master Plan. The natural gas penetration rate target for 2030 has been defined to be 8-10%. Natural gas in Albania will be used to guaranteeing the security of electricity supply since the Albanian power sector is based almost 100% on domestic hydro resources and electricity imports.
- **Combined:** This scenario combines the EE, RES and Natural Gas Promotion scenarios. Under this scenario all above mentioned targets have been aggregated and guarantee a proper development scenario for the energy sector until 2030.

The Energy sector NDC scenario is based on Combined Strategy scenario, calibrated with real figures for the period 2015-2019. The NDC scenario considers the introduction of natural gas in almost all sectors (including energy industry, manufacturing industry, transport, commercial, residential and agriculture). It also considers the implementation of different National Energy Efficiency Actions Plans (NEEAP) to increase energy efficiencies in both supply and demand reaching a 15% of the national final energy demand gain in 2030. It also considers the National Renewable Energy Action Plan (NREAP) with objectives of a share of 38% renewables in the final energy consumption in 2020 (already almost reached in 2019) and 42% in 2030.

Emissions for the NDC scenario for the energy sector (with mitigation measures) increased from 4430 kt CO_2eq. in 2016 to 6,234 kt CO_2eq. in 2030, which represents a growth of +40.3% (see figure below). The difference in 2030 with the BAU scenario is -1,963 kt CO_2eq., representing a mitigation impact of -23.9%.

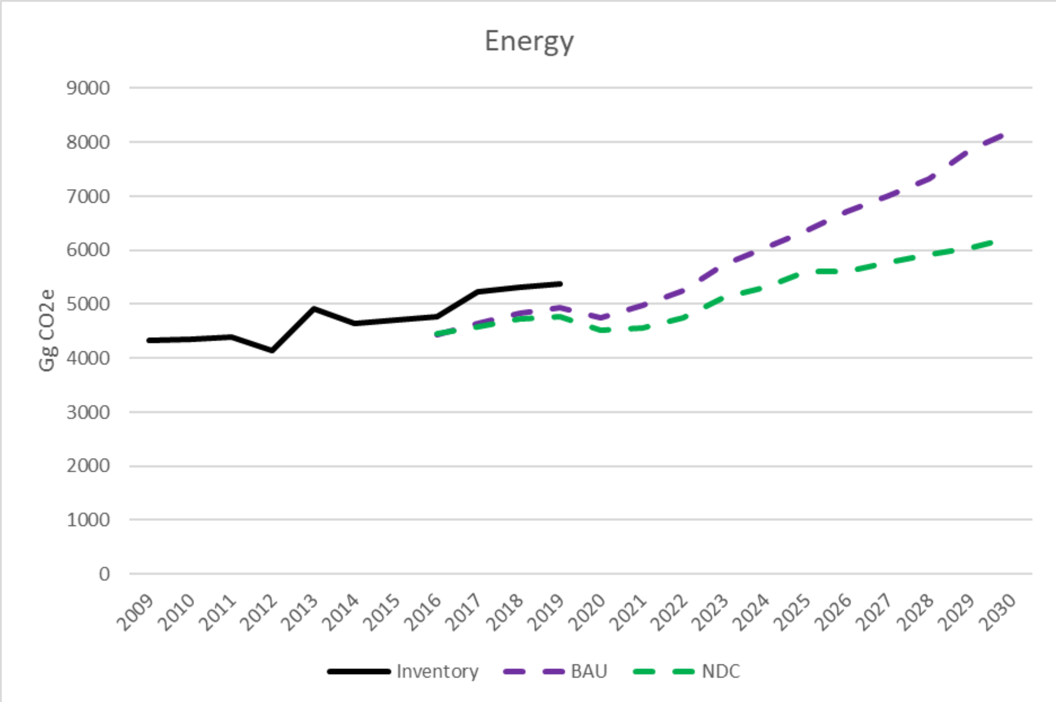


Figure 43: Projected BAU and NDC scenario emissions for energy sector

As discussed above, the BAU scenario has not been updated for this report. It is planned to be updated in 2024, which is 3 years after the previous assessment.

The mitigation actions considered in the NDC scenario for this sector include a list of measures presented under the following strategic documents:

- Strategy of Energy for the period 2016-2030 (approved by the Albanian Council of Ministers) including among other measures also: energy efficiency, new construction of power plants (focus almost to RES electricity generation); and increasing penetration of natural gas (to be used as back-up plants for drier periods (when hydro generation is lower than average generation).
- Nationally appropriate mitigation action (NAMA) – Replacing fossil fuels with non-hazardous waste in the Albanian cement industry (2015-2020)
- NAMA – Financing mechanism for energy efficiency in buildings (2015-2020)
- 1st National Action Plan for Energy Efficiency, 2009-2020
- National Action Plan for Natural Gas Penetration to the Albanian Economy, 2018-2030
- National Action Plan for Renewable Energy Sources 2018-2020 Law 124/2015 on Energy Efficiency (from the entry into force to its revision)
- Law 7/2017 "On the promotion of the use of renewable energy sources"
- Law 116/2016 "On energy performance of buildings"
- DCM No. 709, dated 1.12.2017 on the 2nd&3rd National Energy Efficiency Plan 2017-2020.

The sections below consider the mitigation actions for this sector in more detail.

3.2.1 Power generation

The mitigation action on energy efficiency within the power sector contains a comprehensive set of measures to remove barriers and incentivise small scale renewable energy (SSRE) investments. This action aims to enable a transition process towards diversification away from hydropower and the promotion of alternative sources of renewable energy. Gross final energy consumption is targeted to be 42% by 2030.

The action is comprised of four components:

- **Regulatory component**: Establishment of ALPEX for large Renewable Energy System Independent Power Producers (RES IPPs) and introduction of yearly net metering for RES auto-producers
- **Financial component**: Feed-in tariffs for small RES IPP
- **Technical support component**: Coordination between the Ministry of Infrastructure Energy, UNDP and other donors to incorporate new courses on technical training on SSRE installation, operation and maintenance at accredited vocational schools in the country
- **Outreach component:** The Ministry of Infrastructure an Energy has developed an information campaign in cooperation with the largest utility companies in the country to promote small RES in mailings with electricity bills.

Policies which support this action include:

- National Renewable Energy Action Plan (NREAP)
- National RES Action Plan 2019-2020

Table 30: Estimated investment costs, USD

	All SRES IPPs	Kalivaci HPP	Devolli HPPs Cascade	Skavica HPPs Cascade	Large PV IPPs	Large Wind IPPs	Total ALL RES IPPs
Investment unit costs, USD/kW	1250	1750	1500	2200	1050	1650	
Investment costs, Millions USD	1177	140	353	506	368	165	2708

3.2.2 Industrial energy combustion

The objective for the mitigation action targeting the industrial sector is to remove barriers and incentivise penetration of energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies. This action is comprised of four components:

- **Regulatory component**: Establishment of an energy auditing process, initially for large industrial consumers and then for all industrial consumers
- **Financial component**: EE Agency collaborating with different donors, especially IPA, to establish a project for improving the energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies in the industrial sector
- **Technical support component**: The Ministry of Infrastructure Energy is coordinating with the UNDP and other donors to incorporate new courses on technical training on energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies in the industry sector. Training on the installation, operation and maintenance will be implemented at accredited vocational schools in the country
- **Outreach component**: The Ministry of Infrastructure and Energy might develop an information campaign in cooperation with the largest industries to promote energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies in the industrial sector

Policies related to this action include:

- National Energy Efficiency Action Plan (NEEAP)
- National Energy Strategy 2018-2030

Table 31: Estimated investment costs, USD

	EE of industrial electromotors stock	EE of industrial boilers	EE of other energy consumption industrial technologies	Total ALL EE Industrial Technologies
Investment unit costs, USD/kW	125	75	150	
Investment costs, Millions USD	6.87	21.43	5.56	33.86

3.2.3 Service energy consumption

This mitigation action is to improve the energy efficiency (EE) of central and municipality service buildings and private service buildings which are part of the service sector. This will be achieved through the introduction of a group of EE measures for meeting minimum requirements, measures for net zero emissions and EE measures for biomass boilers and Solar Hot Water Sites. Local and climatic conditions, interior comfort of buildings, and cost-effective measures will be considered when improving energy performance. The target is for each year, a further 2% of public building stock (under public administration, used by a public authority or used to provide a public service) will be renovated to meeting minimum energy performance requirements.

The mitigation action will achieve the objectives through a comprehensive programme of measures to remove barriers and incentivise penetration of an energy efficiency group of measures, which are comprised oof four components:

- **Regulatory component**: Establishment of an energy auditing process, initially for central and municipality service public buildings and private service buildings part of the service sector
- **Financial component**: EE Agency collaborating with different donors, especially IPA, EBRD, GGF, WB, and Climate Fund, to establish a project for the improvement of EE for central and municipality service public buildings and private service buildings part of the service sector
- **Technical support component**: The Ministry of Infrastructure Energy, EEA is coordinating with the UNDP and other donors to incorporate new courses on technical training on energy efficiency of All EE/RES measures at the service sector at accredited vocational schools in the country
- **Outreach component**: The Ministry of Infrastructure and Energy might develop an information campaign in cooperation with central and municipality service public buildings and private service buildings part of the service sector

Policies related to this action include:

- National Energy Efficiency Action Plan (NEEAP)
- National Energy Strategy 2018-2030

Table 32: Estimated investment costs, USD

	EE group of measures for Meeting Minimum Requirements	EE group of measures for NZEB	EE Biomass Boilers	SHWS	Total ALL EE Service Technologies
Investment costs, Millions USD	66.31	21.43	5.56	93.31	186.62

3.2.4 Residential energy consumption

This mitigation action is to improve the energy efficiency of Single and multi-apartment buildings within the residential sector. This will be achieved through the introduction of a group of EE measures for meeting minimum requirements, net zero emissions, and EE measures for biomass boilers. Local and climatic conditions, interior comfort of buildings, and cost-effective measures will be considered when improving energy performance.

The mitigation action will achieve the objectives through a comprehensive programme of measures to remove barriers and incentivise penetration of an energy efficiency group of measures, which are comprised oof four components:

- **Regulatory component**: Establishment of an energy auditing process, initially for multi-apartment buildings part of the residential sector
- **Financial component**: EE Agency collaborating with different donors, especially IPA, EBRD, GGF, WB, and Climate Fund to establish a project to improve the EE of multi-apartment buildings part of the residential sector
- **Technical support component**: The Ministry of Infrastructure Energy, EEA is coordinating with the UNDP and other donors to incorporate new courses on technical training on energy efficiency of All EE/RES measures in the residential sector at accredited vocational schools in the country
- **Outreach component**: The Ministry of Infrastructure and Energy might develop an information campaign in cooperation with construction companies and Homeowner Associations to promote energy efficiency within the residential sector

Policies related to this action include:

- National Energy Efficiency Action Plan (NEEAP)
- National Energy Strategy 2018-2030

Table 33: Estimated investment costs, USD

	EE group of measures for Meeting Minimum Requirements	EE group of measures for NZEB	EE Biomass Boilers	SHWS	Total ALL EE Residential Technologies
Investment costs, Millions USD	6.87	21.43	5.56	33.86	67.72

3.2.5 Agriculture energy consumption

This mitigation action is to improve energy efficiency within the agriculture sector, particularly across the following areas:

- Energy consumption used by tractors
- Energy consumption used by irrigation
- Agriculture biomass

Measures to improve energy efficiency are comprised of four components:

- **Regulatory component**: Establishment of an energy auditing process, initially for large farms
- **Financial component**: Collaboration between the EE Agency, Ministry of Infrastructure and Energy, Ministry of Agriculture and Rural Development and donors, especially IPA, to establish a project to improve the energy efficiency of 1. EE tractors; 2. EE irrigation; 3. Agriculture biomasses in the agriculture sector
- **Technical support component**: The Ministry of Infrastructure Energy is coordinating with the UNDP and other donors to incorporate new courses on technical training on energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies at the industry sector, installation, operation and maintenance at accredited vocational schools in the country
- **Outreach component**: The Ministry of Infrastructure and Energy together with Ministry of Agriculture and Rural Development might develop an information campaign in cooperation with the largest farms and stables for the promotion of 1. EE tractors; 2. EE irrigation; 3. Agriculture Biomasses at the agriculture sector

Table 34: Estimated investment costs, USD

	1. EE tractor	2. EE irrigation	3. Agriculture biomass in the agriculture sector	Total ALL EE/RES Agriculture Technologies
Investment unit costs, USD/kW	500	500	180	
Investment costs, Millions USD	59.41	6.61	2.64	68.67

Table 35: Mitigation policies and measures, actions and plans for the Energy sector

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
Expansion of large RES IPPs, small RES IPPs and self-supply renewable energy systems (SRES auto producers)	A comprehensive programme of measures to remove barriers and incentivise SSRE investments	To reduce emissions from fossil fuel fired power plants by fostering self-supply renewable energy projects and to contribute to the long-term development of the renewable energy industry	Regulatory	Adopted	Power sector (electricity generation, transmissions and distribution)	CO_2	2016	Ministry of Infrastructure and Energy	Not estimated	61.47 (average annual reduction from 2016 to 2030)
Improved energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies in the industrial sector.	A comprehensive programme of measures to remove barriers and incentivise SSRE investments.	To reduce emissions from fossil fuel fired power plants by improving energy efficiency of electromotors stock, industrial boilers and other energy consumption technologies in the industry sector.	Regulatory	Adopted	All industrial subsectors	CO_2	2016	Ministry of Infrastructure and Energy	Not estimated	17.28 (average annual reduction from 2016 to 2030)
Improved energy efficiency of Central & Municipality Service Public Buildings and Private Service Buildings part of the Service Sector	A comprehensive programme of measures to remove barriers and incentivise penetration of EE group of measures for Meeting Minimum Requirements, EE group of measures for	To reduce emissions from fossil fuels by improving energy efficiency of Central & Municipality Service Public Buildings and Private Service Buildings part of the Service Sector	Regulatory	Adopted	Central & Municipality Service Public Buildings and Private Service Buildings part of the Service Sector	CO_2	2016	Ministry of Infrastructure and Energy	Not estimated	9.71 (average annual reduction from 2016 to 2030)

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
	NZE, EE Biomass Boilers and SHWS									
Improved energy efficiency of Single and multi-apartment buildings part in the Residential Sector	A comprehensive programme of measures to remove barriers and incentivise penetration of an EE group of measures for Meeting Minimum Requirements, EE group of measures for NZE, EE Biomass Boilers and SHWS	To reduce emissions from fossil fuels by improving energy efficiency of Single and multi-apartment Buildings part of the Residential Sector	Regulatory	Adopted	Single and multi-apartment buildings part of the Residential Sector	CO_2	2016	Ministry of Infrastructure and Energy	Not estimated	9.71 (average annual reduction from 2017 to 2030)
Improved energy efficiency within the agricultural sector	A comprehensive programme of measures to remove barriers and incentivise penetration of energy efficiency of 1. EE tractors; 2. EE irrigation; 3. Agriculture Biomasses at the agriculture sector	To reduce emissions from oil by products and fossil fuel fired power plants by improving energy efficiency of 1. EE tractors; 2. EE irrigation; 3. Agriculture Biomasses at the agriculture sector	Regulatory	Adopted		CO_2	2016	Ministry of Infrastructure and Energy together with Ministry of Agriculture and Rural development	Not estimated	9.71 (average annual reduction from 2016 to 2030)

3.3 Transport

The **Transport Sector** is the largest energy consuming sector in Albania and plays an important role in the consumption of energy resources. After 1990, there was a significant increase in transport activity, especially for road transport, which led to a significant increase of transport fuel consumption, mainly diesel and gasoline. To calculate the future transport energy demand, the sector was divided in two sub sectors: transport of freight and passengers. For the transport sector, two main indicators forecast the demand for passenger and freight transport: passenger-km and ton-km. It is forecast that ton-km will increase by 85% in 2030 compared to 2014, while passenger-km will increase by 37%. Most of the transport is undertaken by road vehicles. Albania's transport sector has been increasing rapidly since 2000. The number of vehicles in circulation has increased and infrastructure is being improved, which leads to an ever-increasing total traffic load. The transport sector consumes significant quantities of energy (mostly in the form of diesel and gasoline).

3.3.1 Road transport energy efficiency

The mitigation action aimed at reducing emissions from road transport is a modal shift towards active travel such as cycling and walking, and to encourage use of public transport. This action also encompasses development of an efficient transport system, as documented in the National Energy Strategy 2018-2030. The National Energy Strategy details the aim of decreasing private vehicle use, increasing e-mobility (through electricity supplied by RES plants/autoproducers) for both passenger and freight transport. For example, by 2030 30% of road journeys longer than 300 km shall be shifted to other transport modes, increasing to 50% by 2050.

The mitigation action is comprised of four components:

- **Regulatory component**: Establishment of the Municipality Energy and Climate Action Plan process by promoting walking, biking, e-cars and public transport
- **Financial component**: Collaboration between each Municipality and donors, especially IPA, to facilitate the promotion of walking, biking, e-cars and public transport
- **Technical support component**: The Ministry of Infrastructure Energy is coordinating with the UNDP and other donors to incorporate new courses on technical training promoting walking, biking, e-cars and public transport at accredited vocational schools in the country
- **Outreach component**: The Ministry of Infrastructure and Energy might develop an information campaign promoting walking, biking, e-cars and public transport

The following plans and laws were considered when drafting this mitigation action:

- Transport Sector Strategy and Action Plan (TSSAP) (2016-2020)
- Sustainable Transport Plan (STP) – Background document (2016-2020).
- National Energy Efficiency Action Plan (NEEAP)
- National Energy Strategy 2018-2030

Table 36: Estimated investment costs, USD

	EE of passenger road transport by promoting biking (including walking)	EE of passenger road transport by promoting e-cars	EE of passenger road transport by promoting public transport	Total ALL EE Possibilities on Passenger Transport
Investment unit costs, USD/Million pass-km	22000	11000	5500	
Investment costs, Millions USD	6.87	21.43	5.56	33.86

Table 37: Mitigation policies and measures, actions and plans for the Transport sector

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
Improved energy efficiency of passenger road transport by promoting walking, biking, e-cars and public transport	A comprehensive programme of measures to remove barriers and incentivise penetration of passenger road transport by promoting walking, biking, e-cars and public transport	To reduce emissions from oil by-products by improving the energy efficiency of passenger road transport through promoting walking, biking, e-cars and public transport	Regulatory	Adopted	Road transport	CO_2	2016	Ministry of Infrastructure and Energy	Not estimated	8.98 (average annual reduction from 2016 to 2030)

3.4 Agriculture

The **BAU emission trend for agriculture** predicted between 2019 and 2030 is based on an interpolation between 2030 values used in Albania's NC3 and the FAO values from 2019. The assumption from the NC3 is an increase in most of the livestock populations (except for sheep, goats, horses, mule and asses) in line with the objective of promoting the Albanian agricultural production. It assumed no change in animal feed regimes and associated productivity, and a constant distribution of animals per manure management systems.

For the calculation of nitrogen from crop residues, the analysis considers stable land areas by types of crops, except for wheat, which is decreasing, and assumes an increase in the average yield of these crops. The mineral fertilisation projection is based on the evolution of area of total cropland (in line with the LULUCF sector), assuming that the average nitrogen rate is constant for the BAU scenario. Assumptions of stability have been made regarding other nitrogen inputs. The area of histosols is assumed stable. For crop residue burning, data from the European Forest Fire Information System (EFFIS) are considered for the period 2009-2018. Average rate of burning for wheat during this period (2009-2018) equals 1.3% and is maintained for the whole period (2019-2030). For pasture burning, the average area burnt during 2009-2018 (5,154 ha) has been used for projected years.

In the Agriculture sector, emissions for the BAU scenario decrease from 2,343 kt CO_2eq. in 2016 to 2,297 kt CO_2eq. in 2030, which represents a change of -2.0% (see figure below). However, the decreases from 2016 to 2019 are based on FAO datasets, and the projection for BAU considers a small increase from 2020 to 2030, in line with livestock population projected for the NC4.

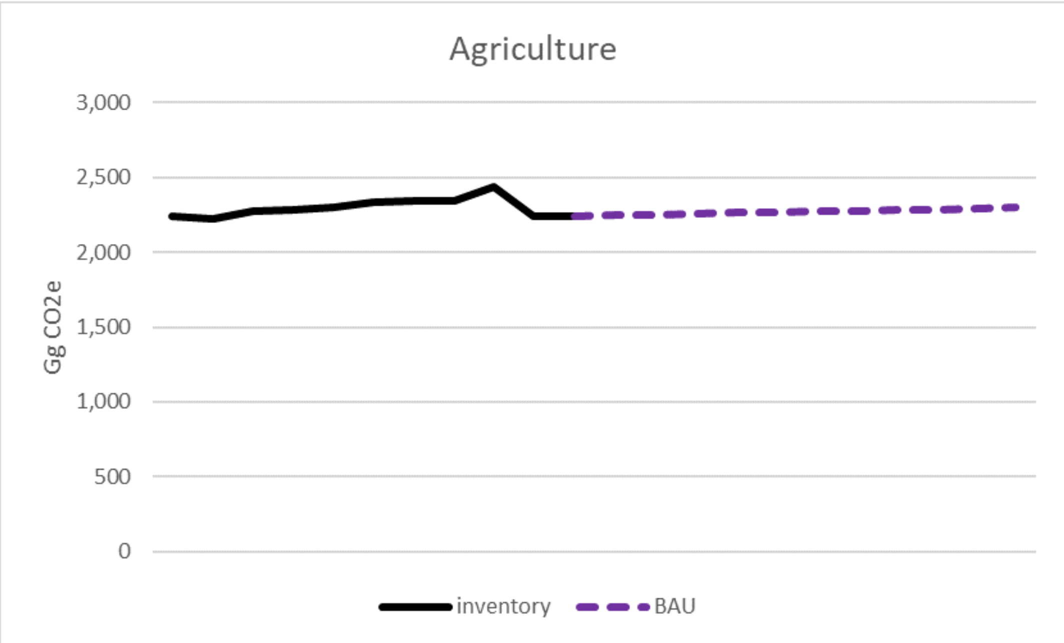


Figure 44: Projected BAU agriculture-related emissions

Additional mitigation measures considered in Agriculture allow an improvement of fertilisation, pasture, and animal feeding practices (see section 3.4.1 for further detail). However, these actions have little impact considering the importance of livestock population in the emissions. In line with the national strategy, and considering the national economic circumstances, the aim is an increase in production, no decrease of livestock population, and an increase in yields.

This explains that emissions for the **NDC scenario for the agriculture sector** (with mitigation measures) decrease from 2,344 kt CO_2eq. in 2016 to 2,183 kt CO_2eq. in 2030, which represents a change of -6.8% (see figure below). The difference, in 2030 with the BAU scenario is -114 kt CO_2eq., which represents a limited mitigation impact of -4.8%.

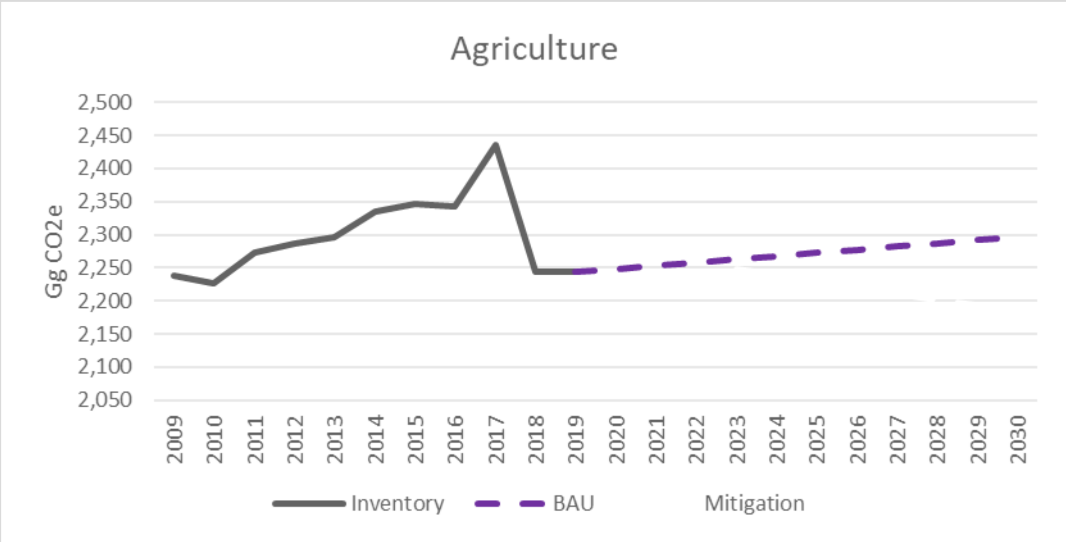


Figure 45: Projected BAU and NDC scenario emissions for agriculture sector

The following plans and strategies were considered and analysed:

- Inter-sectoral strategy for Agriculture and Rural Development in Albania (ISARD) (2014-2020)
- Rural Development Programme 2014-2020 under the Instrument for Pre-Accession Assistance (IPARD) (2014-2020)

3.4.1 Optimisation of animal feeding

The mitigation action will achieve the objectives through reducing GHGs emissions from livestock by improving animal feeding. This can be done through measures such as:

- Feed cattle and other animals based on nutrient needs
- Boosting efficiency of livestock production and resource use
- Striving for healthy, sustainable diets and accounting for protein alternatives
- Use of livestock feed additives
- Selecting high quality feeds that will reduce methane released from enteric fermentation

The four components of the mitigation action are:

- **Regulatory component:** Establishment of the animal feeding guideline and regulatory framework
- **Financial component**: Ministry of Agriculture and Rural Development collaborating with farmers, IPARD programmes and state funds to establish a project for improvement of feeding the animal based on (i) diets, (ii) feed additives, (iii) improving quality of the feed and (iv) protein alternatives
- **Technical support component**: The Ministry of Agriculture and Rural development in cooperation with different donors (FAO, EU, UNDP, etc.) to introduce new approach on animal feeding

- **Outreach component**: Ministry of Agriculture and Rural Development might develop a guideline in cooperation with agriculture universities and the largest livestock farms

Improved feeding techniques will lead to a decrease in nitrogen excretion rate (N inputs from feeding fitting better to animal needs) – we assume a 10% reduction for improved feeding. It will also lead to a decrease in enteric CH_4 (add of fat in feeding): according to the GACMO tool, this can lead to a reduction of 4% of CH_4 emissions for 1% of fat added.

Table 38: Estimated investment costs, USD

	1. Use of pills	Total ALL EE/RES Livestock
Investment unit costs, USD/ton CO_2	80	
Investment costs, in million USD	4.82	4.82

3.4.2 Improving manure management systems

The mitigation action will achieve the objectives by improving Manure Management Systems through improving practices in collection, treatment, storage, and application of manure to soils. This not only improves yields but can also have other co-benefits such as reducing nitrate (NO−3) and phosphorus (P) leaching, as well as reducing both ammonia (NH_3) volatilization and nitrous oxide (N_2O) and methane (CH_4) emissions. Other actions can be:

- Cover manure storage facilities
- Optimize manure use with nutrient management plan
- Capture and combust methane from manure storage

The components of the action are:

- **Regulatory component**: Establishment of the manure management regulatory framework and relevant guidelines
- **Financial component**: Ministry of Agriculture and Rural Development collaborating with farmers, IPARD programmes and state funds to establish a project for improvement of feeding the animal based on; (i) improved practices in collection, (ii) treatment, (iii) storage, (iv) optimize manure use with nutrient management plan; (v) capture and combust methane from manure storage
- **Technical support component**: The Ministry of Agriculture and Rural development in cooperation with different donors (FAO, EU, UNDP, etc.) to introduce new approach on animal feeding
- **Outreach component**: Ministry of Agriculture and Rural Development might develop a guideline in cooperation with agriculture university and the largest livestock farms

Table 39: Estimated investment costs, USD

	1. Improve MMS technologies	Total ALL EE/RES Livestock
Investment unit costs, USD/ton CO_2	40	
Investment costs, in million USD	1.14	1.14

Table 40: Mitigation policies and measures, actions and plans for the Agriculture sector

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
Optimizing animal feeding to reduce CH_4 emissions from livestock	Reducing GHG emissions from livestock by improving animal feeding. This can be done through; Feed cattle and other animals based on nutrient needs; Boosting efficiency of livestock production and resource use; Striving for healthy, sustainable diets and accounting for protein alternatives; Use livestock feed additives, Select high quality feed that will reduce methane released from enteric fermentation etc.	To reduce GHG emissions through improving animal feeding in Albania, reducing GHG emissions by 5% from this sub-sector by 2030.	Economic	Planned	Livestock and agriculture sector	CH_4	2023	Private enterprises (owner of the farms) with Ministry of Agriculture and Rural Development	Not estimated	34.84 (average annual reduction from 2023 to 2030)
Improving Manure management systems to reduce N_2O and CH_4 emissions (livestock)	Improving Manure Management Systems involves improved practices in collection, treatment, storage, and application of manure to soils that can not only improve yields, but can also have other co-benefits, such as reducing nitrate (NO_3^-) and phosphorus (P) leaching, as well as reducing both ammonia (NH_3) volatilization and nitrous oxide (N_2O) and methane (CH_4) emissions. Other	to reduce GHGs emissions through improving manure management systems in Albania, reducing by 10% of the GHGs emissions from this sub-sector until 2030.	Economic	Planned	Livestock and agriculture sector	CH_4, N_2O	2023	Private enterprises (owner of the farms) with Ministry of Agriculture and Rural Development	Not estimated	3.57 (average annual reduction from 2023 to 2030)

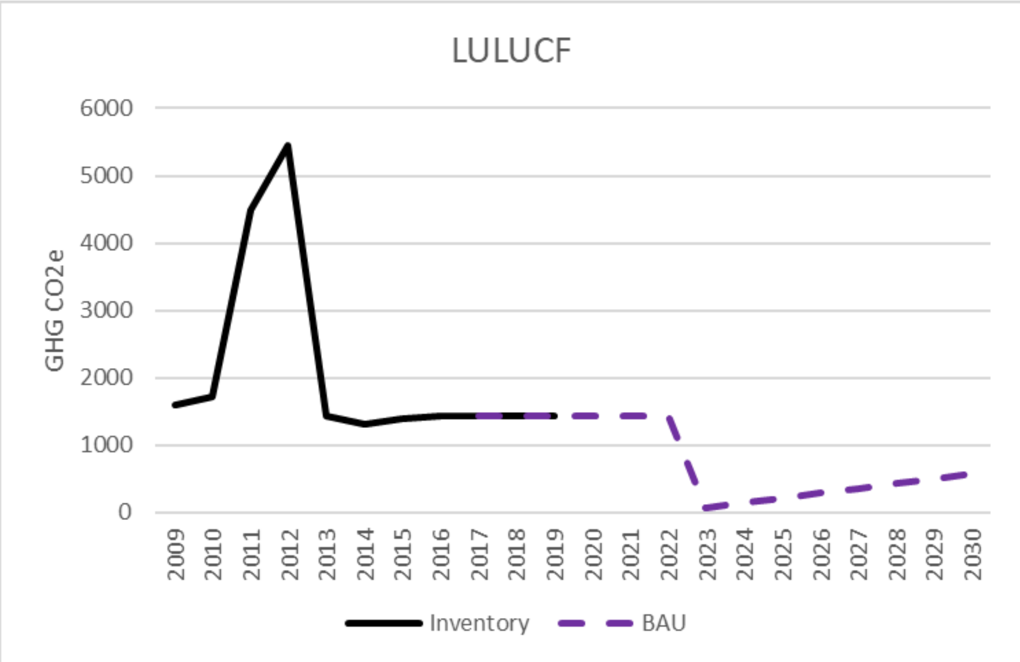
Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
	actions can be cover manure storage facilities; Optimize manure use with nutrient management plan; Capture and combust methane from manure storage									

3.5 LULUCF

The **BAU scenario for the LULUCF sector** considers the continuation of the situation and trends of the recent decade covered by the inventory, in particular in terms of trends for land-use change areas, wood and fuelwood harvests (stable, as in the 2009-2016 period). For wildfires, EFFIS data is used for 2017-2018, and it explains the second peak in 2017. Forest fires episodes, which happen at irregular times, cannot be projected: only a background level was projected, based on the whole period without considering exceptional episodes. it is assumed an increasing probability of fires for this background level, with a linear increase.

In the LULUCF sector, emissions for the BAU scenario increase from 1,430 kt CO_2eq. in 2016 to 1,480 kt CO_2eq. in 2030, which represents an evolution of +3.4% (see figure below).

Figure 46: Projected BAU FOLU-related emissions



Emissions in the **LULUCF sector for the NDC scenario** (with mitigation measures) decrease from 1,430 kt CO_2eq. in 2016 to 326 kt CO_2eq. in 2030, which represents an evolution of -77.2% (see figure below). The difference of 2030 with the BAU scenario is -1,153 kt CO_2eq., which represents a mitigation impact of -80.6%. The big forest fires episodes caused the two peaks (2011-2012 and 2017) and such episodes could not be projected. However, it is considered, in line with the national policy (Draft Environmental Cross-cutting Strategy), that an effort is put to avoid such episodes through the improvement of the monitoring system to prevent wildfires. In addition to this action regarding the prevention of wildfires, other mitigation measures are considered in the NDC scenario: the reduction of the use of fuelwood (the assumption on fuelwood consumption being estimated in the Energy sector so that LULUCF and Energy sectors are consistent); new afforestation areas; improved efficiency of fuelwood harvest; improved sustainable management of forests, cropland and grassland to enhance carbon sequestration and protect biodiversity.

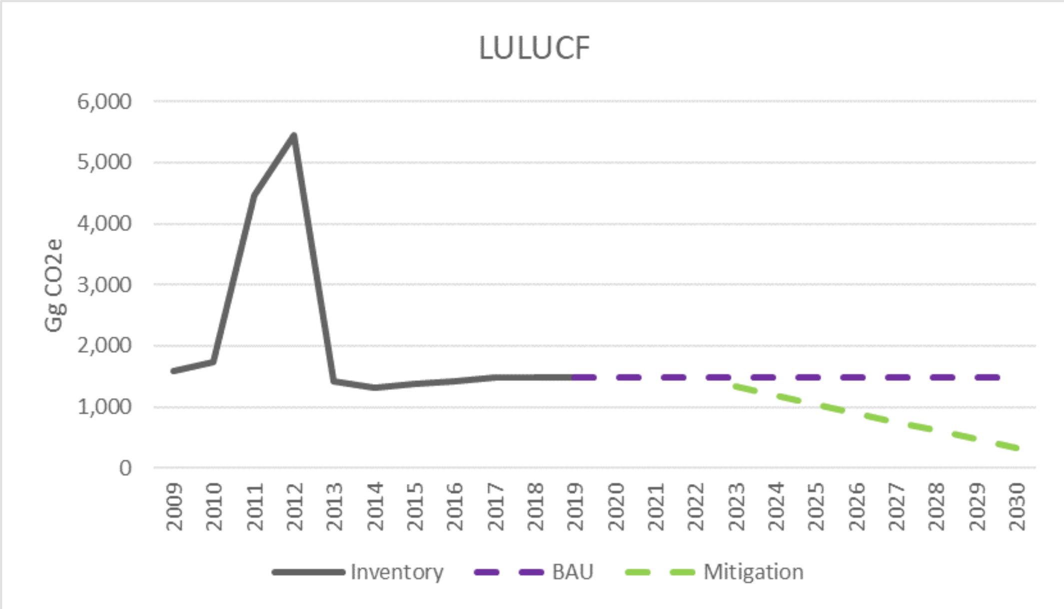


Figure 47: Projected BAU and mitigation scenario LULUCF-related emissions

3.5.1 Implementation of agro-forestry practices in agricultural lands

This mitigation action is to reduce emissions by implementing agro-forestry practices in agricultural lands. This will be achieved through (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage. These measures are comprised of four components:

- **Regulatory component**: Establishment of good practise and guidelines in agro forestry
- **Financial component**: Ministry of Agriculture and Rural Development collaborating with RDA and different donors, especially IPA, to design a project for the implementation of agro-forestry practices in the agriculture sector
- **Technical support component**: The Ministry of Agriculture and Rural Development will lead the process towards good management practices in the field of agro forestry. For example, creating wind-break belts and planting multi-purpose trees and fast-growing species along agriculture land, irrigation canals, riversides and pasture lands
- **Outreach component**: Ministry of Agriculture and Rural Development might develop an information campaign to promote the importance of agro-forestry practices in the country

Table 41: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in agricultural lands	Total ALL EE/RES Agriculture Technologies
Investment unit costs, USD/t CO_2	97	
Investment costs, Millions USD	2.40	2.40

3.5.2 Implementing new afforestation areas

This mitigation action is to invest in afforestation in degraded forest lands by planting high growth-rate species, which can result in; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage. Based on national circumstance, and considering the current trends, the potential for afforestation areas is estimated at 300 ha per year. The programme of measures for this action includes four components:

- **Regulatory component**: establishment of good practise and guidelines in forestry
- **Financial component**: Ministry of Tourism and Environment, National Forest Agency and municipalities collaborating with RDA and different donors, especially IPA, to implement afforestation in the forestry sector and implement existing management plans
- **Technical support component**: The Ministry of Tourism and Environment (National Forest Agency and ARD) and other donors will lead the afforestation activities in the country, planting multi-purpose and fast-growing species in degraded lands, burned areas etc.
- **Outreach component**: Ministry of Tourism and Environment might develop an information campaign for promotion the project on importance of afforestation and forest protection in the country.

Table 42: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in new afforested lands	Total from forestry
Investment unit costs, USD/t CO_2	139	
Investment costs, Millions USD	31.43	31.43

3.5.3 Improving management and monitoring to prevent wildfires

The objective of this mitigation action is to increase the carbon sink in Albanian forest ecosystems by improving forest protection by wildfires. While it is not possible to predict future episodes of wildfires, the improvement of monitoring and management of forest fires will help reduce this risk. This will be achieved through a comprehensive programme of measures to invest in protection of the forests by forest fires which can result in; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage. The components of the measures include:

- **Regulatory component**: Establishment good practise and guidelines in forestry
- **Financial component**: Ministry of Tourism and Environment, National Forest Agency and municipalities collaborating with RDA and different donors, especially IPA, to implement relevant measures for forest protection from fires
- **Technical support component**: The Ministry of Tourism and Environment, National Forest Agency, municipalities, National Agency of Protected areas and ARD, as well other donors will implement forest protection measures from forest fires
- **Outreach component**: Ministry of Tourism and Environment might develop an information campaign to promote the project on the importance of forest protection in the country

Table 43: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in forest lands	Total from forestry
Investment unit costs, USD/t CO_2	56	
Investment costs, Millions USD	13.20	13.20

3.5.4 Improve fuelwood combustion through improving efficiency of stoves

The mitigation action is to improve the energy efficiency of the fuelwood combustion by introducing modern and very efficient stoves. This will be achieved through a comprehensive programme of measures to invest in introducing new and very efficient stoves (up to 95%), resulting in; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage. It will also result in a decrease in wood dumping. The components of the mitigation action include:

- **Regulatory component**: Establishment of good practise and guidelines in forestry
- **Financial component**: Ministry of Tourism and Environment, Ministry of Infrastructure and Energy, National Forest Agency and municipalities collaborating with RDA, and different donors, especially IPA, to implement relevant measures for forest utilization
- **Technical support component**: The Ministry of Tourism and Environment, Ministry of Infrastructure and Energy, National Forest Agency, municipalities, National Agency of Protected areas, NAPA, ARD, municipalities as well other donors will implement improvement measures in fuelwood combustion technology
- **Outreach component**: Ministry of Tourism and Environment might develop an information campaign for promotion the project on importance of energy efficiency from fuelwood combustion. .

Table 44: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in forest lands	Total from forestry
Investment unit costs, USD/t CO_2	784	
Investment costs, Millions USD	16.00	16.00

3.5.5 Improve forest utilisation

This measure aims to improve the utilization of the biomass harvested in the forests. Due to the low level of mechanization in forests, a significant part of wood biomass remains in the forest during forest exploitation. This unused biomass goes up to 25% of the total biomass cut in the forest. Improving forest utilization means a reduced amount of the harvested biomass left in the forest, with the aim to decrease it from 25% to 15% in 2030. The four components of this action are as follows:

- **Regulatory component**: Establishment of good practise and guidelines in forestry
- **Financial component**: Ministry of Tourism and Environment, National Forest Agency and municipalities collaborating with RDA, and different donors, especially IPA, to implement relevant measures for forest utilization
- **Technical support component**: The Ministry of Tourism and Environment, National Forest Agency, municipalities, National Agency of Protected areas, NAPA, ARD, municipalities as well other donors will implement improvement measures in forest utilization technology
- **Outreach component**: Ministry of Tourism and Environment might develop an information campaign to promote the project on the importance of forest utilization

Table 45: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in forest lands	Total from forestry
Investment unit costs, USD/t CO_2	11	
Investment costs, Millions USD	1.88	1.88

3.5.6 Improving sustainable forest management

This measure aims to increase forest biomass through silvicultural interventions, resulting in increased biomass growth per year. The components of this measure include:

- **Regulatory component**: Establishment of good practise and guidelines in forestry
- **Financial component**: Ministry of Tourism and Environment, National Forest Agency and municipalities collaborating with RDA, and different donors to support implementation the relevant measures for forest improvement through silvicultural treatment
- **Technical support component**: The Ministry of Tourism and Environment, National Forest Agency, municipalities, National Agency of Protected areas, NAPA, ARD, municipalities as well other donors will implement improvement measures by silvicultural interventions
- **Outreach component**: Ministry of Tourism and Environment might develop an information campaign to promote the project on importance of forest improvement

In the NDC scenario, grassland soil is improved by additional inputs from agricultural management (livestock management, more inputs, as seen in Agriculture sector).

Table 46: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in forest lands	Total from forestry
Investment unit costs, USD/t CO_2	214	
Investment costs, Millions USD	23.10	23.10

3.5.7 Improve forest management by managing pests and diseases

This measure aims to improve pest and disease management in the forests. Improving pest and disease management will result in increased total biomass growth. This measure is comprised of four components:

- **Regulatory component**: Establishment of good practise and guidelines in forestry
- **Financial component**: Ministry of Tourism and Environment, National Forest Agency and municipalities collaborating with RDA, and different donors, especially IPA, to implement relevant measures for pest and disease management
- **Technical support component**: The Ministry of Tourism and Environment, National Forest Agency, municipalities, National Agency of Protected areas, NAPA, ARD, municipalities as well other donors will implement improvement measures in pest and disease management technology
- **Outreach component**: Ministry of Tourism and Environment might develop an information campaign to promote the project on importance of forest improvement

Table 47: Estimated investment costs, USD

	1. Carbon sequestration by biomass growth in forest lands	Total from forestry
Investment unit costs, USD/t CO_2	180	
Investment costs, Millions USD	45.00	45.00

Table 48: Mitigation policies and measures, actions and plans for the LULUCF sector

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
Implementation of agro-forestry practices on agriculture lands	A comprehensive programme of measures to invest in agro-forestry practices by; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage	To reduce emissions by implementing agro-forestry practices to contribute in agricultural GHG mitigation actions	Economic	Planned	Agriculture, forestry, pasture	CO_2	2023	Ministry of Agriculture and Rural development	Not estimated	111 (2023-2030)
Implementing new afforestation areas	A comprehensive programme of measures to invest in new afforestation in degraded forest lands, by planting high growth rate species which can result in; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage	To increase the carbon sink in Albanian forest ecosystems, turning them from carbon emitters to a carbon sink	Economic	Planned	Forestry	CO_2	2023	Ministry of Tourism & Environment and municipalities	Not estimated	1.02 (2023-2030)

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
Improving management and monitoring to prevent wildfires	A comprehensive programme of measures to invest in the protection of the forests by preventing forest fires which can result in; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage	To increase the carbon sink in Albanian forest ecosystems, by improving forest protection by wildfires	Economic	Planned	Forestry	CO_2	2023	Ministry of Tourism & Environment and municipalities	Not estimated	1.05 (2023-2030)
Improve fuelwood combustion through improving efficiency of stoves	A comprehensive programme of measures to invest in introducing new and very efficient stoves (up to 95%), resulting in; (1) sequestering carbon in terrestrial biomass and soils, (2) reducing GHG emissions, and (3) avoiding emissions through reduced fossil fuel and energy usage	To improve the energy efficiency of the fuelwood combustion by introducing modern and very efficient stoves	Economic	Planned	Forestry	CO_2	2023	Ministry of Tourism & Environment and municipalities	Not estimated	0.73 (2023-2030)
Improve forest utilization	To improve the utilization of the biomass harvested in the forests	To improve the forest utilization resulting in biomass gain	Economic	Planned	Forestry	CO_2	2023	Ministry of Tourism & Environment and municipalities	Not estimated	0.77 (2023-2030)

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)	
									Achieved	Expected
Improve the sustainable forest management	This measure aims to increase forest biomass through silvicultural interventions, resulting in increased biomass growth per year	To improve the forest utilization resulting in biomass gain	Economic	Planned	Forestry	CO_2	2023	Ministry of Tourism & Environment and municipalities	Not estimated	0.48 (2023-2030)
Improve forest management by managing pests and diseases	To improve pest and disease management in the forests, resulting in in increased total biomass growth	To improve pest and disease management resulting in biomass gain	Economic	Planned	Forestry	CO_2	2023	Ministry of Tourism & Environment and municipalities	Not estimated	1.13 (2023-2030)

3.6 Waste management

In the Waste sector, emissions for the BAU scenario changed from 977 kt CO_2eq. in 2016 to 968 kt CO_2eq. in 2030, which represents a growth of -1.0% (see figure below).

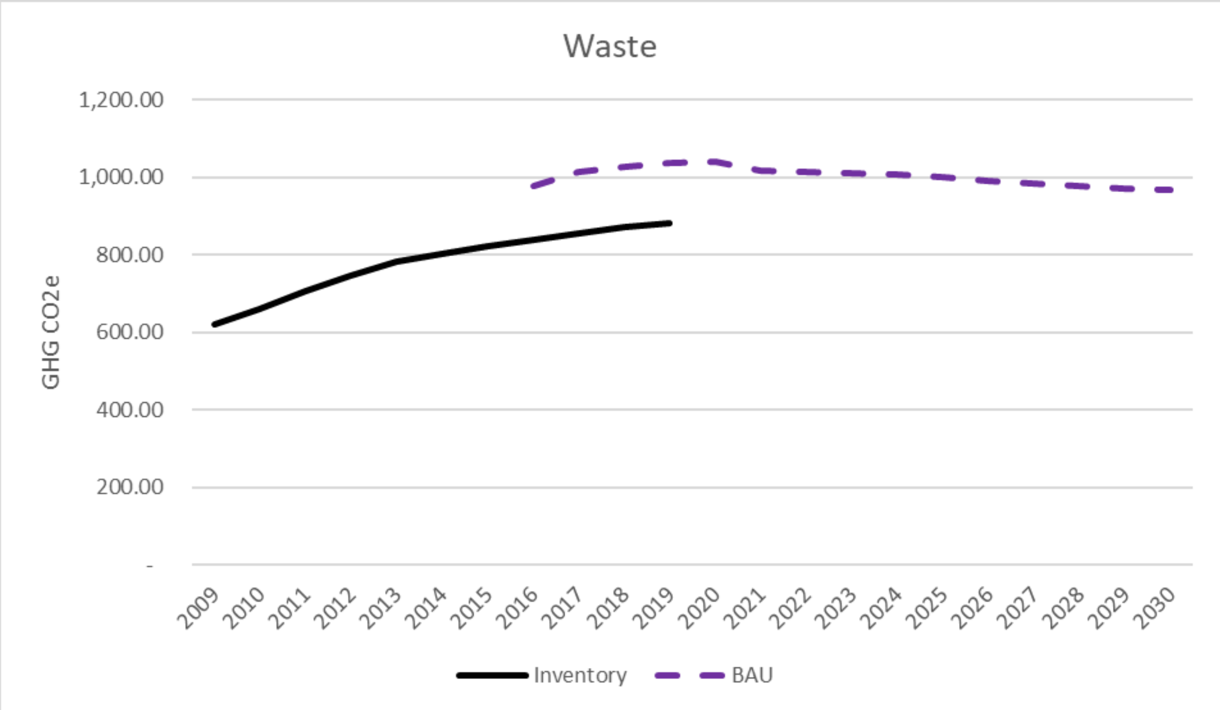


Figure 48: Projected BAU waste-related emissions

The **BAU scenario for the waste sector** assumes a stable level of waste produced per year and per capita, a stable ratio of waste going to landfill, no methane capture installation, an amount of composted, incinerated and open burnt waste per inhabitant equal to the mean value of the three recent years and evolving with population growth. The wastewater treatment forecast is based on industrial production trends.

In the **Waste sector, emissions for the NDC scenario** decreased from 977 kt CO_2eq. in 2016 to 796 kt CO_2eq. in 2030, which represents an evolution of -18% (see figure below). The difference in 2030 compared to the BAU scenario is -171 kt CO_2eq. The difference observed between the two scenarios can be partly explained by the degradation kinetics of the waste sent to landfills. In parallel, a strong increase of emissions associated with the development of waste incinerators in the country is considered.

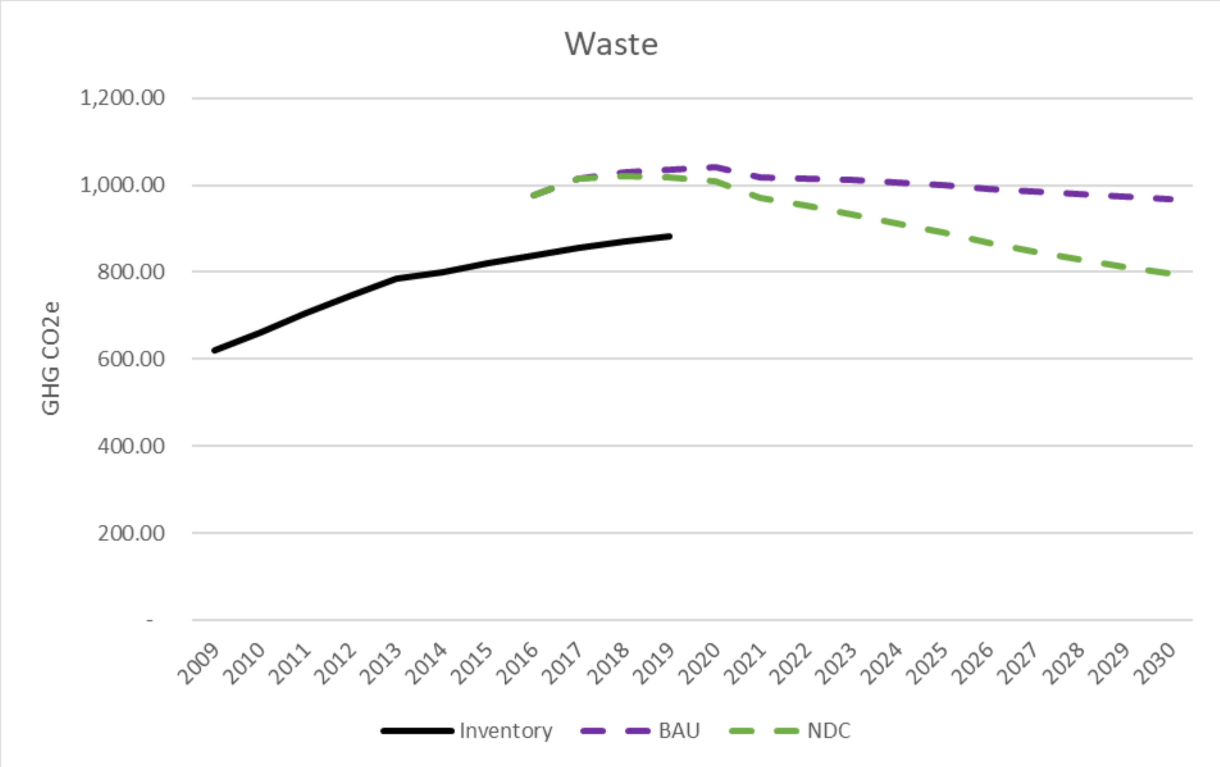


Figure 49: Projected BAU and NDC scenario emissions for waste sector

The following table presents a summary of the mitigation actions considered in the NDC scenario for this sector.

3.6.1 Improved management and monitoring of landfilling

This mitigation action has the following objectives:

- **Reduce the amount of waste going to landfill**: 35% reduction in the amount (by weight) of biodegradable municipal waste produced going to landfill, compared to 2010. This is in accordance with the national regulatory framework in force (Governmental Decree No.418, dated 27.05.2020)
- **Result in methane capture installation**: initiation of CH_4 capture in 2025 and a linear evolution to 10% of 1.34 million m^3 of CH_4 is captured in 2030
- **Increase the amount of composted waste**: 85% increase between 2009 and 2020 and +3% each year until 2030

Table 49 below outlines the progress that has been made thus far for each objective.

Table 49: Comparison between targets in place and achievement so far

	Target	Baseline scenario (2020)
Landfill	*35% reduction by 2025*	*13% reduction*
CH_4 capture	*0.134 mio.m^3 by 2030*	*0 mio.m^3*[31]
Composted wate	*132 kt by 2020*	*41 kt*

[1]The start date for addressing this objective is 2025.

The main impact of this action on GHG emissions will be a result of changing treatment practice. More waste will be treated with incineration technology and less waste will go in landfills and dumpsites. Incineration of the same amount of carbon from biodegradable waste as solid waste disposal on land will generate more CO_2 but far less CH_4. This means that the GWP (CO_2eq.) for the same amount of carbon will be much less.

Estimated costs: Investment of 140 million EUR for the construction and operation of incineration facilities already in 2022. By 2025 the investment will be more than 300 million Eur.

3.6.2 Development of the waste incineration technology with energy recovery

This action is the development of waste incineration technology, using energy recovery for a portion of the waste that would otherwise go to landfill or be burned through open burning. Objectives covered under this action include:

- Increase of MSW incineration: Starting in 2017 with a progressive increase between 2021 until 2030
- Increase diversion of waste from landfills and dumpsites to incineration
- Decrease in the amount of waste burned in open fires through improving collection rates of MSW

Table 50 outlines the target phasing for the quantity of MSW incinerated and open burned. For open burning, values relate to the amount of waste burned in proportion to the quantity of waste not collected in the country.

Table 50: Timeframes and target changes for MSW incinerated and burned in open burning

MSW incineration		Open burning	
Timeframe	Target % change	Timeframe	Target % change
2017	+100%	2016 – 2017	-31%
2017 - 2018	+50%	2016 - 2020	-76%
2019 - 2020	+33%	2016 - 2030	-74%
2020 - 2021	+25%		
2021 - 2030	+27%		

The decision of the government to increase the use of incineration technology has already produced a shift in the MSW quantities disposed of on land before 2017. By 2030 the incineration technology will be used at its full planned capacity and the amount of waste treated will be diverted from landfills or dumpsites.

Estimated costs: Investment of 140 million EUR for the construction and operation of incineration facilities already in 2022. By 2025 the investment will be more than 300 million Eur.

Table 51: Mitigation policies and measures, actions and plans in the Waste sector

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)[j]	
									Achieved	Expected
Improved management and monitoring of landfilling sub-sector	Reduce by 35% (compared to 2010) the amount of bio-waste going on landfills by 2025 Organize the setting up of methane capture installations on landfills. Organize the development of the composting sector to increase the amount of composted waste.	To reduce the amount of waste disposed of in landfills and dumpsites and remediation of existing disposal sites. Better environmental performance of all disposal activities.	Legislative framework, national and regional plans	Adopted	Solid waste management	CH_4	2020	Government of Albania, municipalities	Not estimated	171 (in 2030)
Development of the waste incineration technology with energy recovery	Reducing the amount of waste going to landfills and dumpsites	Increase MSW incineration Increase diversion of waste from dumpsites	Legislative framework, national and regional plans	Adopted	Solid waste management	CO_2	2020	Government of Albania, municipalities	Not estimated	171 (in 2030)

diverting a part of the amount of waste going on landfills and a part of waste burned in open burning	through incineration Remediation works in existing solid waste disposal sites	and landfills to incineration Decrease in the amount of waste burned in open fires								

3.7 Additional information on mitigation actions

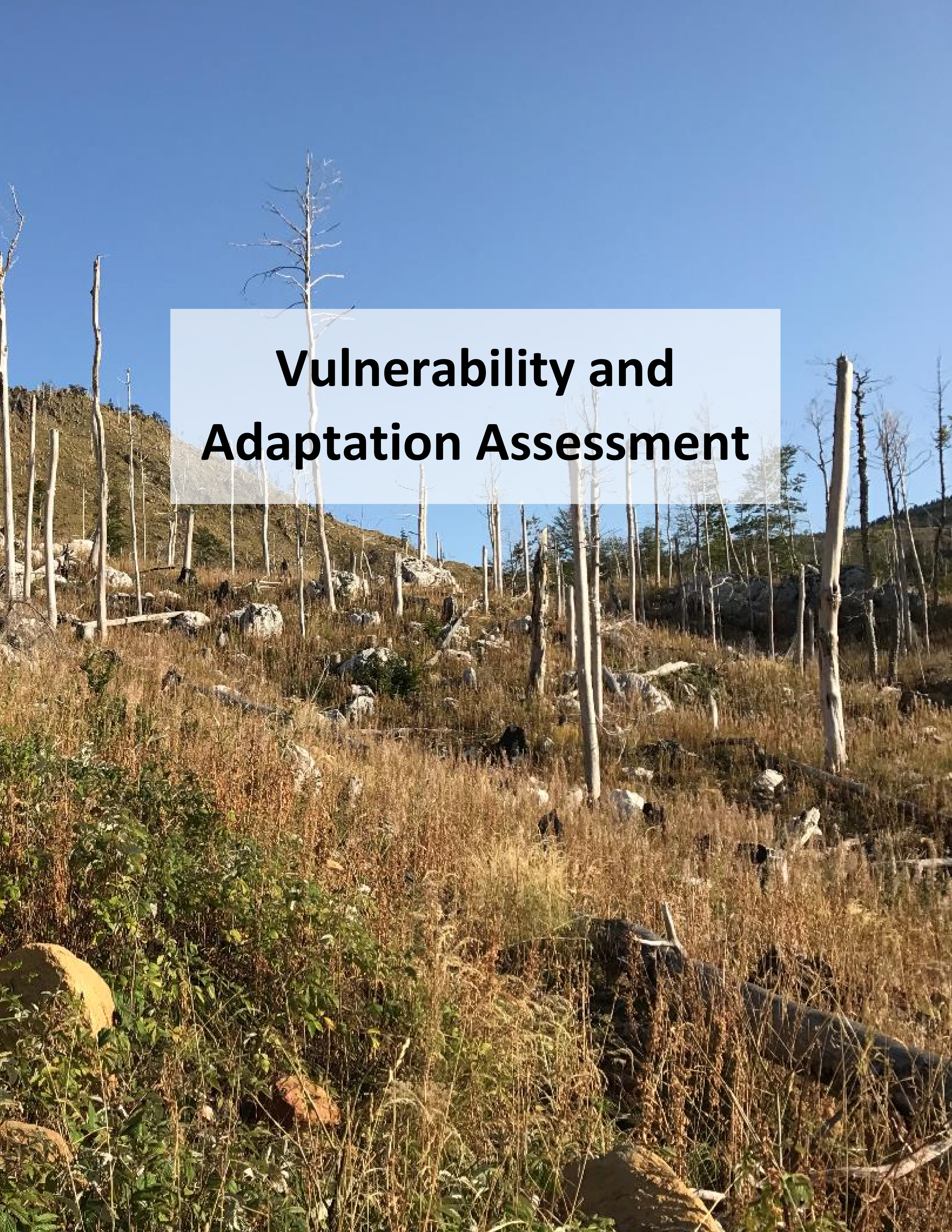
Albania has secured support from the NDC Partnership[50] to update and enhance the initial NDC that it submitted in 2015. In 2020 Albania secured support from the UNDP Climate Promise to revise the initial NDC. In particular, Albania aimed to increase its mitigation ambition, expanding the sectors that are considered (adding transport and agriculture, forestry and land use, to energy and industrial processes); and including adaptation measures, especially related to coastal areas since a high percentage of the Albanian population is concentrated on the coastal zone and agriculture. The focus is on settlements, population and tourism in coastal areas and agriculture. The country's revised NDC shows the consistency and accuracy of mitigation calculations in a transparent manner, and the fairness of its ambition, and presents Albania's national circumstances. More specifically, the NDC is enhanced by:

- Covering gases other than CO_2 (i.e. CH_4, N_2O, F-gases), that were not included in the first NDC, but are covered in the NC3 and the BUR1, even though they have large uncertainties.
- Covering all emission sectors: Energy; Industrial processes LULUCF and Waste. The first NDC only covered Energy and Industrial processes.
- Considering the latest methodological improvements of the local team in charge of the national inventory, the NC3, and the First Biennial Update Report.
- Considering potential ways for enhancing the country's climate ambition, in accordance with the Paris agreement framework and the need of a collective raise of climate pledge to reach the aim to limit global warming to +2°C or even +1.5°C.
- Including climate change adaptation measures and an aim at mainstreaming climate change adaptation into relevant development and sectoral strategies (this represents enhancement in terms of increased geographic and sectoral coverage (including new sectors)). As mentioned, the initial NDC did not include an adaptation component.
- Reflecting Albania's specificities: the use of renewable sources for electricity production (95% hydro power, meaning low emissions for energy but a high vulnerability to climate change), the demand in fuel wood, the need to set up a register for waste generated by industrial and non-household activities, the lack of collection and treatment system for the waste water, the lack of cadastre for a national precise monitoring of land use changes, the concentration of population, infrastructure and tourism activities along the coast.

The revised NDC of Albania is aligned with Albania's long term national and sectoral development strategies, plans and goals, including NSDI-II and climate-related strategies. It is also in harmony with Albania's post-earthquake/disaster and COVID-19 green recovery strategies and plans.
At the regional level, the revised NDC is aligned with EU's Green Deal and the Green Agenda for the Western Balkan's. At the global level, it contributes to the achievement of the Paris Agreement in a fair and ambitious manner, considering that Albania's GHG emissions are low at the global level and in comparison, with other European countries. The implementation of the NDC will contribute to Sustainable Development Goals 3, 5, 7, and 13, and to further human rights. It will also contribute to the Sendai Framework for Disaster Risk Reduction 2015-2030.

The mitigation assessment presented in this report reflects on the work undertaken during the revision of the NDC. The revised NDC of Albania is submitted to UNFCCC on 12 October 2021.

[50] The NDC Partnership is a coalition of countries and institutions committed to supporting countries in implementing and increasing the ambition of their NDCs. Albania joined the NDC Partnership on August 27, 2019.



Vulnerability and Adaptation Assessment

4 Vulnerability and Adaptation Assessment

4.1 Background

At the request of the Government of Albania, the vulnerability and adaptation (V&A) analysis performed for the NC4 is focused on the Vjosa River Basin (VRB), which is the second largest water system in Albania. This chapter aims to provide a research-based analysis on:

- climate vulnerabilities (current and future due to climate changes) for sectors/systems: water resources, agriculture, biodiversity and forests, soils, health, disaster risk, tourism, population and settlements, and gender
- existing adaptive capacities
- priority adaptation measures potential to cope with climate changes.

The Vjosa River is of pan-European or even global importance. It represents one of the last intact large river systems in Europe, hosting all different types of ecosystems: from the narrow gorges in the upper part to the wide braided river sections in the middle part to the near natural delta at the Adriatic Sea[51].

Because the river has not been subjected to large damming or channelling schemes, it is considered one of the rare remaining natural flow regimes in Europe.

The Vjosa River basin (VRB) is the second largest water system in Albania (6784 km^2)[52] and is one of the longest transboundary rivers in the Balkan area. Approximately one-third of its headwaters are in northwest Greece, where it is known as the Aoös (Αώος) River (Figure 50).

Figure 50: Vjosa river Basin

In Greece, the Aoös catchment is shared among three prefectures: Ioannina, Kastoria and Grevena. The river's source is situated at 2600 meters above sea level (m.a.s.l.), below the Mavrovouni Mountain in the Pindus mountain range in Greece. The Aoös River flows over 85 km before crossing Albanian border. In Albania, it continues as the Vjosa River, and flows over a distance for 190 km before discharging into the Adriatic Sea north of Vlora city, where it intermittently shapes and nourishes the Narta lagoon. The Narta Lagoon is considered one of the most important wetland areas of Albania for its biodiversity and the number of habitats.

In the southern part of VRB area is Butrinti National Park. It is comprised of a high diversity of natural, semi-natural and artificial habitats that shelter a high diversity of species of global and regional importance. The area around the historic town of Butrinti, given its rich cultural history, has been designated as a UNESCO World Heritage site.

In Albania, the Vjosa catchment has a mean elevation of about 855 m, and it is shared among seven districts: Erseke, Permet, Gjirokaster, Tepelene, Mallakastra, Fieri, and Vlora (Vlora and Gjirokastra

[51] Save the blue hart of Europe. https://v2.balkanrivers.net/en
[52]Ministria e Bujqësisë, Zhvillimit Rural dheAdministrimittëUjëravePërgatitjadheZbatimi i njëStrategjie MIBU. StrategjiaKombëtarepërMenaxhimin e IntegruartëBurimeveUjore 16 qershor 2017

Counties/qark). The main water bodies are Vjosa, Drino and Shushica Rivers, Butrinti Lake and Narta and Orikum lagoons.

4.1.1 Current climate trends

Temperature regime

The mean temperature trend for the period 1930 to 2006 against the 1961-90 average for the Vjosa catchment area shows the period 1931 to 1970 had a positive anomaly followed by a negative anomaly between 1971 and 2000 (Figure 51). After 2000 there has been a period of the positive anomaly from 2001 to present. This is a consequence of an increase in both maximum and minimum daily temperatures, especially in summertime.

Further analysis shows that since the turn of the century there has been a positive trend of increasing temperature for all seasons (winter: from +1.60 to +2.5^{o}C; spring: from +2.00 to +3.0^{o}C; summer: +3.0^{o}C; and autumn: +2.0^{o}C). The annual average temperature in 2010 has already reached the values projected for '2020.

The fact that the temperature trend is increasing in the last decades is also illustrated in Figure 52 and Figure 53. The total number of days with Tmax>=35°C, an indicator of extremely hot days, is higher for the period 1986- 2005 (20 years) compared with the period 1961-90 (30 years) (Figure 52). A reverse trend is observed in the number of frost and extremely cold days (Figure 53).

Very important indicators to evaluate the climate change impact are absolute maximum and minimum temperatures. Figure 54 presents the values of absolute maximum temperatures expected to be met in return periods of 2, 5, 10, 20, 50 and 100 years and duration calculated by using daily long-term series at selected monitoring stations. With a frequency 1 to 50 years the highest values of 44.5 °C (1 day) and 41.8°C (3 consecutive days) are expected to be observed in Selenice area.

The results of a similar analysis related to the absolute minimum values are presented in Figure 55. The lowest values are expected to meet in the upstream part of the VRB. With a frequency 1 to 50 years the lowest value of -11.8°C (1 day) and -9.2°C (3 consecutive days) are expected to be observed in Permet area.

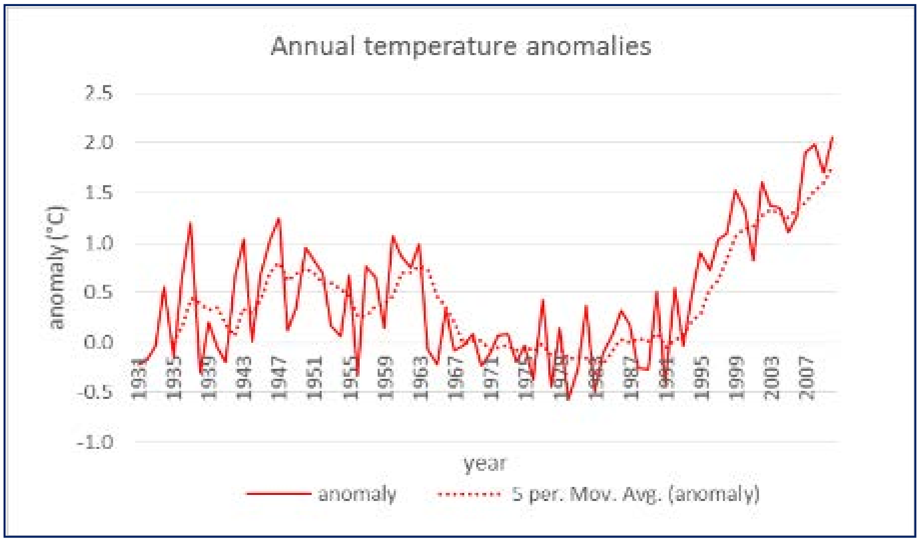
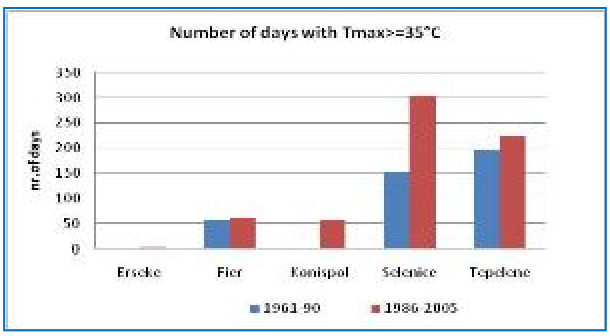


Figure 51: Anomalies of average annual temperature, Vjosa River downstream



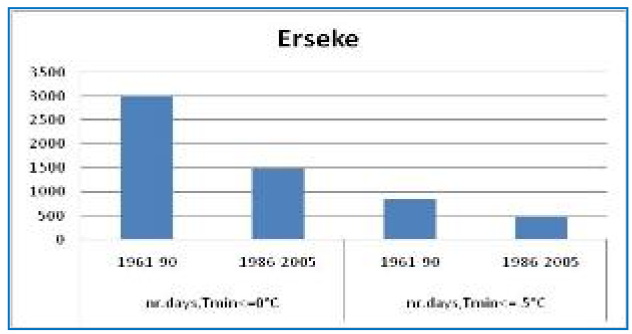
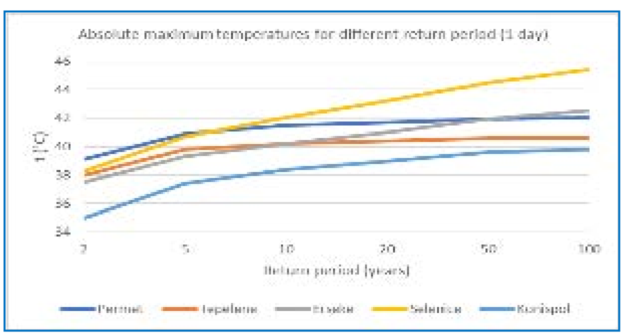


Figure 53: Number of frost and extremely cold days

Figure 52: Number of extremely hot days in VRB area



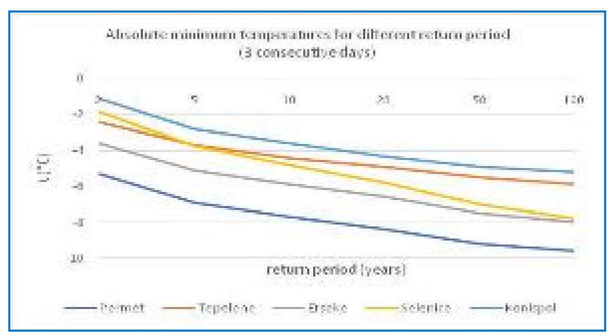


Figure 54: Absolute maximums of air temperature for different return periods, VRB area

Figure 55: Absolute minimums of air temperature for different return periods and duration, VRB area

Precipitation regime

Figure 56 presents the annual distribution of precipitation simulated with a resolution of 1*1km. It shows that in mountainous areas in the upstream of the Vjosa catchment, the annual precipitation values vary between 1600-2200 mm. Over the midstream part, it varies between 1000-1400 mm and in downstream between 900-1100mm.

Analysis of anomalies of the annual precipitation trend for the period 1931-2008 for the Vjosa downstream area (Figure 57) shows that the variation around the normal value (1961-1990) can be divided into different sub periods: with a highly wet period during 1935-1945, followed by a wet period between 1951-1980 up to 40% above the normal value, a dry period between 1981-2000 up to 45.3% below the normal value, and since 2000 a period of increasing precipitation. Analysis of seasonal precipitation patterns shows no consistent patterns in variation with periods above and below normal values.

The interannual distribution of precipitation has a different pattern compared with temperature. The wettest months are November and December (with long term average values varying from 5 to 12 mm/day) and the driest months are July and August (average daily values from 0 to 2 mm/day).

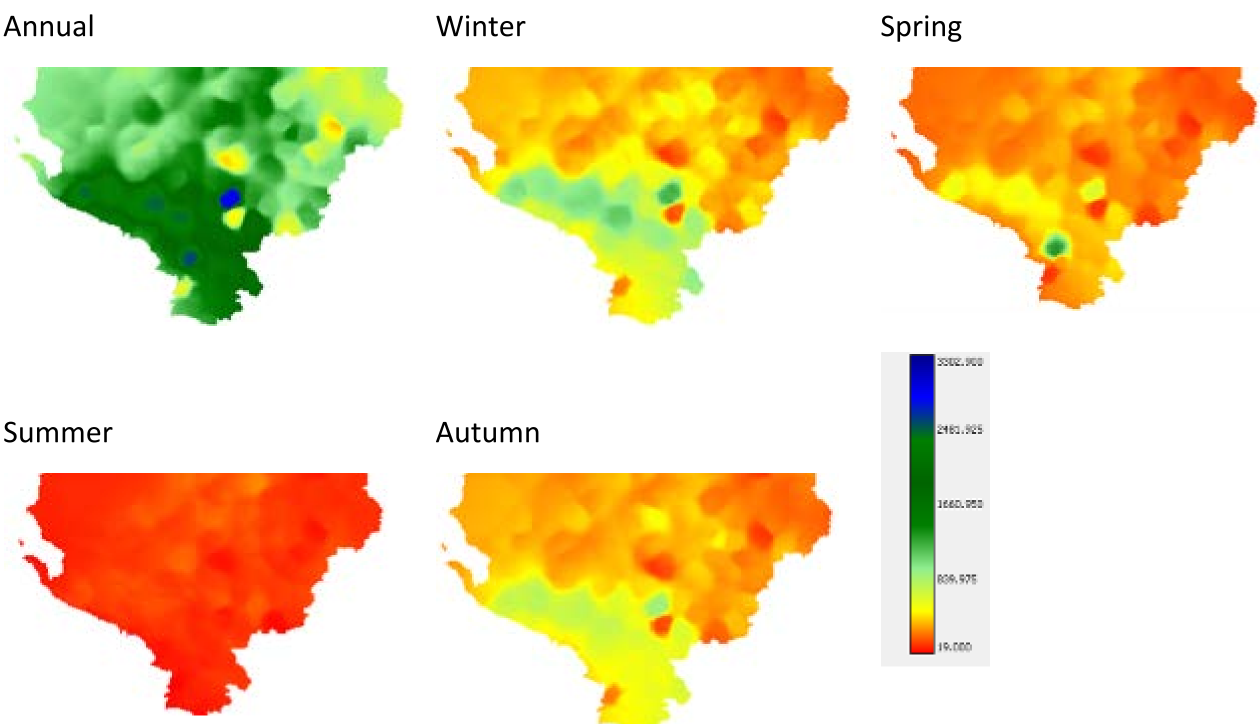


Figure 56: Annual and seasonal distribution of precipitation

The distribution of number of days with precipitation R>=10 mm shows a decreasing tendency over the years. The 24-hour maximum amount of precipitation is the most important parameter concerning the rainfall intensity. The highest values registered over the Vjosa catchment area are 70mm/d in Erseke (27 December 1967), 160 mm/d in Selenice, 239.5mm/d in Permet (15 November 1962), Myzeqeja field (23 October 1981), etc. A very important indicator in climate impact assessment is the maximum precipitation for return periods 2, 5, 10, 20, 50 and 100 years and duration (referring to 1 to 5 consecutive days). With a frequency 1 to 50 years the highest values of 24-hour maximum precipitation are observed in Permet and Fier, 189.9 mm/day and 202.8mm/day respectively (Figure 58). The expected values for 3 consecutive days with the same frequency, once in 50 years, are 202.8mm/day and 255.8 mm/day, respectively.

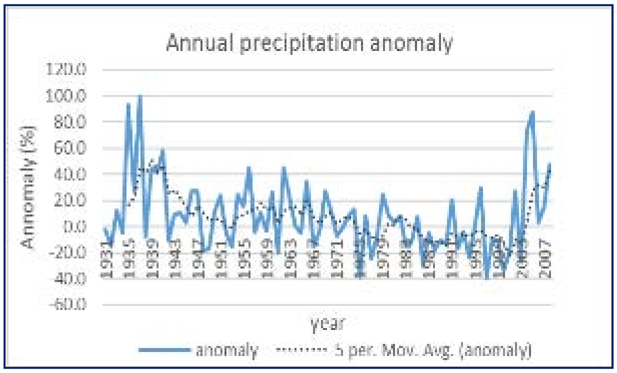


Figure 57: Anomalies of average precipitation (b) , Vjosa River downstream

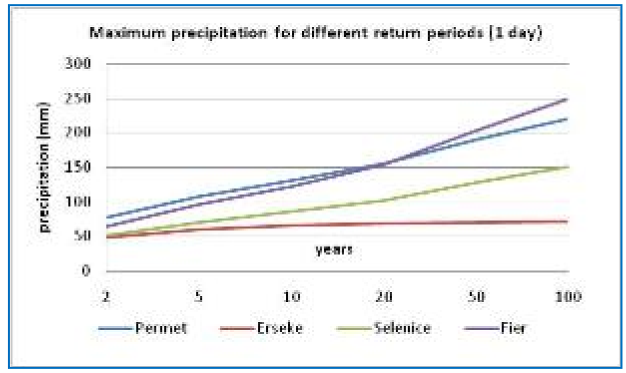


Figure 58: Maximum precipitation for different return periods (1986-2005) in the VRB area

4.2 Methodology

For the climate impact analysis, the river basin is divided into three sectors (based on topography): the upstream sector (mountainous), the middle sector (hills of varying altitudes) and the downstream sector, which is comprised of wetlands and flat terrain.

The climate trends assessment consists of the evaluation of:

(i) *temperature patterns:* expected changes in minimum, maximum, 10% and 20% percentiles, and absolute maximum and minimum values for different return periods

(ii) *precipitation patterns:* trends in precipitation and 24hour maximums for different return periods.

The climate change projections are downscaled from the global 'Representative Concentration Pathways' (RCPs) for the climate science assessment ('Working Group I') of the Fifth Assessment Report (IPCC AR5, 2014) and calibrated for the Vjosa River basin (VRB) area. Scenarios are developed by using SimCLIM 4.0 for Desktop[53], a computer-based customized GIS modelling system that examines the effects of climate variability and change over time and space and provides a spatial analysis of climate variability and change and associated impacts on various social-economic sectors.[54] Scenarios for the VRB are generated up to the year 2100, while the climate change impact analysis as per different sectors is limited to the year 2050.

[53] Available at http://www.climsystems.com/simclim

To minimise uncertainties, the SimCLIM 4.0 software is run with an ensemble of 63 Global Circulation Models (GCMs) to generate the temperature, precipitation, wind, humidity changes and an ensemble of 40 GCMs to generate the changes in extreme values, for each RCP. A statistical downscaling process up to 1*1 km, which considered the country's topography, was carried out for the VRB area.

The impact of climate changes on some climate indicators was evaluated: maximum temperatures ≥ 35°C, minimum temperatures < -5°C, heat and cold waves, warm and cold days, changes in growing season, degree days for heating & cooling, SPI/droughts, tourism climate index (TCI).

The development of Shared Socioeconomic Pathways (SSPs) for population and GDP for Vjosa River basin is based on respective SSPs' IPCC AR5 scenarios for approximately 10, 25 and 50 years into the future.

The SSPs scenarios considered are:

- **SPS 1**: Sustainability – Taking the Green Road (Low challenges to mitigation and adaptation)
- **SPS 2**: Middle of the Road (Medium challenges to mitigation and adaptation)
- **SPS 3**: Regional Rivalry – A Rocky Road (High challenges to mitigation and adaptation)
- **SPS 4**: Inequality – A Road Divided (Low challenges to mitigation, high challenges to adaptation)
- **SPS 5**: Fossil-fuelled Development – Taking the Highway (High challenges to mitigation, low challenges to adaptation)

The SSPs narratives developed for Albania and the Vjosa area are presented in Table A6-1 in Annex VI.

The data for the development of GDP and population scenarios have been downscaled from the data for Albania from SSP Public Database. Secondary data from public databases (such as INSTAT) has been used to set up the base year for the water, tourism and agriculture sector, and to further develop scenarios for each sector. Then projections of the rate of change in population or GDP (or both) foreseen in each SSP for Albania have been applied to each sector.

The key indicators of agriculture, water, population and tourism sectors are identified based on stakeholder consultation, literature review and expert opinions. Accordingly, cereals yield is used as an indicator for Agriculture Sector, water needs as an indicator for water sector, number of visitors as an indicator for the tourism sector and population growth rate as an indicator representing population changes.

The impact assessment as per sector is primarily based on three approaches: (i) modelling, (ii) analogue studies, and (iii) expert judgement as follows:

- Water resources: WATBAL, WEAP, empirical statistical models.
- Soils: the Erosion Potential Method (EPM) to estimate the potential quantity of eroded and deposited material and the erosion coefficient (Z) in Vjosa River Basin.
- Agriculture: CROPWAT 8, statistical models, analogue studies, expert judgment.
- Forestry: statistical models to evaluate the shift in bioclimatic floors, analogue studies, expert judgment.
- Biodiversity: empirical model analogue studies, expert judgment.
- Tourism: Statistical models, Tourism Climate index, expert judgement, GIS.
- Population & settlements: GIS maps
- Adaptation maps (schematic, designed at scale 1:50,000): the spatial mapping of adaptation measures proposed and prioritized in the frame of V&A activity.

The respective sector reports identify the potential adaptation measures to cope with climate change impacts. Measures are divided in four main categories:

- **Soft:** e.g., capacity building at local and national, legislation, etc.
- **Ecosystem based Measures (EbA), or Nature based Solutions (NbS):** inspired and supported by nature, cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience
- **Engineering intervention**
- **Fiscal**

A special focus is paid to EbA and NbS to help the adaptation to climate change and human development. Nature-based human development is about nesting human development—including social and economic systems—into ecosystems and the biosphere in a way that puts people's agency at the core. The potential is huge, with benefits ranging from climate change mitigation and disaster risk reduction to improving food security and increasing water availability and quality[55].

The sector analysis has produced very long lists of potential measures, which sometimes are duplicated. The first step of the analysis is the screening of proposed measures to eliminate duplication and improve formulations. The second step is prioritization using the methodology developed for the Albania's Revised Nationally Determined Contributions[56]. For more details see Annex IV on methodology.

4.3 Institutional arrangements

As in Albania's previous National Communications to the UNFCCC, specific institutional arrangements were put in place to ensure the sustainability of the process of assessment of climate vulnerabilities and adaptation. A set of professionals from academia, universities and the private sector were involved in the vulnerability and adaptation team (each of the team's experts responsible for one or more sectors). They also performed capacity building of the relevant structures within the Ministry of Tourism and Environment and its National Agency of Environment and other institutes on climate change impact and adaptation.

In order secure the long-term sustainability and quality, the processed climate and sectorial data required to perform the impact analysis, as well as the outputs of climate scenarios, are collected in a database (excel sheets) for the VRB area. Data on temperatures (daily) and precipitation (monthly)[57] for Albania for the period 1961-2000 are provided by the Institute for Geosciences, Water and Energy (IGEWE). The processing of the observation data, including quality control, is operationally performed by IGEWE. The sectorial data is collected by different sources, like line ministries, INSTAT, different publications, local municipalities in the VRB area, etc.

The Steering Committee, comprised of representatives from the Ministry of Tourism and Environment, Ministry of Infrastructure and Energy, Ministry of Agriculture and Rural Development, Ministry of Health and Social Welfare, Ministry of Defence, Vlora Prefecture, National Agency of Environment, Institute of

[55] Human Development Report 2020

[56] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Albania%20First/Albania%20Revised%20NDC.pdf

[57] Provided by Institute for Geosciences, Energy, Water and Environment (IGEWE), Polytechnic University of Tirana. IGEWE is the only institution in Albania responsible for observation, processing, including QC and maintaining/processing the climate data

Geosciences, Energy, Water and Environment and environmental related NGOs, has ensured streamlining of the results of the NC4 to sectorial policies and/or strategies.

4.4 Expected impacts of climate change

4.4.1 Expected changes in temperature

All scenarios for Vjosa River basin suggest that the area is likely to become warmer. Similarly, increasing trends in annual and seasonal temperatures, both minimum and maximum values, are expected.

The expected changes in annual maximum temperature for all Representative Concentration Pathways (RCPs), compared to the period 1986-2005, are presented in Table 52. Given the mitigation approach (warming at global scale is limited up to 2°C), RCP2.6 projects the lowest increase. The projections of average temperatures reach up to 1.1°C above the normal period (1986-2005) record by 2050 and remain unchanged thereafter. The RCP8.5 (4°C world) reveals the worst projections; increases in annual maximum temperatures up to 2.0°C and 4.7°C by 2050 and 2100, respectively. The distributions of expected annual changes in maximum temperatures for different RCPs and time horizons are shown in Figure 59.

Table 52: Projected annual and seasonal changes in mean maximum temperature (°C) and their variation

	Scenarios	2050	2100
Entire Year	RCP2.6	1.1 (0.7-1.5)	1.0 (0.7-1.3)
	RCP4.5	1.5 (1.0-1.9)	1.9 (1.4-2.6)
	RCP8.5	2.0 (1.4-2.8)	4.7 (3.4-6.7)
Winter	RCP2.6	0.8 (0.6-1.2)	1.1 (0.7-1.5)
	RCP4.5	1.1 (0.8-1.7)	1.5 (1.1-2.1)
	RCP8.5	1.6 (1.1-2.1)	3.9 (2.7-5.5)
Spring	RCP2.6	0.9 (0.6-1.3)	0.9 (0.6-1.3)
	RCP4.5	1.2 (0.8-1.8)	1.8 (1.1-2.3)
	RCP8.5	1.7 (1.2-2.4)	4.1 (2.8-6.1)
Summer	RCP2.6	1.5 (1.0-1.9)	1.4 (1.0-1.8)
	RCP4.5	2.0 (1.4-2.6)	2.5 (1.8-3.3)
	RCP8.5	2.6 (1.9-3.4)	6.4 (4.4-8.3)
Autumn	RCP2.6	1.1 (0.8-1.4)	1.1 (0.8-1.4)
	RCP4.5	1.4(1.0-2.0)	2.0 (1.4-2.6)
	RCP8.5	2.1 (1.5-2.7)	5.0 (3.5-6.5)

The climate change scenarios project lower maximum temperature increases in winter and spring compared to summer and fall. In summer, projections of the mean temperature changes are likely to reach up to 1.5°C (1.0-1.9°C) by 2050 for RCP2.6, and from 2.6°C (1.9-3.4°C) to 6.4°C (4.4-8.3°C) for RCP8.5, by 2050 and 2100, respectively.

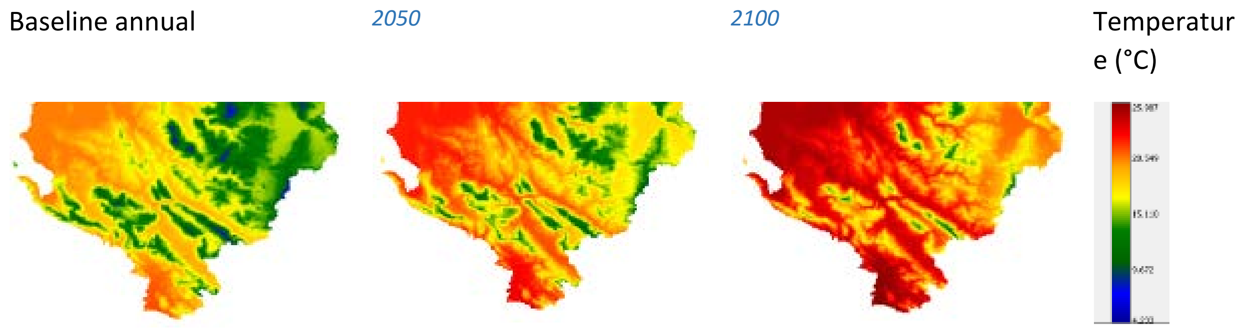


Figure 59: Annual distribution of Tmax, RCP8.5 different time horizons

Referring to these projections, the Vjosa basin is likely to experience average maximum temperatures higher than 25°C by the summer of 2050, and average maximum temperatures up to 30°C will dominate in all parts of this zone by 2100.

The projections show that high-percentile temperatures (90%) increase faster than mean temperatures, especially in summer. The simultaneous increase in minimum temperatures (see Figure 61 below) suggests that heat wave intensities will also increase in the future. These temperature changes will likely be amplified by changes in soil moisture.

Through the similar analytical process are evaluated the projected minimum temperatures for the VRB. The main conclusion is that the average minimum temperatures and their variation limits are likely to increase (Figure 60). The expected changes in winter are increases of 1.0°C by 2100 for RCP2.6, and 1.5°C and 3.4°C by 2050 and 2100 respectively for RCP8.5.

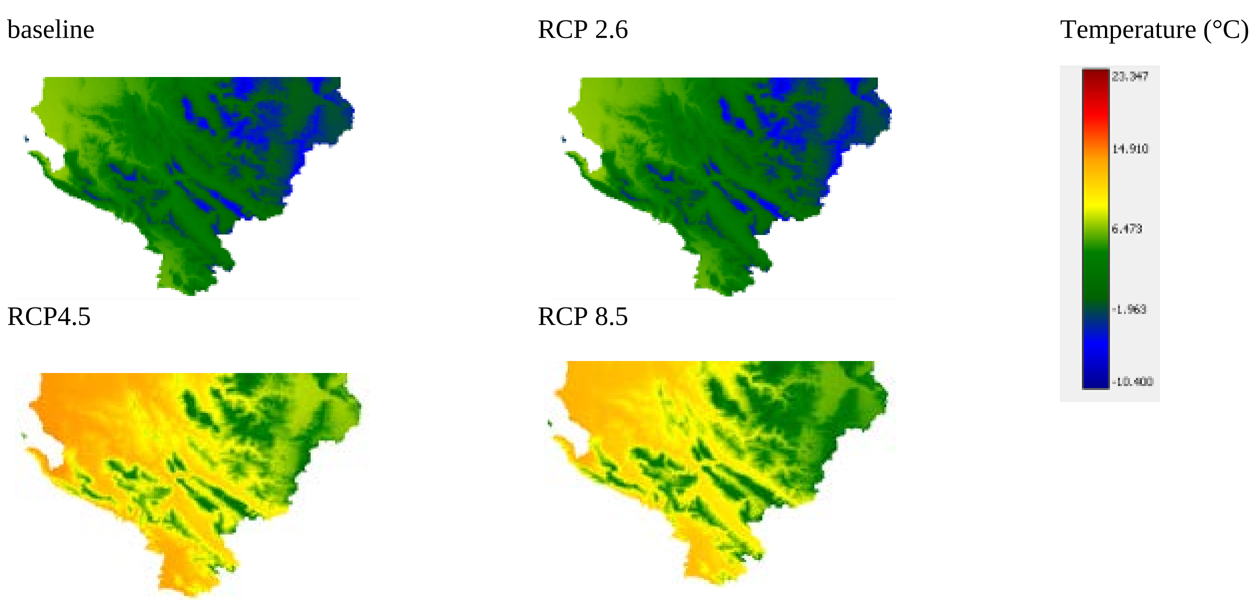


Figure 60: Distribution of averages of winter Tmin under different scenarios by 2050.

Average minimum temperatures (Tmin) of above 16°C will be observed after mid-June (RCP8.5) and beyond July and August (which it is limited to in the baseline scenario) in Permet area (Figure 61). A similar analysis for winter shows that that frost days (Tmin<0) are likely to be a very rare phenomenon and future winters will be more temperate over the whole VRB.

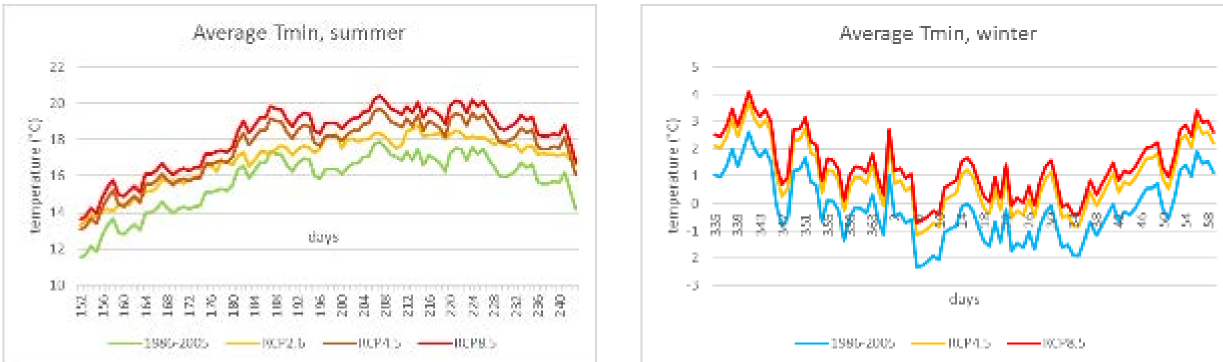


Figure 61: Baseline and expected changes in daily average minimum temperatures for winter and summer by 2050, Permet

The projected increase in maximum and minimum temperatures (Tmax and Tmin) is expected to have as consequence the increase in number of warm days (Tmax>35°C) and decrease the number of cold days (Tmin<0°C). RCP8.5 projects the highest increase in number of warm days (Figure 62) and the lowest decrease in number of cold days (Figure 63, Figure 64) compared to other scenarios.

The temperature extremes are also expected to increase according to all RCPs scenarios. In Permet, the absolute maximum temperature is expected to change from 42.5°C (current record) to 44.2°C (RCP2.6), 44.7°C (RCP4.5) and 45.5°C (RCP8.5) by 2050.

On the other hand, the return periods of maximum absolute temperatures are expected to drastically decrease over the VRB area. Temperatures of 40°C that are currently reached once in 50 years might occur more frequently, once in every 3 years (RCP2.6) or 2 years (RCP8.5) in Tepelenë area (Table 53).

A reverse trend is expected with regard to occurrence of absolute minimum temperatures between 2005-2100. All the RCPs project that the return periods of absolute minimum temperatures are expected to increase. For example, the return periods for absolute minimum temperatures of about -14°C are expected to increase from 1:50 years to 1:92 and 1:127 years respectively for 1 and 3 consecutive days according to RCP8.5 for the Përmet.

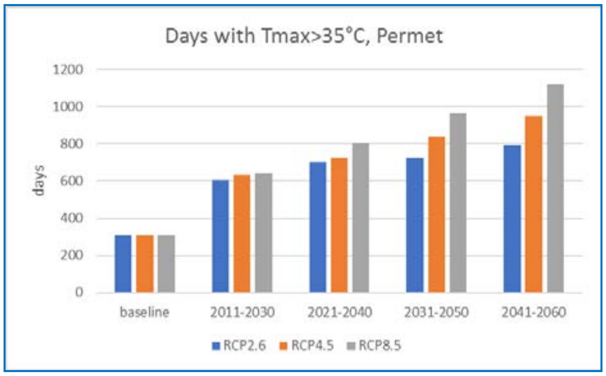


Figure 62: Baseline and projected changes in number of days with Tmax≥35°C, different scenarios, VRB area

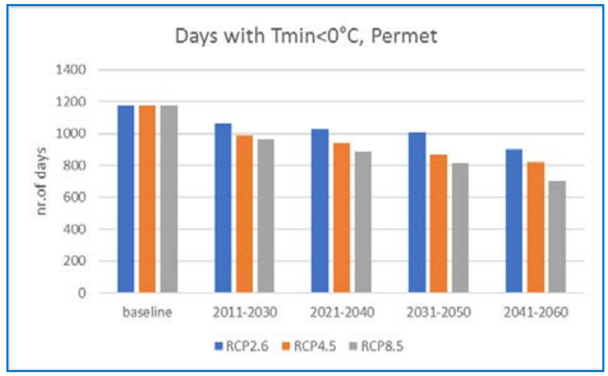


Figure 63: Baseline and projected changes in number of days with Tmin≤0°C, different scenarios, VRB area

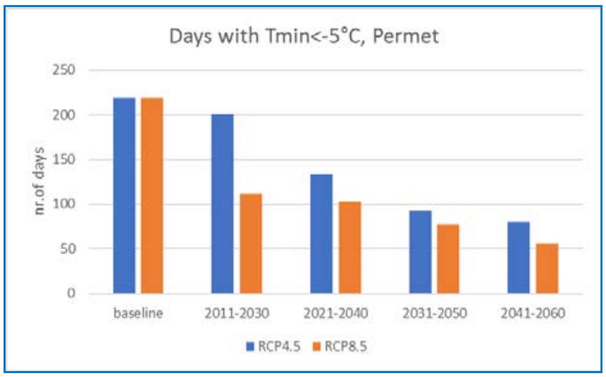


Figure 64: Baseline and projected changes in number of days with Tmin≤-5°C, different scenarios, VRB area

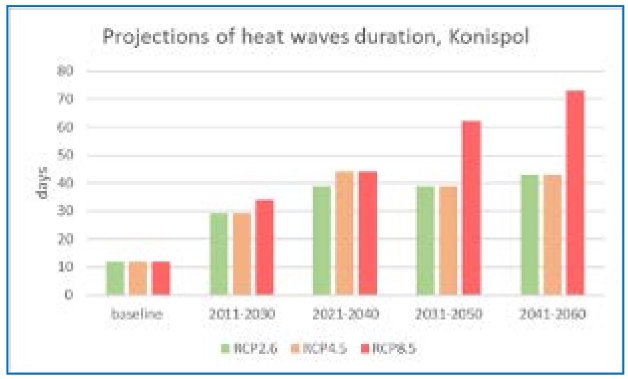


Figure 65: Projected increase in heat waves duration

Table 53: Change of return periods of maximum temperatures for scenarios RCP2.6 and RCP8.5, different consecutive days, Tepelene

	1 day			3 days (consecutive)			5 days (consecutive)		
Base RP	Value (°C)	RCP2.6	RCP8.5	Value (°C)	RCP2.6	RCP8.5	Value (°C)	RCP2.6	RCP8.5
2	38.0	1.5	1.3	35.8	1.5	1.3	34.5	1.4	1.3
5	39.8	2.1	1.6	37.6	2.1	1.6	36.2	2.1	1.5
10	40.2	2.4	1.7	38.2	2.6	1.7	36.7	2.4	1.7
20	40.4	2.7	1.8	38.5	2.9	1.9	36.9	2.7	1.8
50	40.6	2.9	1.8	38.7	3.3	2	37.1	2.9	1.8
100	40.6	2.9	1.9	38.7	3.4	2	37.1	3	1.9

4.4.2 Expected changes in precipitation

All the RCPs reveal a likely decrease in annual and seasonal precipitation relative to the 1986-2005 period for all time horizons up to 2100 (Table 54). It should be noted that the projection of variability around the average values (levels 10% and 90%) are high in both cases (Figure 66).

Table 54: Projected changes in precipitation (%), annual and seasonal (averages over the Vjosa basin)

		2050	2100
ENTIRE YEAR	RCP2.6	-2.4 (-13.5 to +8.4)	-2.2 (-13.2 to +8.5)
	RCP4.5	-3.1 (-18.3 to +12.0)	-4.6 (-25.0 to +15.9)
	RCP8.5	-7.7 (-45.7 to +29.8)	-9.5 (-57.8 to +39.9)
WINTER	RCP2.6	-0.3 (-9.5 to +8.6)	-0.6 (-10.2 to +10.8)
	RCP4.5	+0.8 (-14.2 to +14.9)	+1.0 (-18.8 to +20.0)
	RCP8.5	+0.9 (-19.5 to +20.8)	+2.2 (-46.7 to +13.6)
SPRING	RCP2.6	-3.1 (-14.2 to +7.4)	-3.1 (-14.2 to +7.3)
	RCP4.5	-4.3 (-19.4 to +10.3)	-5.6 (-25.7 to +13.6)
	RCP8.5	-5.9 (-27.2 to +13.9)	-14.5 (-63.0 to +34.4)
SUMMER	RCP2.6	-8.2 (-25.1 to +7.7)	-8.2 (-25.3 to +8.2)
	RCP4.5	-11.5 (-34.6 to +10.6)	-15.3 (-46.7 to +13.6)
	RCP8.5	-16.0 (-48 to +14.5)	-37.5 (-99.0 to +36.2)
AUTUMN	RCP2.6	-2.7 (-12.0 to +7.0)	-2.6 (-11.8 to +7.0)
	RCP4.5	-3.4 (-16.5 to +9.5)	-5.0 (-21.8 to +13.1)
	RCP8.5	-5.1 (-23.1 to +13.0)	-12.3 (-54.2 to +32.3)

The analysis of the precipitation projections according to different RCPs shows that all scenarios project a negative slight trend for all seasons and time horizons.

The scenario RCP8.5 projects the highest percentage decreases in precipitation. The annual and summer values are likely to reach up to -7.7% (-45.7% to +29.8%) and -16.0% (-48% to +14.5%) respectively by 2050 (Figure 65).

The mitigation scenario, RCP2.6 projects the lowest percentage decreases in precipitation compared to other RCPs, likely to reach a value of -8.2% (-25.1% to +7.7%) in summer and -2.4% (-13.5% to +8.4%) over the year by 2050. The scenarios RCP 4.5 and RCP8.5 project a slight positive trend of winter precipitation for all time horizons (Table 55). These positive trends may arise because of higher winter temperatures more rainfall than snow will be consequently. The reduced snowfall will lead to subsequent decreasing of river flows during spring.

The RCP projections show that high-percentile precipitation (90% - Figure 66, Table 54) change/increase faster than average precipitation changes. This indicates a higher risk for intensification of heavy precipitation that causes flooding. On the other hand, the high reduction at the 10% percentile level of changes indicates a likely increase in drought frequency.

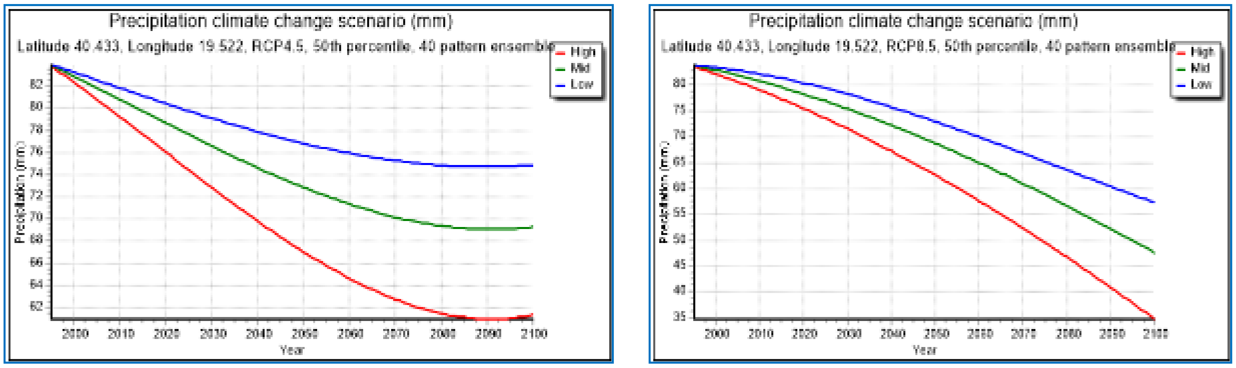


Figure 66: Precipitation projections for RCP4.5 and RCP8.5, Vlora area

The return periods of maximum precipitation levels are expected to decrease over the VRB area. More frequent heavy rains with longer duration can cause flooding and economic damages. For example (Table 55), a maximum precipitation of 150mm/d that historically occurred once in 50 years in Permet may now be expected to occur more frequently, every 40 years (RCP2.6), 36 years (RCP4.5) or 34 years (RCP8.5). In parallel with a decrease of return periods, the amount of total precipitation falling during intense multi-day's events is expected to increase from 134 (1 day) to 186 mm (2 day) and 218 mm (3 day) events.

Table 55: Changes in return periods of maximum precipitation, Permet area

	1 day				3 days (on total)			
Base RP	Value	RCP2.6	RCP4.5	RCP8.5	Value	RCP2.6	RCP4.5	RCP8.5
2	**65.8**	1.9	1.9	1.8	**99.3**	1.9	1.9	1.8
5	**87.0**	4.6	4.4	4.2	**132.8**	4.6	4.5	4.3
10	**101.4**	8.9	8.5	8	**157.2**	9	8.6	8.2
20	**115.5**	17.1	16.1	15	**182.3**	17.4	16.6	15.6
50	**134.1**	40.2	37.3	33.9	**217.7**	41.6	39.1	36
100	**148.3**	76.2	69.6	61.9	**246.4**	80.1	74.2	67.3

4.4.3 Sea level rise

Sea level is projected to rise. Figure 67 illustrates the projections of sea level changes, running the SimClim 4.0 for Desktop with global data (the closest grid point to Vjosa discharge) for the three scenarios RCP2.6, RCP 4.5 and RCP8.5. Median estimates are given as full thick lines and the lower and upper bound given as dotted lines.

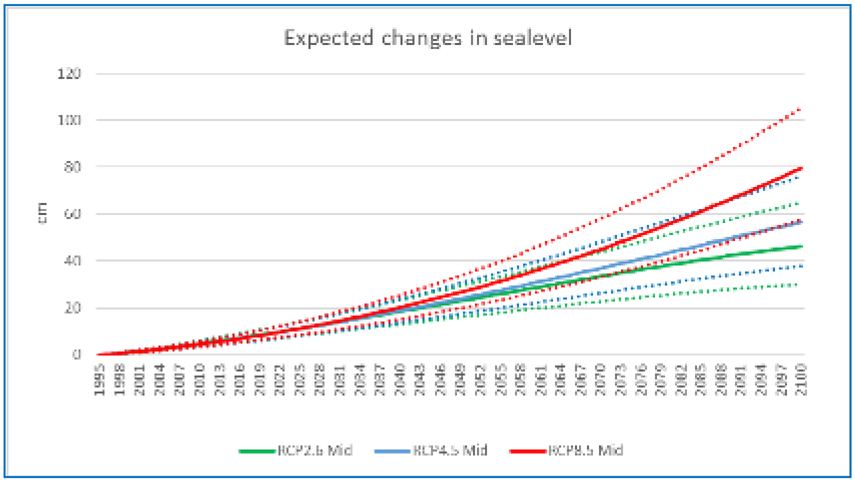


Figure 67: Sea level projections (grid point: latitude 40.375; longitude 19.625)

As per the worst scenario, RCP8.5 the sea level is expected to rise by 27 cm (20.4 to 34.7 cm) and 80 cm (57.5 to 105.4cm) by 2050 and 2100, respectively. These simulations do not consider the tectonic movements.

4.5 Shared Socioeconomic Pathways (SSPs), Baseline scenarios for Vjosa River Basin

4.5.1 Baseline scenarios for GDP

Data from the SSP Public database show GDP scenarios for Albania for GDP interpretations of the SSPs developed by the team from the Organization for Economic Co-operation and Development (OECD). The GDP scenarios start from a reference value of 24,545 billion US$ 2005/year. All GDP projections were performed using international dollar in purchasing power parity[58] (PPP) rates. The GDP projections are supposed to be used as part of the SSPs, therefore the GDP scenario design follows the underlying SSP narratives. A share of 5% (rounded ratio) of GDP is allocated to the southern prefectures that are part of the VRB basin. GDP projections for the country and VRB area are shown in Table 56.

Table 56: GDP projections as per different SSPs

Scenario	Variable	Unit	Albania				Vjosa River basin			
			2010	2020	2035	2060	2010	2020	2035	2060
SSP1	GDP|PPP	billion US$2005/yr	24.55	30.45	48.03	83.03	1.23	1.52	2.40	4.15
	GRP growth	%						2.50	3.20	1.54
SSP2	GDP|PPP	billion US$2005/yr	24.55	30.56	43.56	68.08	1.23	1.53	2.18	3.40
	GRP growth	%						2.51	2.20	1.54
SSP3	GDP|PPP	billion US$2005/yr	24.55	31.01	41.70	55.73	1.23	1.55	2.085	2.79
	GRP growth	%						2.67	1.58	0.99
SSP4	GDP|PPP	billion US$2005/yr	24.55	30.34	42.80	64.59	1.23	1.5	2.14	3.23
	GRP growth	%						2.42	2.18	1.33
SSP5	GDP|PPP	billion US$2005/yr	24.55	30.30	51.99	103.79	1.23	1.52	2.60	5.19
	GRP growth	%						2.46	3.98	2.11

Source: SSP database &E. Pojani calculations

Baseline scenarios for GDP for Vjosa Basin approximately 10, 25 and 50 years into the future are shown in Table 56 and Figure 68.

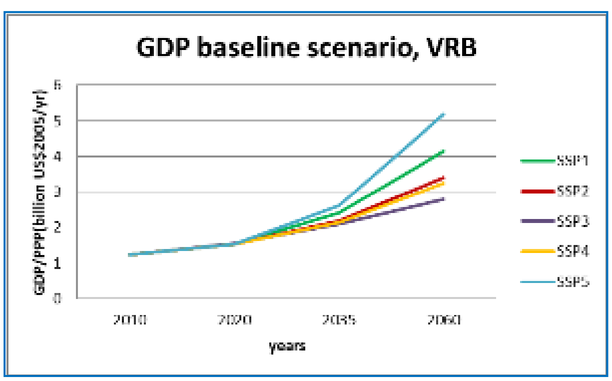


Figure 68: GDP baseline scenarios, VRB

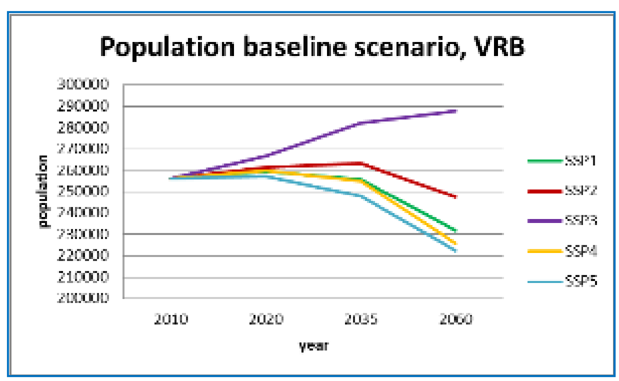


Figure 69: Population baseline scenarios, VRB

[58] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/purchasing-power-parity

In all scenarios, economic growth is projected to slow down over time, with average growth rates in the second half of the century approximately half of those in the first half. This slowdown is most marked in middle income countries like Albania.

4.5.2 Baseline scenarios for population

Table 57 shows the baseline scenarios for population of Albania derived from the SSP public database. For each SSP a single population and urbanization scenario, developed by the International Institute for Applied Systems Analysis (IIASA) and the National Center for Atmospheric Research (NCAR), is provided.

As mentioned above, the population of the area is over 200,000 inhabitants. Based on multiple sources defining the population of the area, a rounded value of 8% of total population of Albania is allocated to the VRB area. Accordingly, the scenarios of population of Albania are downscaled to the VRB area (Table 57 and Figure 69).

Population scenarios show different population dynamics in the future. Consistent with the narratives, population is lowest in the SSP1, SSP4 and SSP5 and the highest in SSP3, respectively.

Downscaling using the top-down approach is considered adequate in this case since trends of internal and international migration have stabilized after major development during 1990-2010. Therefore, the trend of population in the area is believed to follow the scenarios of the country.

Table 57: Baseline Scenarios of Population for Albania (IIASA, NCAR models) and VRB

Scenario	Variable	Unit	Albania				VRB area			
			2010	2020	2035	2060	2010	2020	2035	2060
SSP1	Population	million	3.20	3.25	3.20	2.90	0.26	0.26	0.26	0.23
	Growth	%						0.09	-0.17	-0.55
SSP2	Population	million	3.20	3.27	3.29	3.10	0.26	0.26	0.26	0.251
	Growth	%						0.19	-0.04	-0.36
SSP3	Population	million	3.20	3.34	3.53	3.60	0.26	0.27	0.28	0.29
	Growth	%						0.46	0.25	0.04
SSP4	Population	million	3.20	3.25	3.19	2.82	0.26	0.26	0.26	0.23
	Growth	%						0.1	-0.22	-0.66
SSP5	Population	million	3.20	3.22	3.10	2.78	0.26	0.26	0.25	0.22
	Growth	%						-0.03	-0.29	-0.58

In terms of urbanization, the National Center for Atmospheric Research (NCAR) has developed the scenarios for Albania (Table 58). All scenarios show an increase in urban population, which follow the migration trends of the country during the past 3 decades. Migration from villages to towns and from mountainous areas to lowland areas has been observed and this has changed the dynamics of demography of the country. Since data shows that in the Vjosa river basin 80% of the population live in rural areas, the urbanization scenario for the area has a different starting point. The rate of change or urban population throughout the time horizon is the same as in the baseline scenario of urbanization of the country.

Table 58: Baseline scenario of urban population for Albania (NCAR model) and VRB

Scenario	Variable	Unit	Albania				VRB			
			2010	2020	2035	2060	2010	2020	2035	2060
SSP1	Population|Urban|Share	%	51.91	61.34	73.07	85.95	20	23.63	28.15	33.11
SSP2	Population|Urban|Share	%	51.91	59.57	67.42	74.75	20	22.95	25.97	28.80
SSP3	Population|Urban|Share	%	51.91	54.70	58.48	63.75	20	21.08	22.53	24.56
SSP4	Population|Urban|Share	%	51.91	61.34	73.07	85.95	20	23.63	28.15	33.11
SSP5	Population|Urban|Share	%	51.91	61.34	73.07	85.95	20	23.63	28.15	33.11

Source: SSP Database & Pojani calculations

4.5.3 Baseline scenarios for tourism

To develop tourism scenarios, a combination of the top-down and bottom-up approach is used. A simple downscaling cannot be achieved without analysing the touristic features of the area.

Albania has seen a rapid growth in tourists over the past several years, following the end of communism in the 1990s and an increasing recognition of Albania's natural landscapes coupled with the country's affordable prices.

Wickel *et al*. (2017)[59] report defines three ways the tourism sector can impact the area and affects vulnerability and adaptation:

1) It can increase the population, and accordingly the demand for water to hotels and restaurants that grow out of the tourist industry

2) Population of the area can increase because people who have migrated return due to the increased touristic jobs

3) Because the tourists may be coming from regions with higher water use, is assumed that tourists demand more water per capita than the Albanian inhabitants.

Tourism is affected by two driving forces:

- population dynamics, implying that declining or rising numbers in population will lead to decline or rise of number of domestic and/or tourists.
- economic development, meaning that higher economic development will increase accordingly tourism demand.

The effect of both has been combined to calculate the total effect on tourism. To do this, the rate of change in SSPs for GDP and Population of the World has been used, since the dynamics and scenarios for international tourists in the area are considered.

[59] Wickel B., Galaitsi S., Bruci E. *et al.,* 2017.Assessment of hydro-ecological and socio-economic systems of the Vjosa River. Under the EU Flood Protection Infrastructure Project – FPIP.

The indicator chosen for the tourism sector is total number of tourists. Tourism statistics on foreign nationals entering the country are publicly available. Therefore, scenarios are accordingly developed for international tourists. The tourism scenarios start in 2020, since public data on tourism visits are not available for 2010. The number of international tourists in 2020 is assumed 150,000 following the trend of international tourist visits of 2014-2018. Table 59 shows the baseline scenario for the number of international visitors in Vjosa Rover Basin. For the calculation methodology see the note in Annex VI.

Table 59: International tourists' baseline scenario for Vjosa River Basin (according to OECD Env-Growth model)

Scenario	Variable	Unit	2020	2035	2060
SSP1	No. of tourist	People	150,000	298,225	583,640
	Rate of change	%		4.32%	1.90%
SSP2	No. of tourist	People	150,000	272,446	512,288
	Rate of change	%		3.46%	2.13%
SSP3	No. of tourist	People	150,000	253,568	401,982
	Rate of change	%		2.76%	1.50%
SSP4	No. of tourist	People	150,000	272,079	465,564
	Rate of change	%		3.45%	1.56%
SSP5	No. of tourist	People	150,000	337,707	791,559
	Rate of change	%		5.31%	2.62%

Source: calculated by E. Pojani

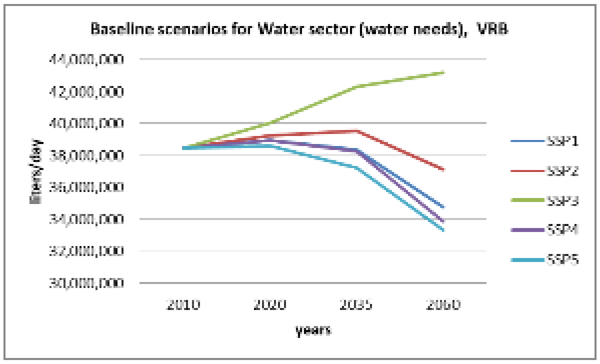
4.5.4 Baseline scenarios for Water sector

Projections of population and tourism, along with higher rates of economic growth will lead to higher demand for water in all sectors: domestic, agriculture and industry.

Scenarios on population are the baseline for the development of water sector scenario. The indicator chosen for the sector is water needs. Through expert consultation, the normative amount of 150 l/d/c is defined as water needs for the population. Table A6-2 in Annex VI and Figure 70 show water demand for the population of Vjosa River basin for each SSP, for both models used also in developing population scenarios (IIASA and NCAR).

4.5.5 Baseline scenarios for Agriculture

The SSP public database offers the quantitative projections of the Integrated Assessment scenarios for each SSP. Scenario on agriculture production for the region "Reforming economies" is shown in Table A6-3 in Annex VI.



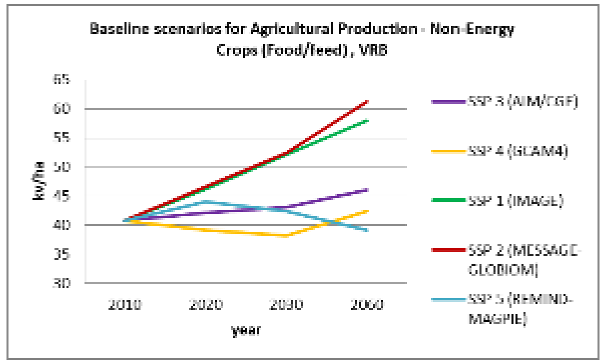


Figure 70: Baseline scenarios for Water sector (water needs) in Vjosa River Basin (according to IIASA-WiC POP and NCAR models)

Figure 71: Baseline scenarios for agricultural production in Vjosa River Basin

The baseline scenarios for agriculture in Vjosa River Basin are constructed applying the same rate of change to the level of agricultural production. Data provided by the expert on agriculture show a cereal yield of 40.78 kv/ha in Vjosa region in 2010. The baseline scenarios for agricultural production in Vjosa River Basin are shown in Figure 71 and Table A6-4 in Annex AVI.

4.6 Vulnerability and adaptation assessments of key sectors

4.6.1 Water sector

Climate change will affect the hydrology of Vjosa watershed. Using the climate scenarios projections as input, the changes in surface runoff are simulated. For all approaches used, the decrease in mean annual precipitation produces a decrease in mean annual runoff (Figure 72).

For all scenarios, a negative trend in runoff is projected. The higher changes are obtained for the extreme scenario, RCP 8.5 by 2050 and 2100. The annual values of the runoff may decrease till 10.9% and 13.5% by 2050 and 2100, respectively. The mitigation scenario RCP2.6 projects the lowest percentage decreases in runoff compared to other RCPs, -3.4% and -3.15% by 2050 and 2100, respectively.

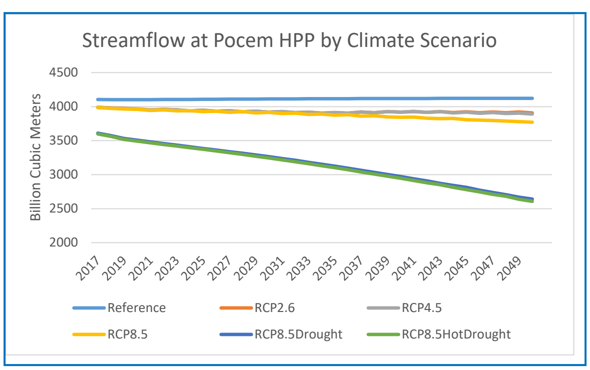


Figure 72: Annual total streamflow at Pocem HPP site by climate scenario (2017-2050)

Source: Wickel B., et al.[60]

[60] *Report on "Assessment of hydro-ecological and socio-economic systems of Vjosa River Basin Area."* under the European Union (EU) Flood Protection Infrastructure Project (FPIP) for the Vjosa Basin in Albania

For the winter period, both scenarios RCP 4.5 and RCP8.5 project a slight positive trend of winter precipitation for all time horizons and the temperatures for this season show a rise in their values as well from 1.1; 1.6 for 2050 till 1.5 and 3.9 for toward the year 2100.

These positive trends in temperatures mean more rainfall than snow during the winter and this will lead to an increase of runoff in this period. Because there will be not too much snow to melt in spring, the annual distribution of runoff will follow a curve without a second peak during the spring period (March-April) which is a characteristic so far for this water basin[61]. This will result in decreasing of river flows during spring. Figure 73 shows the monthly averages of stream flows (2015-2050) for two calibrated catchments, Drinos and Permet in Vjosa river basin. The stream flows for the extreme scenarios, RCP8.5 Drought and RCP8.5 Hot Drought[62] are markedly lower than the others. There Reference Scenario climate produces the highest stream flows, though often by a slim margin.

Expected changes in precipitation and temperatures will affect not only the hydrology of the watershed but demand for water as well. The analysis using WEAP model (performed for irrigation, industry, population and energy production sectors) shows that the annual unmet water demand exists for RCP8.5 Drought and RCP8.5HotDrought scenarios starting in 2035. The RCP2.6, RCP4.5 and RCP8.5 do not show up in the chart because their zero values are underneath the zero values for the Reference Scenario (Figure 74). In the seasonal scale, the demands are (Figure 75), unmet during the month of July, August, and the highest unmet demand occurring each year in September.

Drinos

Permet

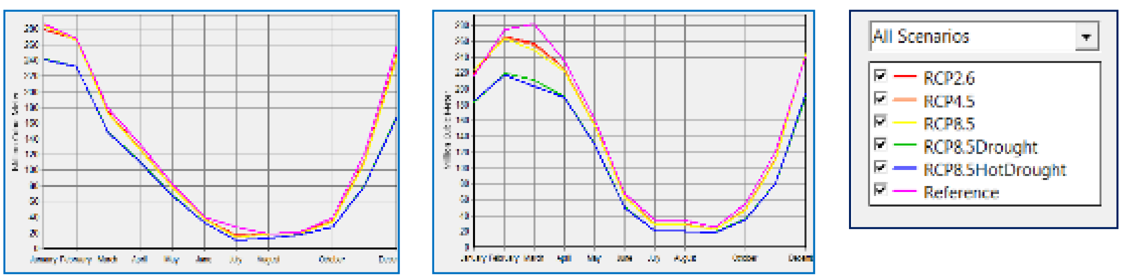


Figure 73: Streamflow comparison for scenarios for the 2 calibrated gauges

Source: Wickel B., et al.

[61] Report on "Assessment of the Current Impact of climate on water resource and Adaptive Capacities". M.Ndini.

[62] RCP8.5 Drought considers average temperature changes (50% percentile) and minimum precipitation (10%percentile); RCP8.5 Hot Drought considers maximum temperature changes (90% percentile) and minimum precipitation (10%percentile)

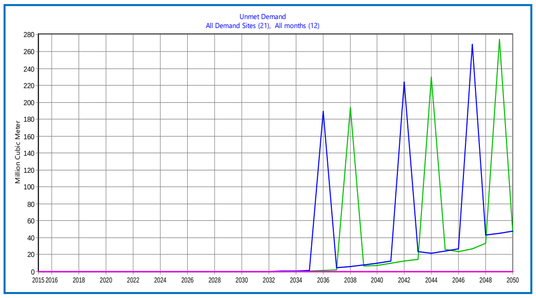


Figure 74: Total unmet demand for Vjosa watershed between different climate scenarios

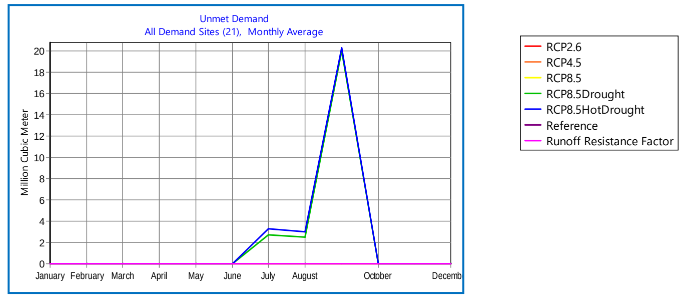


Figure 75: Monthly variation of unmet demand (averaged 2015-2050)

Source: Wickel B., et al.

Given the expected increase in runoff during winter and expected decrease in return periods of maximum precipitation, more frequent heavy rains with longer duration can cause more severe flood events, which will affect water quality, water infrastructure integrity and increase fluvial erosion. Figure 76 shows the flooded area from a 1m rise of river and sea levels.

The spring season will be affected by negative trends resulting in less runoff. The Summer season will be dry with less runoff, which will affect water availability and water quality. However, the Vjosa River has a strong groundwater supply which means that the decrease of the runoff in general will be less than in another catchment in Albania.

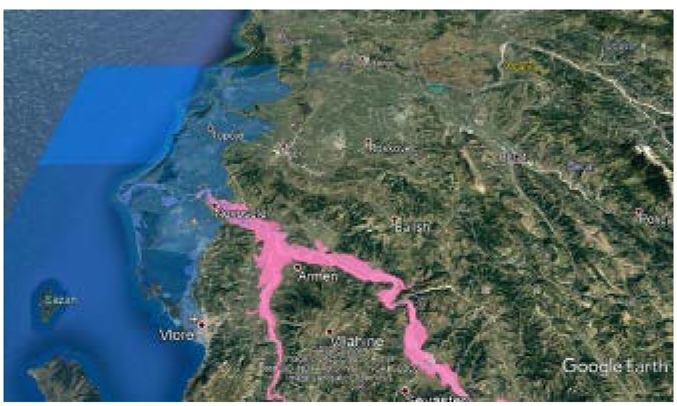


Figure 76: 1m sea level rise and river level rise

Hydrological changes will directly affect the potential output of hydro-electric facilities in Vjosa for possible future projects. Plans already exist for many small-scale hydropower plants on the tributary rivers in the catchment. Irrespective of climate change, new dams are expected to be built for hydropower generation as well as water supply. On the main channel of the Vjosa River, near the Pocem river gauge, a new Hydropower Plant will be constructed. The Pocem Hydropower plant depends on sufficient streamflow to produce hydroelectricity. For all the climate scenarios, the waterflow is expected to reduce toward the time horizon 2050 and beyond (Figure 72).

Another critical issue is coastal erosion. The Vjosa river mouth is formed of highly sensitive wetlands that are impacted by suspended sediment transport[63]. If the Pocem Hydropower plant is constructed, the sediment transport will be reduced and trapped in the reservoir. This lack of sediment supply by the river and predicted sea level rise will lead to the degradation of the wetlands as well as of the lagoon itself.

In addition to submergence, seawater intrusion into freshwater aquifers in deltaic areas is an increasing problem associated with rising sea level. The Vjosa River mouth is highly influenced by the sea level and backwaters are not rare in the river channel. In this context the expected sea level rise will affect the river flow and increase the river water level, leading to the flooding of the flat areas on both sides of river. The expected increase in number of storm surges due to climate change will increase the size and magnitude of flooded and eroding coastal areas. In this context, the river mouth, beaches, and lagoons are particularly vulnerable to the adverse effects of climate change. Table presents a summary of expected effects of climate changes on water resources.

Table 60: Expected effects on water resources due to climate changes in VRB area

Factor	Effects/Risks	Effects on water resources
Temperature	• Decreased annual runoff • More rainfall than snow during the winter • Increased evaporation • Increased frequency of droughts.	• Increased demand for water for agriculture, industry, population, tourism • Decreased water l in the water supply system • Increased demand for drinking water in the summer with unmet demands during the months of July, August, and the highest unmet demand occurring each year in September.
Precipitation	• Increased occurrence of floods, especially during winter, but also during autumn and spring months.	• Effects on water quality, water infrastructure integrity and increase fluvial erosion.
Sea Level Rise	• Salinization of coastal aquifers • Seawater intrusion into freshwater aquifers in deltaic areas • Increased exposure of coastal areas to floods from storm surges and erosion.	• Decreased availability of freshwater • Destruction of settlements, infrastructure and natural environment from floods and erosion and in coastal part and along the Vjosa Riverbed.

4.6.2 Soils

The European Commission's Soil Thematic Strategy has identified soil erosion as a key priority for the protection of soils and calls for quantitative assessments of soil loss rates at the European level. Mediterranean regions are particularly vulnerable to erosion because of the highly irregular behaviour of the rainfall regime, both on spatial and temporal scales; inappropriate agricultural management practices, overgrazing and wildfires. Also, erosion rates are higher in mountainous areas than in lowlands due to the steeper relief and the higher and more intense rainfalls. The potential quantity of eroded and deposited material in Vjosa River Basin is estimated by using the Erosion Potential Method (EPM, also known as "Gavrilovic") which considers the geological formation, watershed slope, climate data, vegetation cover and watershed elevation[64]. The EPM method is used also to calculate the erosion coefficient (Z) which provides for each sub -basin the risk of erosion, taking several criteria in consideration soil, slope, land use and occurrence of erosion phenomena. Figure 77 shows the distribution of erosion risk.

[63] Measuring of sediment transport and morpho-dynamics at the Vjosa river / Albania
[64] Extreme events data are not considered; coastal erosion is not evaluated separately

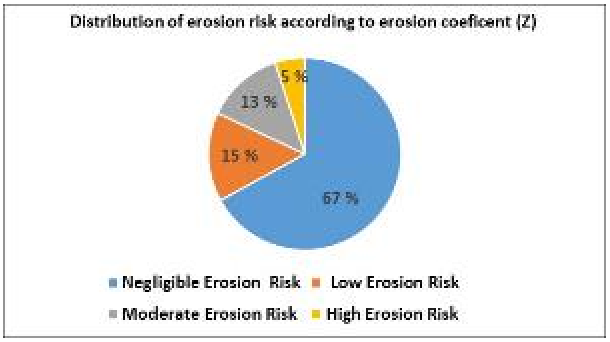


Figure 77: Distribution of erosion risk

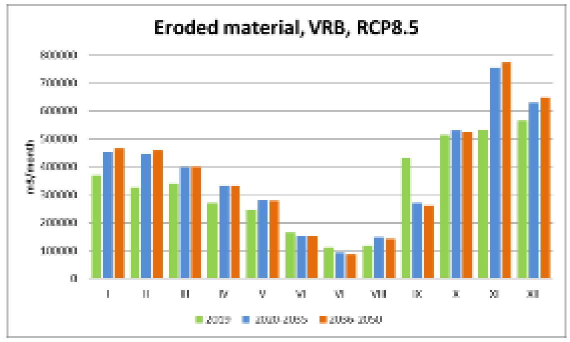


Figure 78: Eroded material, baseline and projected values

Table 61: Projections of eroded deposited material, current and different RCPs

	Current	RCP4.5		RCP8.5	
		2035	2050	2035	2050
Eroded material (m^3/year)	3,976,382	4,486,407	4,523,731	4,485,136	4,516,896
Eroded material per hectare (m^3/ha/year)	6.14	6.93	6.99	6.93	6.98
Deposited material (m^3/year)	2,067,718	2,332,931	2,352,340	2,332,270	2,348,785

The soil erosion phenomenon is moderate in the VRB (Table 61). According to RCP4.5 scenario is expected an increase in the quantity of eroded material about 0.79 m^3/ha/year or 12.7% by 2035 and 13.5% by 2050 and 0.85 m^3/ha/year or 13.8% by 2050. A similar situation is expected as regards to RCP8.5 simulations. Increases of about 0.79 m^3/ha/year or 12.7% by 2035 and an increase in the quantity of eroded material about 0.84 m^3/ha/year or 13.6% by 2050 are expected. Figure 78 shows the monthly distribution of eroded material as per RCP8.5 scenario.

The main conclusion is that the phenomenon of soil erosion in the Vjosa River Basin will continue to be active in the coming years, for both two climate change scenarios RCP8.5 and RCP4.5, undergoing a gradual increase of the quantity of eroded material.

4.6.3 Agriculture

Agriculture is one of the key sectors of Albanian economy, playing a significant but varying role contributing about 19 % of GDP (2017). The sector is still the main source of employment for about half of population, mostly for those living in rural areas.

Agriculture is one of the sectors most vulnerable to climate changes. Even nowadays the observed warmer temperatures have already increased the length of the growing season in hilly and mountain areas in the country. In other hand, this warmer temperature has negatively affected the lowland areas due to increased water demand and heat stress to the crops. Flowering and harvest dates for cereal crops are now happening several days earlier in the season compared with the previous years and decades.

VRB represents an interesting geographic area regarding agriculture. It lies in three agro-ecological zones (AEZ) [65]: the Lowland, Intermediate and Southern Highlands (Southern Highlands and Northern & Central Mountains) mountain zones.

Considering the climate projections, VRB is likely to experience average maximum temperatures higher than 25°C by the summer of 2050. This means the agriculture, especially in the lowland AEZ, will suffer from high summer temperatures which coincide with the growing season for most of the agriculture crops. This is expected to bring negative effects for most agricultural crops because it increases the risk of water stress and the amount of solar radiation which can cause singe (burning) of fruits etc. In general, the expected impacts are shown in Table 62.

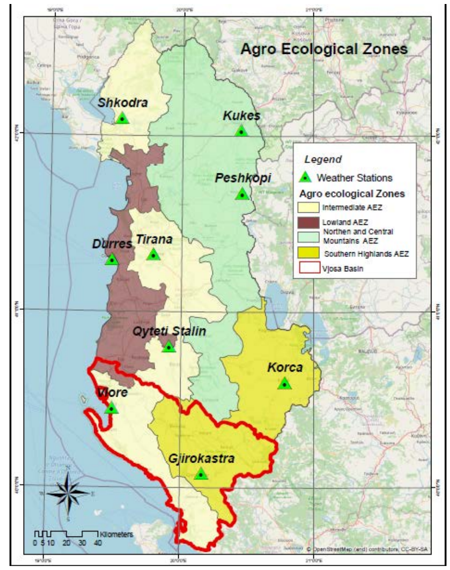


Figure 79: Agro-ecological zones

Going more in detail, some of the expected impacts on specific agriculture crops are:

<u>Maize</u>: exposure to temperatures above 30 °C damages cell division, pollen viability decreases with exposure to temperatures above 35 °C, during the temperatures from 30 °C to 35 °C the potential kernel growth rate reduces along with final kernel size.

<u>Tomatoes</u>: fail to produce viable pollen under heat stress. While their leaves remain active, the non-viable pollen does not pollinate flowers causing failure in fruit set.

<u>Perennial plants</u>: apples exposed to high temperatures above 22 °C during reproduction suffer from a decrease in firmness as a quality parameter. For cherries, increasing the temperature 3 °C above the 15 °C optimum mean temperature decreases fruit set. For citrus fruits, the optimum temperature range is 22−27 °C and temperatures greater than 30 °C increase fruit drop.

Temperature stresses on annual and perennial crops have an impact on all phases of plant growth and development.

Projections for the average minimum temperatures and their variation limits for different RCPs indicate that frost days ($T_{mi}N<0$) are likely to be a very rare phenomenon and future winters will be more temperate over the whole VRB. Many perennial crops have a chilling requirement in which plants must be exposed to a number of hours below some threshold temperature before flowering can occur. For example, chilling hours for apple and for perennial crops for fruit development may not be met. This means that is expected a yield reduction to those crops.

[65] http://www.fao.org/ag/agp/AGPC/doc/Counprof/Albania/albania.htm

Table 62: General effects of climate changes in agriculture

Factor	Effects/Risks	Effects on agriculture
Temperature	• Temperatures higher than 25°C in summer, • Increased evaporation, • Increased frequency of droughts, • Decreased number in frost days, • Extension of the growing season length.	• Increased risk of water stress and increased demand for irrigation, • Yields of most agricultural crops are expected to decrease, • Damages in maize, tomatoes, perennial plants production, • Yield reduction in perennial crops that have a chilling requirement, • Some of the crops, like alfalfa, grass and winter wheat, will be positively impacted.
Precipitation	• Increased occurrence of floods due to more frequent heavy rains with longer duration.	• Intensive flooding of agriculture area and large economic damages.
Sea Level Rise	• Salinization of coastal aquifers. •	• Decreased availability of freshwater, • Intrusion of salt waters in agriculture lands, loss of lands (coastal erosion).

Being the primary source of soil moisture, a change in the precipitation regime may be even more important than a change in the annual rainfall total as regards to the crop productivity. All the RCPs reveal a likely decrease in annual and seasonal precipitation relative to the 1986-2005 periods for all time horizons up to 2100, accompanied with the increased temperature will have a negative effect in crop yields.

Expected impact on water demand for irrigation

In the VRB, most of the farmers depend on rain fed agriculture which makes the agricultural economy vulnerable to the effects of precipitation. Using the programme CROPWAT 8.0, projections are run on the dependence of some agriculture crops from water provided by rains, for period up to 2060. In VRB the rainfall reduction will happen mostly during spring and summer time, which is at the same time the pick of the growing season for most of the agriculture crops. RCP8.5 projects the highest percentage decreases in precipitation.

Figure 80 shows the projections for water requirements and water from rain for different crops. It might be expected that the tomatoes cannot survive in the conditions of a changing climate. This is because the increase in temperature will cause the crops to require more water. As precipitation is expected to decrease, it makes it impossible to cultivate tomatoes based solely on rainfall. So, the only way to cope with the effects of climate change, among other things, is to adapt by improving irrigation technology and genetic improvement of the crop.

Maize is also expected to suffer from the climate changes. This is because the amount of water the plant needs is more than double the water amount from rainfalls. Unlike tomatoes, for maize it is more difficult to improve irrigation technology and water management in general. Therefore, the crop remains among the most vulnerable due to climate changes.

Taking into consideration the growing period for wheat, this crop is not expected to suffer from climate change until 2060. This is because the longest period of crop growth coincides with the winter and spring season, where even rainfall is more abundant. Therefore, it is expected that climate change will have a limited impact on wheat.

Watermelon is also expected to be greatly affected by climate change, as the amount of water it requires in relation to what will come from rainfall is very small. Citrus is not expected to be affected by lack of water from rainfall. This is because they grow almost all year round. The negative impact is expected to be from high temperature extremes or lack of minimum temperatures in wintertime.

In general, an increased water demand for irrigation is expected. As seen from Figure 81, most crops require around twice as much water than is available through rainfall. Considering this increased water demand is important to invest in improvement of existing irrigation system.

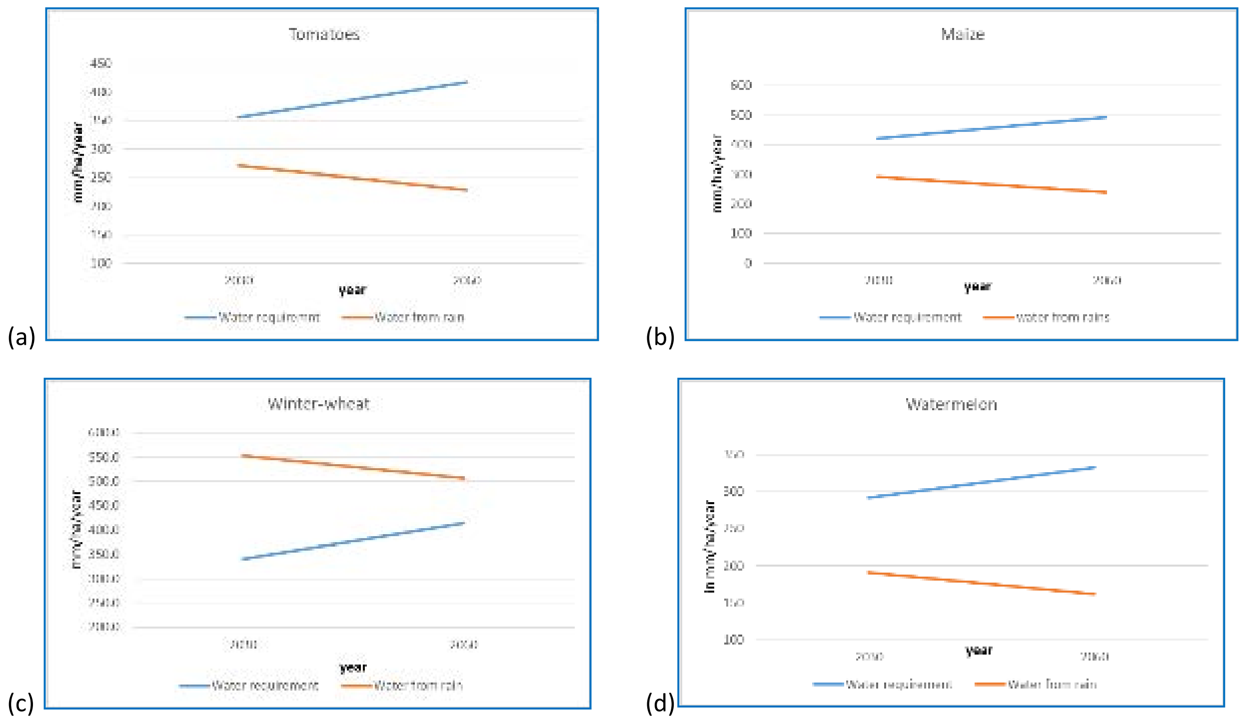


Figure 80: Water requirements and water that comes from rain (a) tomatoes; (b) maize; (c) winter heat and (d) watermelon

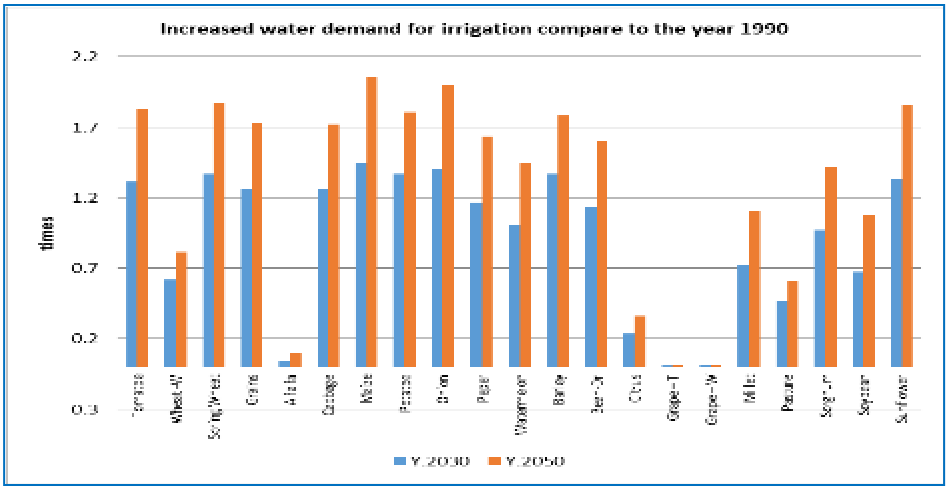


Figure 81: Increased water demand for irrigation

Expected impact on Crop Yields

A detailed work on projection of expected changes (annual and seasonal) in the crop yields under medium climate change scenario[66] is presented in the study “Reducing the Vulnerability of Albania’s Agricultural Systems to Climate Change”[67]. It is concluded that the seasonal changes in climate have clear implications for crop and livestock production, if no adaptation measures are adopted beyond those that farmers already employ (such as changing planting dates in response to temperature changes). The results show that grapes and olives will be most affected by climate change, with grape yield declines in all AEZs and olives particularly affected in the Intermediate AEZ. Yield increases can result, however, for winter wheat, as climate change will likely result in an extended growing season, more moderate fall and winter temperatures, and greater precipitation and water availability during the wheat growing season. Alfalfa production should also increase in most regions. Effects on maize vary by region, with increases in the Southern Highlands and decreases in other regions, probably because current temperature is most moderate in the Southern Highlands and so increases can enhance yields.

The projections in crop yield variability are presented in the figures below for each AEZ.

- **The lowland zone (L-AEZ).** L-AEZ is also expected to be the area most negatively affected by climate change among three AEZs in the VRB. The pedoclimatic conditions of this AEZ favour the cultivation of many crops. Irrigation is necessary during summer. Agricultural crops like alfalfa, grapes, olives, maize, and watermelon are expected to have a significant yield reduction by 2060. A decrease in maize yield of about 8% is expected by 2050 (Figure 82 and Figure 83). On the other hand, yields for irrigated alfalfa, grassland and winter wheat, because to their phenology, are expected to increase due to climate change (Figure 82).

[66] The increase of temperature with 1.5 ^{0}C (average scenario) up to the year 2050 projected by this scenario corresponds to the projected change of average temperature by RCP4.5 for the VRB area.

[67] Sutton, William R., Jitendra P. Srivastava, James E. Neumann, Kenneth M. Strze̜pek, and Peter Droogers. 2013. *Reducing the Vulnerability of Albania’s Agricultural Systems to Climate Change: Impact Assessment and Adaptation Options.* World Bank Study. Washington, DC: World Bank. doi:10.1596/978-1-4648-0047-4. License: Creative Commons Attribution CC BY 3.0

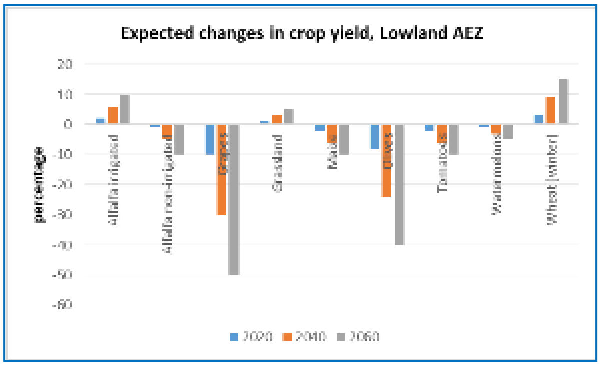


Figure 82: Changes in crop yield in lowland AEZ

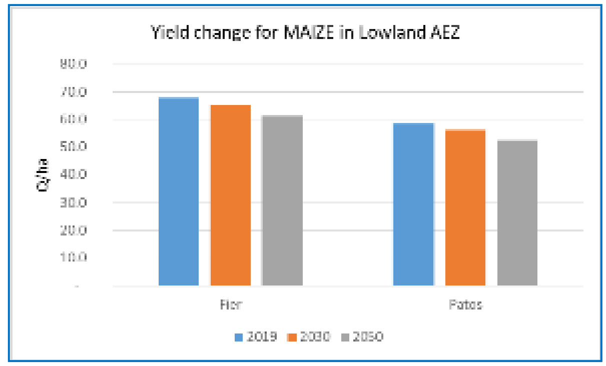


Figure 83: Changes in maize yield in Lowland AEZ

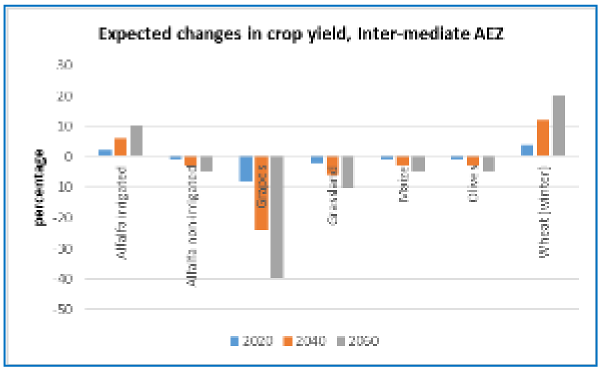


Figure 84: Changes in crop yield in Inter-mediate AEZ

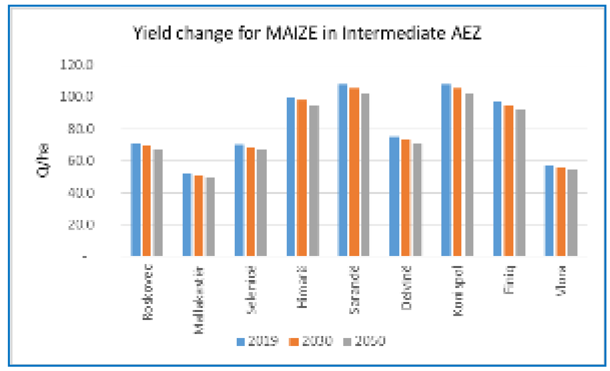


Figure 85: Yield change for maize in IAEZ

- **The Intermediate zone (I-AEZ)** is expected to be the second most affected area. With exception of the irrigated alfalfa and the winter wheat, the yields of most agricultural crops are expected to decrease (Figure 84). Figure 85 shows the changes in maize yield for the intermediate AEZ for 2019-2050. The maize yield is expected to reduce up to 4-5% by 2050, which is small compared to that for L-AEZ.
- **The Southern Highlands Mountain zone (SM-AEZ)** is expected to be less affected area by climate change. Some crops such as irrigated alfalfa, maize, winter wheat and grasslands are expected to increase their yield in the expected new climate conditions. On the other hand, the yields of most of the agriculture crops are expected to reduce by 2100. Most negatively impacted will be grapes and olives.

Impact on growing season length

Growing season, calculated as the days with persisting temperature >5^{0}C, is related with mean temperature of February/March (beginning day) and November (ending day). As both $T_{mi}N$ and T_{max} are projected to increase, an extension of the growing season length is expected. It covers almost the entire year (Table 63) for Përmet and especially the western part of the VRB area.

Table 63: Projected changes in growing season length, Permet

Scenario	1986-2005		2021-2040		2041-2060	
	begin	end	begin	end	begin	end
RCP2.6	36	346	10	365	8	365
RCP4.5	36	346	8	365	8	365
RCP8.5	36	346	7	365	1	365

As seen, it is expected that the growing season will be 12-13% longer than the 1986-2005 period.

Some of the crops, like alfalfa, grass and winter wheat, will be positively impacted by extension of the growing season. The positive impact on alfalfa and grass is related to the fact that the vegetative periods for the growth of their biomass will be longer, in a longer growing season. This will be converted in an increased yield under all climate change scenarios. Also, the winter wheat is expected to have a positive impact from the growing season, as the winter period during which the wheat vegetates will be shorter than nowadays.

Considering the period of plant growth (their phenological stages) some crops are expected to be more influenced by the water stress than others. For many crops, the periods of maximum number of consecutive days without precipitation coincides with three quarters of their development stages. Some crops like; maize with short cycle, soybean, maize, spring wheat, barley, beans, tomatoes, cabbage, millet, onion, sorghum, pepper, sunflower and watermelon are expected to be affected from the maximum number of days without precipitation, because their development phases are expected to happen in that period without rains. Alfalfa and winter wheat are expected to be less affected, but in general the changes in precipitation are expected to affect most of the agriculture crops.

Flooding

Referring to the section 4.6.7 on disaster risk, the VRB area, especially the L-AEZ is extremely vulnerable to flooding from the river and storm surges. In recent years there have been frequent floods in the Fier and Vlora area, causing significant damage to housing, infrastructure, agriculture and livestock. Referring to the climate change scenarios, the return periods of maximum precipitation levels are expected to decrease over the VRB area. Consequently, more frequent heavy rains with longer duration can cause more intensive flooding of agriculture area and large economic damages are expected (see section 4.4).

Sea level rise

Sea level as in the case of RCPs scenarios is projected to rise. As per the worst scenario, RCP8.5 the sea level is expected to rise by 27 cm by 2050 and 80 cm by 2100.

In the flat coastal area likely changes in the sea level will have a great impact in the agriculture in the area because flooding, intrusive of the salt waters in agriculture lands, loss of lands (coastal erosion) etc.

The most potential affected agricultural area will be the western part of Vjosa, especially the part around Vjosa estuary (Fieri, Vlora) and in south-west of the country; Vrina field in Sarande and Konispol municipalities (see section 4.6.7).

4.6.4 Livestock

Livestock products constitute a main source of incomes, thus being the most important sector of agriculture. In the 1990s, two phases of dairy development have been described: until 1994, production increases were based on rising animal numbers, while in the second phase yield increases were observed[68]. Yet the intensity of production is low compared to European standards. The dairy industry, along with it the milk collection system, are still modernizing structures and technologies. Most small processing units use traditional technologies until today.

The number of livestock is almost constant since the year 2010. However, the poultry sector is the only that recognizes continuous increase from year to year. The number of livestock for the year 2018 is given in the Table 64.

Table 64: Structure of livestock in cattle units, 2018, in 000s

Region	Total	Cattle	Sheep & Goats	Pigs	Poultry	Equidae	% of the country
Fier	131	63	28	7	25	8	11
Gjirokastër	63	16	39	0	2	5	8
Vlorë	83	23	47	3	4	6	9
Total	**277**	**102**	**115**	**10**	**30**	**19**	**28**

Thus, livestock is another important source of employment and incomes for families living in rural areas of VRB. It is also very important in terms of the financial resources and turnover this sector provides to local communities. Table 65 shows different products from livestock sector and their value.

Table 65: Value of the livestock products in 2018 in VRB

Livestock products in VRB	Unit	Production	Value/unit, euro	Value, in euro
Meat	**Tones**	18,719	3,500	65,516,500
Honey	**Tones**	650	12,000	7,800,000
Wool	**Tones**	75.5	1,000	75,500
Milk	**Tones**	108,000	500	54,000,000
Eggs	**Pieces**	165,000,000	0.2	33,000,000
Total				**160,392,000**

As seen from the table, most important products in the project area are meat, milk and the eggs. The list of products is not very diverse since the processing industry is still mostly inconsiderable for rural and mountain areas.

The potential climate change impacts on livestock include, among others: water availability, expected change in forage production yield, spread of pests and diseases, heat stress, existence of the rare and/or

[68] XHAXHIU, D., URUCI, M. (2002): Report on milk production evaluation and dairy industry in Albania, prepared for the GTZ Project "Agricultural Policy Advice" to the Albanian Ministry of Agriculture and Food, Tirana/Albania.

local breeds, and expected changes in animal production. The vulnerability assessment for the main livestock categories is given in the Table A9-1 in Annex IX-Livestock.

Based on the analysis done above, it turns out that sheep and cattle will be more affected in Lowland AEZ as heat stress, water availability, pests and diseases and forage production are very limiting factors and have a significant impact on this category. North and Central Mountain AEZ is expected to have the lowest level of impact as the impact of forage production is lower.

Goats are expected to be affected mostly in Lowland and Intermediate AEZ as the stress from the heat and the lack of water will be more evident in these two areas. The least affected categories are expected to be pigs and chickens. The South highland AEZ is expected to be more affected by diseases as the vectors of their spread are affected by global warming is the south-north direction.

4.6.5 Biodiversity

The largest land cover categories in the VRB, according to Corine (2018) are natural grassland, mixed forests, and sclerophyllous vegetation distributed throughout the territory and broad-leaved forest and conifers distributed in its north-eastern and southern parts.

At the boundary between sub alpine pastures and mountain forest ecosystems is a mass of coniferous and deciduous forests represented by forest wood associations dominated by *Abies borisii – regis- Juniperus oxycedrus L*. accompanied by forests of dominant species represented by *Castanea sativa Mill., Fraxinus ornus L., Carpinus orientalis Mill. and Pinus nigra Arn.* This forest belt is considered as the first "invader" of sub alpine pastures where the biggest changes are expected due to the climate.

The second belt that shifts in height is represented by

(i) 1st *Association Ire: Buxo-Pinetum (*with the dominant species *Buxus sempervirens dhe Pinus nigra)*

(ii) *2nd Association IIte: Staehelino-Pinetum (*with dominant species as *Staelinen (*Staehelina uniflosculosa Sibth. & Sm) *and Pinus nigra)*

(iii) *3rd Association: Corylo-Pinetum (*with dominant species *Corylus avellana*) *Pinus nigra, Acer pseudoplatanus, Ostrya carpinifolia Scop*., and *Quercus trojana Web*.

(iv) 4th *Association: Pineto-Fagetum,* Fagus sylvaticum, *Salix caprea, Bredhi maqedonas Abies borisii-regis* Matf., Acer pseudoplatanus L.

The associations in the riverbed is represent by *Platanus orientalis –Salix alba Platanus orientalis* L., *Populus nigra* L., *Alnus glutinosa* (L) Gaertn., *Salix alba* L., *Ulmus campestris* L. Cercis siliquaster, Paliurus spina-christi.

At altitude or around rivers the main associations are *Carpinus orientalis, Quercus petraea and the dominant species are Quercus petraea* (Matt.) Liebl., *Quercus frainetto* Ten*., Quercus trojana*, *Carpinus orientalis* Mill., *Crataegus monogyna* Jacq., Acer spp. Mare (Arbutus unedo), Arbutus andrachne, Quercus ilex, *Quercus coccifera*, Coryllus avellane, *Phyllirea angustifolia*, *Phyllirea media*, *Pistacia lentiscus*. It is expected that this association will have the widest spread due to its flexibility to climate (temperature and precipitation).

In general, the impacts of expected climate change on biodiversity are summarized in Table 66.

Table 66: Expected impact of climate changes in biodiversity

Factor	Effects/Risks	Effects on biodiversity
Temperature, precipitation	• Temperature increase, • Precipitation decreases.	• Habitat fragmentation and vertical displacement of plant associations.
Sea Level Rise	• Seawater diffusion, • Coastal erosion.	• Flooding, land loss, salinization of groundwater and biodiversity loss, • Negative impact in marine and coastal ecosystems services., • Change in water fauna and flora in favour of species that like more warmth and salinity.

Rare, endangered and economic important species

There are identified twelve new taxa, forty species one area and thirty rare and endangered species such as Viola Acroceraunian Island Stachys ceratophylla, localized to VRB area[69]. About 380 species of MAPs (Medical and Aromatic Plants) have been recorded within the watershed, 330 of which are wild species[70]. About 46 species are endangered, threatened, or protected to varying degrees, but are still harvested in the wild, e.g., *Salvia officinalis, Origanum vulgare, Hypericum perforatum, Orchis* spp., *Sideritis raeseri, Laurus nobilis, Juglans regia, Juniperus* spp*., Sambucus nigra, Tilia* spp. They are of special economic importance. They are distributed over a wide geographical area (from 400 to 2000 asl) and may be impacted by ected changes of climate.

A preliminary assessment of rare and endangered species found in Vjosa catchment, about 150 species belong to the Appendices of the Bern Convention, signifying the importance of the site for the biodiversity protection, precisely three species of higher plants, 9 insects, 5 amphibians and reptiles, 107 birds and 17 mammals. The Vjosa River valley represents a biodiversity hotspot of Albania hosting ideal aquatic habitats various migratory fish species like the critically endangered European eel (*Anguilla anguilla*), mullet (*Mugil cephalus*), besides sub-endemic fish species like Ohrid loach (*Cobitis ohridana*) and Pindus stone loach (*Oxynoemacheilus pindus*), globally vulnerable (VU) occurring in the freshwater systems of Albania. Vjosa River provides shelter for globally endangered species of genus *Acipenser* (i.e., *Acipenser sturio* and *Acipenser naccari*). *Lampetra fluviatilis* is part of the National Redlist, under threat category Endangered (EN), while *Petromyzon marinus* under threat category Vulnerable (VU). Both species breed in the lower section Vjosa River. The upper part of Vjosa River, and its main tributaries (Drinos river, Kardhiqi, Bënça) are hosting viable population of the native trout (*Salmo faroides*), listed in the National Redlist under threat category Vulnerable (VU).

Installing hydropower plants will have a serious impact on wildlife. It might cause the permanent loss of habitat and special biotopes through inundation, fluctuating water levels, dispersal of exotic species and obstacles for fish migration. However, the impacts are very general, and it is hard to put any numbers on the losses.

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[69] Malo S. (2010): Studim i diversitetit bimor në rrethin e Gjirokastrës. PhD theses, Faculty of Natural Sciences, University of Tirana. 179 pp. Miho A. & Shuka L., 2017: Medicinal plants in Vjosa catchment, economical and conservation approach.

[71] Kanjir, U and Gregoric Bon,N., 2018, Coastal changes and movements in the wider Vlora (Albania) area, Research paper, September 2016 Conference: GEOBIA. DOI: 10.3990/2.382

Protected area VRB

Three terrestrial national parks (Bredhi i Hotoves-Dangelli NP, Butrint NP and Llogora NP) and one marine national park (Karaburun-Sazan MNP), one Strict Nature Reserve (Kardhiqi SNR), four Nature Monuments (Zheji NM, Sotira NM, "Uji i Ftohte"-Cold Water spring NM, and "Syri i Kalter"-the Blue Eye NM), five Managed Nature Reserves (Karaburun MNR, Poro MNR, Levan MNR, Rrezome MNR, Germenj-Shelegure MNR), one Landscape Protected Area (Vjose-Narte LPA) and one area of Managed Nature Resources (Piskal-Shqerri) are designated as protected areas inside the Vjosa River Basin, with a total surface of about 109,580 ha**.** In addition, there are some 195 Nature Monuments (104 geomonuments, including caves, canyons, geosites and hydrosites, and 91 biomonuments) placed inside the Vjosa basin. One Ramsar site (Butrinti NP) and the only marine national park (Sazan-Karaburuni) are part the VRB. All these figures show the importance of the Vjosa basin at national and international context (Figure 86).

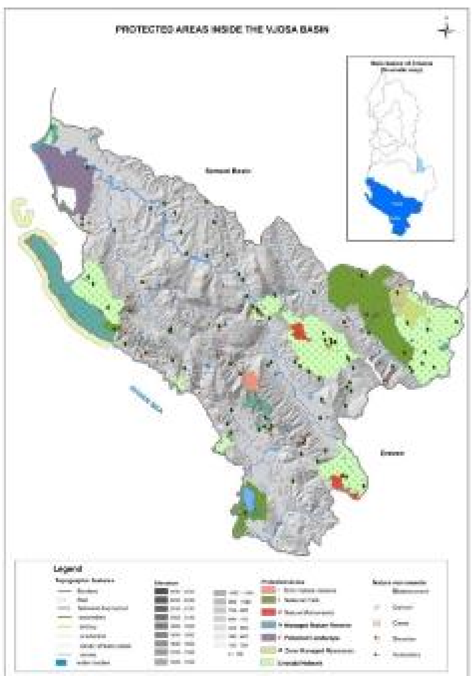


Figure 86: Map of protected area according to the category of protection inside VRB

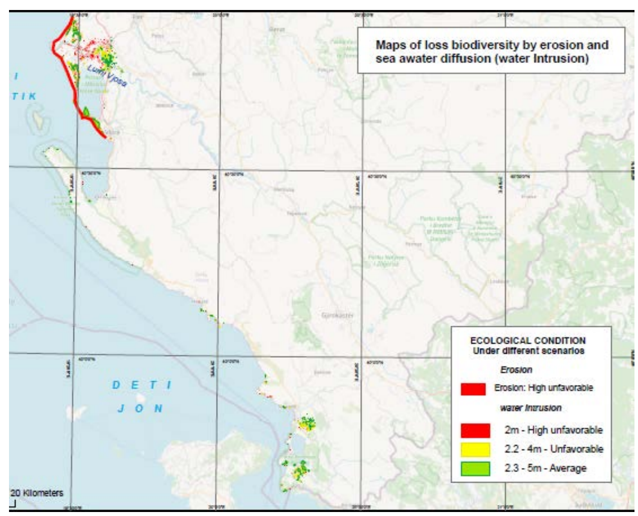


Figure 87: Maps of loss biodiversity by erosion and seawater intrusion

Source: SEA Report of Small Hydro Power Development Policy in Albania, a Comprehensive, Climate Resilient Approach to Sustainable Hydropower for Albania, 2018

Climate change, first, will have an impact on ecosystems and biodiversity in Nature Protected Areas with different protection statuses. Habitat fragmentation and vertical displacement of plant associations are expected to be consequences of climate impacts. The National Biodiversity strategy evaluates as very important to support the creation of protected areas as a safe way to preserve biodiversity.

Impacts from erosion and seawater diffusion

Wetlands of national importance in the Vjosa delta and Karavasta lagoon will be greatly affected. The habitats will change due to the increase of the sea level and the temperature of the aquatic environment. Due to the sea-level rise flooding, land loss, salinization of groundwater and biodiversity loss are expected. Marine ecosystems and biodiversity, already under pressure from pollution, will be affected by warmer temperatures and acidification, with changes in species reproduction, feeding and with changes in distributions of marine organisms, more frequent algae blooms and shifts in plankton communities. Relevant marine and coastal ecosystems services may also be lost with coastal wetlands disappearing.

In the lower part The Vjosa Delta is located the strictly protected area Narte - Vjose (about 20,000 ha). The natural ecosystem of Narta is characterized by a rich diversity of habitats including here (i) the lagoon, (ii) the delta of Vjosa River, (iii) the salt marshes, (iv) the sand dunes, (v) the pine forests and (vi) the island of Zvërneci.

The salt soils species are Salicornia spp., *Arthrocnemum spp., Salsola soda, and Limonium spp*. With the decrease of salt concentration, the variety of species increases with: *Arthrocnemum fruticosum, A. perenne, A. glaucum, salicornia europea, Salsola soda, Juncus acutus, Juncus maritimus, Inula crithmoides, Limonium vulgare, Artemisia coerulescens, Halimione portucaloides*. In the habitat of sweet water reserves the dominant species are *Phragmites australis, Typha angustifolia, Typha latifolia, Scirpus maritimus dhe Scirpus lacustris.* On the alluvial forest the species (forest trees) are *Populus alba, Populus nigra, Salix alba, Salix purpurea, Salix amplexicaulis, Salix elaeagnos subsp. angustifolia, Alnus glutinosa, Alnus incana, Platanus orientalis, Ulmus minor, Ulmus glabra, Fraxinus angustifolia* while on the Sandy dunes they are *Ammophila arenaria subsp arundinaceae, Elymus farctus, Echinophora spinosa.*

By analysing optical remote sensing data at the Vlora area, Kanjir and Gregoric Bon[71] found strong coastal erosion 20 – 50 cm/year along the southern Albanian coastline. It is estimated that the eroded areas in Narta coast are close to 2.0-3.0 ha per year. This erosion rate is expected to intensify due to the increased frequency of storm surges. Some habitats are expected to suffer major damage from biodiversity loss. Semi-freshwater areas to be reduced, vegetation of sand dunes to be lost and alluvial forest belt to be damaged depending on the location from the coast. In 2050 the eroded surfaces are expected to be close to 90 ha while the surfaces formed by sediments to grow north of the Vjosa delta. Although due to sediments new sandy surfaces are added every year the loss of biodiversity is high because the rehabilitation of new ecosystems, the planting of vegetation and the functioning of the ecosystem as such requires a long time.

Change in water fauna and flora in favor of species that like more warmth and salinity is also likely[72]. Areas projected to be affected by marine water intrusion will be about 1,900 ha, 2300 ha and 3,900 ha for the advancement of water salinization respectively for up to 2 m, from 2 to 4 m and from 4 to 5 m height of the coastal terrain (Figure 87).

[71] Kanjir, U and Gregoric Bon,N., 2018, Coastal changes and movements in the wider Vlora (Albania) area, Research paper, September 2016 Conference: GEOBIA. DOI: 10.3990/2.382
[72] Travers, A., Elrick, C. and Kay, R (2010). *Background Paper: Climate Change in Coastal Zones of the Mediterranean.* Split, Priority Actions Programme, 2010

4.6.6 Forestry

The forest areas occupy 123,878 ha over the VRB. The largest area is located at the municipalities of Erseke, Himara, Permet, Gjirokaster and Finiq. The largest area in VRB is occupied by shrubs (about 38,500 ha), followed by Oaks (38,500 ha), broad leaf tree (about 14,500 ha), Pine tree (11,660 ha), fir (6,036 ha), beech, poplar and association Chesnutt, walnut and acacia (Figure 88). Protected areas occupy a surface of 58,385 ha or approximately half of the forest area. The largest area "Bredhi i Hotoves" lies mostly in the Korco municipality and is about 33,500 ha.

About 40% of the total area of the upper part of the Vjosa valley is covered by forests. Oaks, beeches, firs and pine trees are the most extensive forest ecosystems of this part.

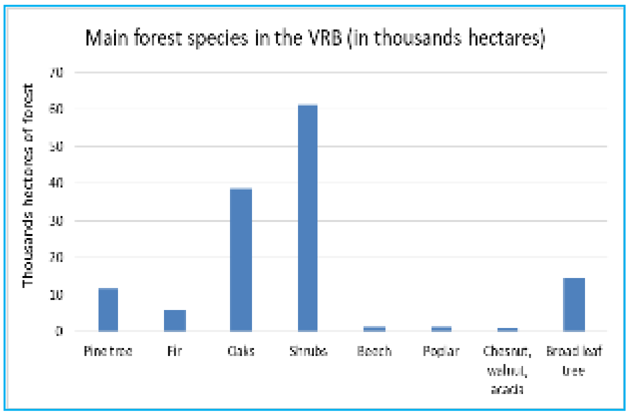


Figure 88: Distribution of main forest species in VRB

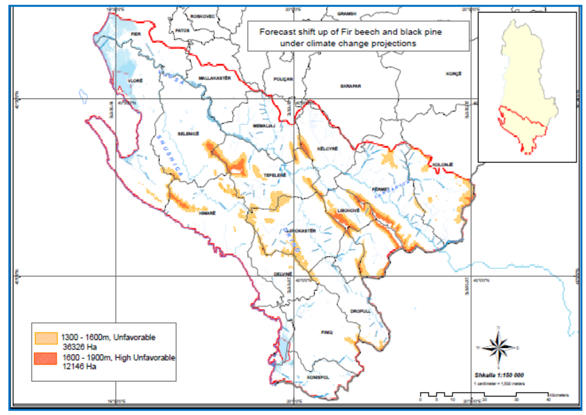


Figure 89: Expected prevalence of fir, black pine and beech due to climate change projections

Climate change directly affects the spatial distribution of forest ecosystems, reflecting the differences in forest belts, pastures, plant associations and even habitats. Functioning, productivity structure, ecological stability, health status and relationships of species with their environment can become fragile with changes in temperature and precipitation.

Considering the climate change scenarios, due to an increase in temperature of 1-2°C in the VRB area, meadow ecosystems are expected to replace forest ecosystems. This will result in different soil conditions making it unsafe to adapt sustainable forests in the mountain meadow land belt up to 1900 m above sea level in the mountains of Murgana, Kardhiq, Cajup, Cike, Shelegur, Dhemblan, Zhulat and Nemercke (Figure 89). This shift of forest vegetation belt above altitudes of fir, beech, black pine is already a phenomenon observed in high mountains.

The projected surface shift/expansion is about 16,000 ha. This change is probably an advantage for forests, but the mountain pasture areas are expected to reduce. As temperatures rise there will be a greater mix of forests. Typical Mediterranean forests (q*uerqus sps., arbutus sps and carpinus orientalis*) and forests with high temperature resistance exposed on the southern and southwestern slopes of the VRB range will be mixed with oak forests. Rare vegetation will become dominant impoverishing forests with environmental and economic value. Xerophytic forest vegetation will be affected by the imbalance of water reserves and will actively penetrate forest ecosystems leading to lower forest production (biomass) and more intensive degradation of terrestrial ecosystems.

Because most plant diseases are strongly influenced by environmental conditions, climate change will affect the pathogen, the host and the interaction between them, resulting in changes in disease impact[73].

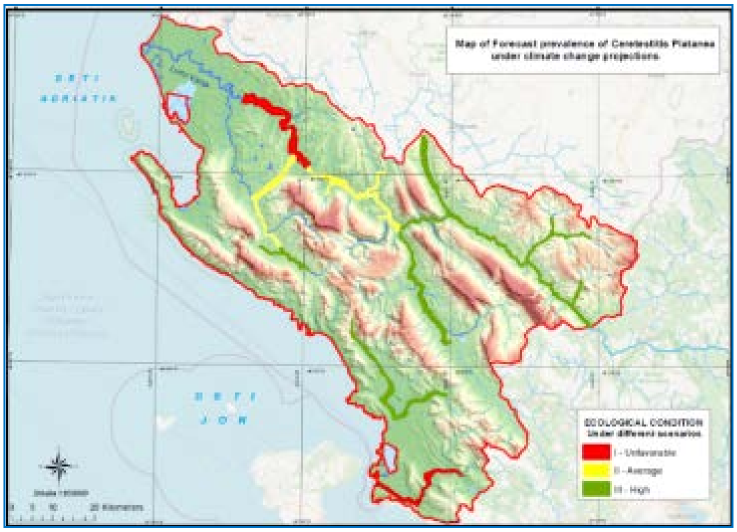


Figure 90: Expected prevalence of Certestitis Platanea in climate change projections

The main diseases and pests that infect the forests in the VRB area are: *Evetia buoliana, Schiff, Phalera bucephala, L., Paranthrene tabaniformis, Rott, Melasoma populi, L, Hylobius abietis, L Lymantria dispar, L Stilpnotia salicis, L Flu Hyphantria cunea, Drury, Tortrix viridana, L Thaumetopoea pityocampa, Schiff* (pine processionary moth), *Thaumetopoea processionea, L* (oak processionary moth), *Blastophagus piniperda, L* whose target are pinus, oaks, salix, poplus.

Oak processionary moths are widespread in the wide area of pinus-oaks located at altitudes from 500 to 1500 m in the highlands of Sotira, Hotova, Nemercka, Cika, Mali. Despite the efforts so far it seems that pine and oak processionary moths are developing by infecting new massive pinus and oaks. Climatic conditions favor this insect which requires temperatures for intensive development at around 25 ^{0}C.

Among the fungal diseases that are infecting Platanus orientalis is canker stain (Cerotostitis Platenea) of plane trees. In the Vjosa valley this disease has appeared in the last ten years and is gaining momentum. The gorge of Kelcyra in Drino and the stream of Suka (Katundishte) were the first areas completely dried by this fungal disease. Temperature changes of 1°C encourage the vectors and the disease itself to spread to the valleys of Drino, Kelcyra, Shushice, Sukes, Langarica, the upper part of the Vjosa and the river Izvor (Figure 90). Table 67 summarises the expected impact of climate change on forests in the VRB.

[73] Sturrocka R. N., Frankelb S. J., *et al*. Climate change and forest diseases. Plant Pathology (2011) 60, 133–149

Table 67: Expected impact of climate change in forests

Factor	Effects/Risks	Effects on forests
Temperature, precipitation	• Temperature increase, • Precipitation decreases.	• Directly affects the spatial distribution of forest ecosystems; with a 1-2°C increase in temperature, meadow ecosystems are expected to replace forest ecosystems, • Functioning, productivity structure, ecological stability, health status and relationships of species with their environment can become fragile.

4.6.7 Disaster Risk

Albania is a disaster-prone country and is exposed to geological hazards (earthquakes, rock falls and landslides) and hydro-meteorological hazards (flooding and flash floods, droughts, snowstorms, high snowfall and windstorms).

Figure 91 shows that the trend of disasters is increasing in the last decades in the VRB area.

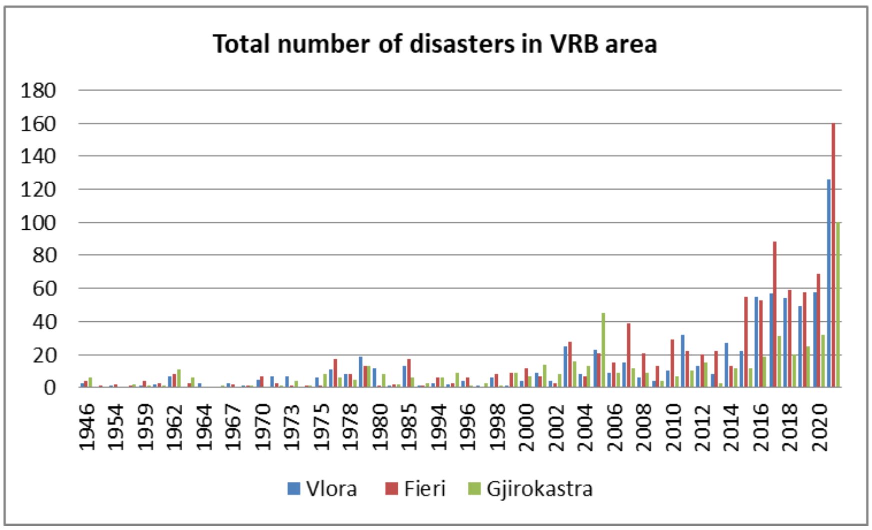


Figure 91: Disaster distribution in VRB area((floods, flash floods, forest fires, storms, earthquake etc.)

Source: DesInventar database, period 1946-2018

The following analysis considers floods, flash floods and forest fires as the most frequent disasters caused mainly by the hydrological and meteorological conditions (accounting for more than 90%). Figure 92 and Figure 93 show the spatial distribution of floods during 1990-2018, at municipality[74] and prefecture levels in the Vjosa River basin. It is visible that the years with highest recorded floods correspond with observed heavy precipitation extremes. The most flood affected areas are Fieri (45% of total events) and Vlora (19%) municipalities, followed by Gjirokastra (19%), Permet (7%), Mallakaster (5%). Vlora and Fieri areas, located in Vjosa downstream, have the highest flood risk. Gjirokastra area is also risked due to the floods of Drinos River (Figure 94 and Figure 95). However, it is important to note that heavy precipitation is not the only factor that causes flooding. Environmental degradation,

[74] map also shows some municipalities that are not part of the Vjosa river basin, like Lushnje, Divjake

maintenance (or lack thereof) of infrastructure designed to manage flood waters intrusion, and lack of appropriate watersheds management have a great impact as well.

Even though they cannot cause forests' ignition of by themselves, the meteorological conditions (high temperatures, lack of precipitation, and strong winds), especially in summertime, play a significant role in their uncontrolled distribution. An increasing number of forest fires, occurred mostly from June to September, is registered during the period 1990-2018, covering almost all the VRB area. The most affected prefecture is Vlora with 131 events, with respective municipalities, Vlora, Saranda, and Delvina, but also the Gjirokastra municipality has an elevated risk.

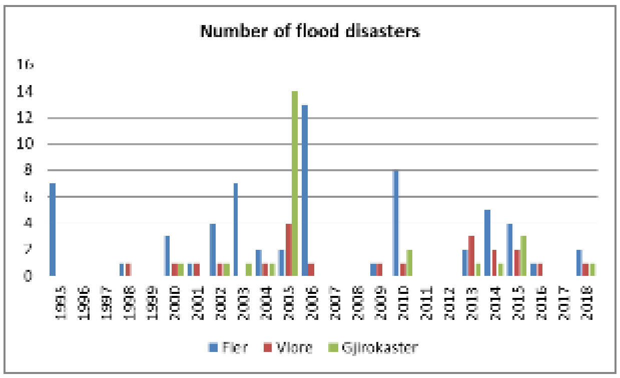


Figure 92: The distribution of flood disasters in the Vjosa river basin 1990-2018, in prefectural level. Accumulative numbers for each year

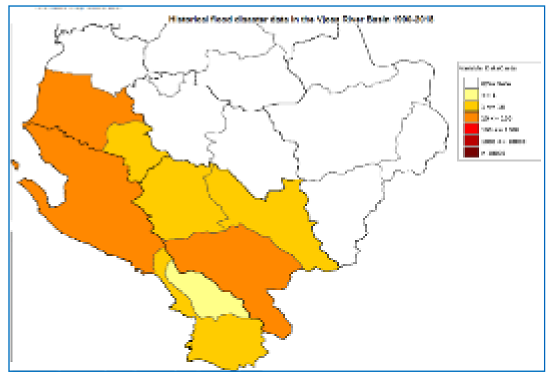


Figure 93: The spatial distribution of flood disasters 1990-2018 of the Vjosa River basin, at municipality level

Figure 94: The Flood Risk Map for the Vjosa River Basin.

Figure 95: Flood hazard map for Vjosa River with return period 50 years.- first draft, developed in the frame of the PRONEWS Programme

Table 68 shows a summary of direct damages caused by flash floods, floods, and forest fires in VRB during 1990-2018, according to prefectures. A detailed description on disaster impacts in different sectors, from the impact on the life of people, in the economy, to the impact in other sectors, agriculture, transport, etc., is given in Table A10-1 in Annex X.

Table 68: The total number of historical disasters in the Vjosa river basin (1946-2018)

Event	Region	Data Cards	Deaths	Houses Destroyed	Houses Damaged	Directly affected	Indirectly Affected	Evacuated
FLASH FLOOD	**Fier**	8			23			
	Gjirokastër	2						
	Vlorë	2			70			
FLOOD	**Fier**	42	2	22	482	198131	1000	220
	Gjirokastër	26		1	30		300	
	Vlorë	19	2		1305	199613		366
FOREST FIRE	**Fier**	127	1	2				
	Gjirokastër	79		5				
	Vlorë	131	1	5	2			
TOTAL		**436**	**6**	**35**	**1888**	**397744**	**1300**	**586**

Source: DesInventar Albania, main risks (flood, flash flood and forest fires).

Some general effects of climate changes on disaster risk are shown in Table 69.

Table 69: Expected disaster risks due to climate changes

Factor	Risks	Effects/disaster risks
Temperature	• Increased frequency of droughts, • Strong winds.	• Increased frequency and intensity of forest fires. •
Precipitation	• Increased frequency of heavy precipitation.	• Increased occurrence of floods, flash floods especially during winter, but also during fall and spring months, • Direct damages (such deaths, missing people, the people directly and indirectly affected), • Destruction of settlements, infrastructure and natural environment.
Sea Level Rise	• Increased exposure of coastal areas to floods from storm surges and erosion.	• Destruction of settlements, infrastructure and natural environment from floods and shoreline regression in low lying coastal areas and riverbeds.

The climate change scenarios for VRB reveal that the frequency and intensity of heavy precipitation will increase as per all RCPs (see section 4.4.2). E.g., a maximum precipitation of 150mm/d that historically occurred once in 50 years in Permet area may now be expected to occur more frequently, every 40 years (RCP2.6), 36 years (RCP4.5) or 34 years (RCP8.5). In parallel with a decrease of return periods, the amount of total precipitation falling during intense multi-day's events is expected to increase (See section 4.4.2, Table 54). Given that, it is reliable that the VRB area is expected to have more often intensified floods.

Expected sea level rise and increased number of storm surges may deteriorate the situation in the Vjosa River discharge area. Due to the terrain, most of the flooding is expected on both sides of the Vjosa River, starting from the village of Mifol towards the Vjosa estuary. In northern part of Vjosa river, most affected villages are in Fier will be: Darzeze, Martine, Bashkim, Pishe, Bishan, Bocove, Qarr. In the southern part of the Vjosa River, in Vlora villages expected to be impacted are Poroje, Akerni, Aliban, Novosele etc. Some areas in Orikum will also be affected from sea level rise. In the southwest, the most impacted villages will be Shendelli ans Vrine in Virna fields (Konispol municipality) and Vurg and Dritas in Saranda municipality.

Temperature extremes are expected to increase according to all RCPs scenarios. It is expected: (a) return periods of maximum absolute temperatures to drastically decrease and (b) their duration to increase over the VRB area (see 4.4.1). Consequently, an increase in frequency and intensity of forest fires during summer is predicted. The expected decrease of precipitation and increase of wind speeds are expected to favor their spread and damages.

4.6.8 Human Health

Health vulnerability of communities living in the regions of Vjosa Basin will be influenced not simply by the individual level of exposure of the people there. Health outcomes will be strongly shaped by demographic and societal factors at a larger scale as well as health preconditions. Additionally, governance and organization of specific elements of the health system, including access to basic health care, public health programs and surveillance systems will also play a crucial role in determining health outcomes.

Climate change may accentuate the health burdens associated with those worsening trends or may slow or reduce any observed improvement.

Impact of current climate on health

All three regions included in Vjosa Region have a higher than national average mortality rate from stroke (cerebrovascular accidents), with an almost 50% excess in Gjirokaster. Vlore and Gjirokaster have higher than national average mortality from ischemic heart diseases and myocardial infarction (heart attack). They all have lower mortality rate for pulmonary diseases. The mortality profile reflects the fact that Vjosa Basin Regions, particularly Gjirokastra and Vlora, have comparatively ageing populations where major health vulnerabilities are related to non-communicable diseases. On the other hand, Fieri is more exposed to infectious diseases compared to two other regions, probably because of a larger proportion of children in population and higher exposure to contamination, caused by floods.

7.6% of children in Fieri region had diarrhoea at any time of the year. Vlora region records one of the highest rates of asthma in the country. One in five children in Vjosa region has signs of anaemia. One in 4 adult women and more than one in 3 adult men in Vjosa Region has hypertension. Gjirokastra has the highest rates of adult disability in the country (8.7% of over 15 years old population), and the highest rate of older people in the country (18.4%). While around half of Albanian population is overweight or obese, Fieri and Gjirokastra haven highest rates in the country.

Gjirokastra has a comparatively poor access to health care: 57.4% of women there reported at least one problem in accessing health care. This indicator is 37% for Fieri, and 24% for Vlora.

The specific exposure-response analysis demonstrates excess mortality related to heat waves and excess gastroenteritis incidence related to higher summer temperatures in Albania. During two heat waves in 2017, increases in total mortality rate (9%-16%) as well as mortality caused by cardiovascular conditions (16-17%), especially by stroke or cerebrovascular diseases (50%) and heart failure (20%-36%) were observed. No change was observed in tumour mortality.

The analysis documented a robust and consistent correlation between the gastroenteritis risk and summer temperatures over the study period, 2006-2018 (Figure 96). Systematically, the years with higher summer temperatures, have higher rates of gastroenteritis and vice versa. The association of yearly incidence of gastroenteritis with higher temperatures remains strong (coefficient r =0.85) and doesn't change with different air temperature's metrics applied.

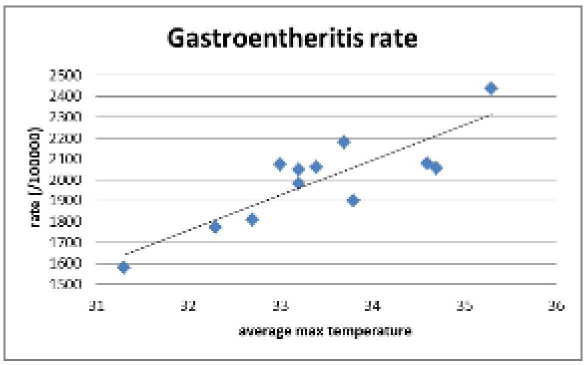


Figure 96: Impact of maximum temperatures in gastroentheritis rates

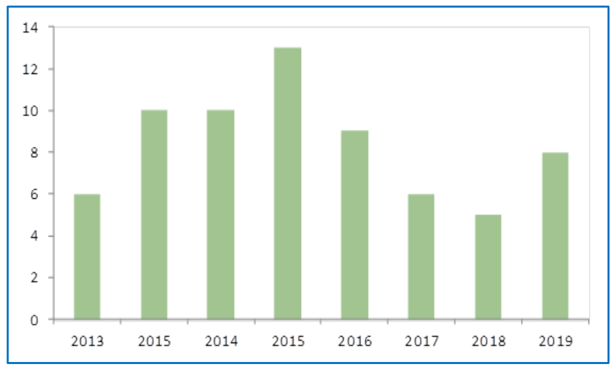


Figure 97: Leptospirises cases over years. Fieri district. 2013-2019

Additionally, the influence of massive floods of February 2015 in the rodent's circulation in Fiery may be one plausible explanation of the peaking of leptospiroses cases later that year (Figure 97), and it is corroborated by findings in post floods Shkodra Region in 2011.

Expected impacts of climate change

For changes in exposures to health risks related to climate change, the future rate of a health impact associated with certain environmental exposure is a factor of three values: the baseline rate of the health impact, the expected change in exposure and the exposure–response function.

The main trend in Albanian demographics is the rapid ageing of the population, with important consequences in health vulnerability related to climate and its change. The proportion of older people has been more than tripled since early 90s. The trend will continue, and projections show important differences among regions. Population of those over 80 years old is the category with the highest increasing trend. Regions of Vjosa Basin, especially Gjirokastra and Vlora will experience the highest elderly dependency ratio[75] in the country; Gjirokastra will have 45 older people for 100 inhabitants of age 15-64 years, as early as 2031.

Climate change impacts to human health will cause an extra burden over these pre-existing trends. Some underlying health conditions can increase sensitivity to climate change effects, such as heat waves (see

[75] Dependency ratio is the proportion of the population of a country aged 65 and over in relation to the population aged 15-64

section 4.4 and Annex V) and the worsening of the quality of water or air. Potential climate change related health impacts may reduce the improvements that would otherwise be expected in some indicators of health status and deteriorate trends towards poorer health in other health indicators. Table 70 shows the projected trends in health conditions possible climate change impacts.

Table 70: Projected trends in health conditions and possible influences of climate change.

Disease	Trends	Possible influences of climate change	Estimations of additional attributable burden of disease in relation to climate change scenarios.
Asthma	The prevalence of asthma has been on increase (on average 5% every year) and is projected to continue to be on increase in Albania and Vjosa Basin regions in the coming decades. Situation is expected to be worse in Vlora. There are no systematic incidence data, but the relative low baseline prevalence indicates a future increase in every year risk.	Asthma is exacerbated by changes in pollen season and allergenicity and in exposures to air pollutants affected by changes in temperature, humidity, and wind.	Despite demographic changes, by 2031 in Vjosa Basin are expected 800-1200 additional cases of asthma, compared to 2019, very likely attributed to climate change. Women are expected to be more vulnerable to this impact. The population of Vlora Region is the most exposed to the condition.
Cardiovascular diseases	Cardiovascular disease was by far the main cause of death in Albania in the last decade. In the coming decade, approximately one third of Albanian population is projected to have some form of cardiovascular condition, including high blood pressure.	Cardiovascular disease increases sensitivity to heat stress.	In the Vjosa Basin regions 190,000 to 230,000 persons are estimated to suffer from cardiovascular diseases (including hypertension) by 2031. This group constitutes the largest population category vulnerable to excess heat. Most of them will have some forms of exacerbations of the condition as consequence of climate change scenario, increasing the need for extra health care efforts and 148eopardizing the efficacy of existing programs of control. It is estimated also that between 2030 and 2050, on average more than 70 additional deaths every year will be attributed to heat waves in Vjosa Basin (see the section below for more details). Gjirokastra is expected to be the most affected region.
Chronic pulmonary diseases	In 2018, approximately 2.1% of adults had been registered with chronic pulmonary diseases by a family doctor. Deaths from chronic lung diseases have not increased during the last decades, but they remain the third leading cause of death and are expected to become some of the costliest illnesses in coming decades.	COPD patients are more sensitive than the general population to changes in ambient air quality associated with climate change.	While it is difficult to project additional pulmonary diseases attributable to climate change, it seems very likely that more than around 30% of the expected pulmonary cases to suffer from additional consequences attributable to climate change and deterioration of air quality. It means, by 2031 climate change in Vjosa Basin will be the underlying factor for additional health consequences in almost 2000 people with chronic pulmonary diseases. Gjirokastra region is expected to be the most affected region.

High Blood Pressure	The prevalence of registered hypertension has been on increase in Albania, and demographic changes will continue to exacerbate the trend. Nevertheless, there is a large potential for better control of high blood pressure, especially for the most severe grades. There are some limited data demonstrating a relative improvement in HBP control during the period 2012-2016. National program of check-ups may have contributed to this.	High blood pressure accentuates vasoconstriction and hardens the heart workload, while significantly increasing the risk for stroke. Both conditions increase sensitivity to heat stress. Vulnerability is reduced or eliminated if hypertension is controlled.	It is hard to predict the combined effect of two antagonist influencers (improving prevention n strategies and climate change), but it is almost certain that uncontrolled hypertension will remain the most widespread underlying condition in Albanian adult population for the coming 3 decades. Projected climate change scenarios will impede or delay the national health system efforts to control hypertension in Vjosa Basin regions. It may be estimated that by 2031, 10000 to 50000 individuals with high blood pressure in Vjosa Basin would need additional health care (visits to primary health care, hospitalisations and medicines) because of higher temperatures. Fieri is projected to be the most affected region.
Smoking	While the decreasing trend of smoking among men is projected to continue its beneficial effects may be hampered or even neutralized if the observed increasing trend among women is not controlled.	Smoking adds to heat stress and air pollution risk.	Smoking is the third major cause of health vulnerability in Albania (after hypertension and diet). Its trend is not directly linked to climate change, but there is a clustering of smoking, hypertension and obesity in Albania. Climate change, in terms of higher temperatures and deterioration of air quality, is expected to have a significant health effect on many of 100,000 projected smokers in Vjosa Basin by 2031. Vlora is expected to be the most affected region.
Diabetes	Registered diabetes prevalence has been on the increase in Albania for more than 10 years. Demographic and lifestyle trends will influence an increase of incidence also, from around 6,500 new cases in 2017 to at least 10,000 new cases in period 2030-2050.	Diabetes increases sensitivity to heat stress; medication and dietary needs may increase vulnerability during and after extreme weather events.	If recent trends continue, it is projected that more than 300,000 Albanians will be recorded with diabetes by a doctor (with population prevalence even higher) by 2050. Vjosa region will have its share of the increase with a least 10% (around 55,000 persons) of the population recorded with diabetes. It is estimated that more than 10,000 of them to need additional health care and experience additional health problems during extreme weather events caused by climate change. Fieri and Gjorokastra are projected to be the most affected regions.
Obesity	Prevalence of overweight and obesity in women has increased from 39% in 2008 to 45% in 2018.	Obesity increases sensitivity to high ambient temperatures.	Without a drastic change of the trend, it is expected that by 2031, 50% or more of the Albanian population will continue to be overweight or obese. This projection can be extrapolated to

			Vjosa Basin population, (which shows already highest risk in the country) to produce more than 250,000 persons. As in the case of hypertension, it may be estimated that by 2031, up to 50,000 individuals with obesity in Vjosa Basin would need additional health care because of higher temperatures. Gjirokastra is projected to be the most affected region.
Dementias	Based on observed trends in population ageing in Albania, it is expected that the prevalence of mental conditions and especially dementias will triple in 2050. This figure is only a fraction of other mental conditions.	Persons with dementias are vulnerable to extreme weather events that require evacuation or other emergency responses. They need constant care by specialized personnel or informal carers. Other mental conditions and especially depression	In Regions of Vjosa Basin are expected to be more than 5000 people with cognitive impairment by 2050. They and their families/carers will constitute an extremely vulnerable category of population in face of more extreme weather events. It can be estimated that, while the need for expensive support and services will double by 2030, only the influence of climate change scenarios, will increase the need by an additional 30%. Gjirokastra expected to be the most affected region. Women to be most vulnerable group as both sufferers and carers.
Depression and other mental illness	The indicator of depression based on primary health care or hospital registry although continuously increasing remain one of the lowest in Europe (less than 13/10,000), but population data on self-reported depression show it to be very high (stigma prevents people to ask for health care). Although risk is high also among youth, the demographic trends indicate doubling of the number of older people with mental illness in the coming 3 decades.	Mental illness may impair responses to extreme events. Depression is strongly associated to cardiovascular risk. Certain medications increase sensitivity to heat stress.	As depression prevalence has already increased, the risk is projected to increase. Extreme weather and higher temperatures are estimated to exacerbate health consequences (including heart disease and stroke) and increase health needs in 10% to 20% of people suffering from depression. This estimation, projected in relation to climate change scenarios in Vjosa Basin, will add by 2030, every year 1000- 2000 health care visits, as well as a similar number of cardiovascular episodes. Women to be the most vulnerable group.
Malignant melanoma and skin cancers	Although mortality has not been increasing significantly, the registered incidence of the malignant melanoma and skin cancers has increased multiple times during the last 20 years (on average 20% increase only in the last 5 years).	Solar ultraviolet radiation is a risk factor for melanoma and skin cancers. Increasing exposure is expected for at least first half of the century.	This trend is expected to continue with population health and health system consequences. While melanoma is a relatively rare cancer in Albania, it remains a deadly disease. Skin cancers are the most frequent category of cancer in Albania. It can be estimated that by 2030, in Vjosa regions, from 10-30 new skin cancers every year will be attributed to increased sun exposure. Fieri is expected to be the most affected region.

Children malnutrition	Prevalence of traditional malnutrition has been on decrease in Albania. The metrics of malnutrition in children (wasting and stunting) have almost halved during the last decade.	Malnutrition has the capacity to obstruct the immunity defences of human organism and while in short term, impair adaptation to extreme events, in longer term, increases general health vulnerability.	While the positive trend is projected to continue, climate change related food security and social vulnerability, may hamper, or even reverse the positive trend. If not mitigated by state interventions, it may be estimated that scenario of long-term draughts in Vjosa Basin regions will be responsible for at least 50 cases malnutrition in children every year.
Disabilities	There are around 140,000 persons who report disability and benefit social aid for it in the country.	Persons with disabilities may find it hard to respond when evacuation is required and when there is no available means of transportation or easy exit from residences	Based on existing demographic and non-communicable diseases trends, the number of disabilities is expected to increase by 50% to 80% during the coming 3 decades. In the Vjosa Basin there are proportionally more people with disabilities than national average; around 40,000 in 2019 and estimated at least 50,000 in 2030. It is estimated that at least 20% of them, or around 10,000 will have increased health and social care needs because of extreme health events caused by climate change. Gjirokastra will be the most affected region. Women are expected to be the most vulnerable group that may be affected by relevant health conditions and as carers.
Infectious and parasitic conditions	The infectious and parasitic diseases in Albania have shown to be in decline in terms of mortality mostly because of a decline in fertility rate and decreasing cohort of children. Albania Demographic and Health Survey (ADHS) 2018 data about acute respiratory infections and diarrhoea confirm this trend. Nevertheless, as demonstrated by the by the analysis included later in this report, these categories of diseases are associated to climate and are showing signs of re-emergence. With climate change their age standardized rate is projected to increase in Vjosa Basin regions.	Many infectious agents (salmonellas, noroviruses, rotaviruses etc), increase their circulation and virulence in warmer temperatures. Additionally, the vectors responsible for their transmission, are influenced by weather and climate changes, as it is the case for leptospirosis and other zoonosis.	With climate change the age standardized rate of a number of infectious and parasitic disease is projected to increase in Vjosa Basin regions. Gastroenteritis incidence in Albania show to be associated with almost 170 new cases per 100,000 inhabitants per year for summer temperatures 1 degree Celsius higher (see the section below for more details). This is translated in 250/100,000 excess rate for summer temperatures expected to increase 1.5 C^{o}. In Vjosa regions it may be estimated that, in the period 2030 to 2050, climate change to be responsible for around 1500 to 2500 new cases of gastroenteritis every year, in the higher temperatures scenario. To these cases it must be added a smaller number of other infectious or parasitic diseases. Fieri is expected to be the most affected region

Other climatologic events are also shown to influence the pattern of occurrence of some vector-related diseases in Vjosa Basin. Expanded geographic ranges of tick and parasite vectors due to climate change already are pushing infectious diseases into unfamiliar territory. Albania being in the Mediterranean area is subject to potential disease outbreaks of tropical origin such as Chikungunya, West Nile disease and malaria. The health impact currently seems small but could increase soon.

Climate related events such as droughts, fires, floods and other potentially extreme events will increase the risk for injuries and preventable deaths among the most vulnerable population groups.

The health system will likely feel the burden of additional health conditions with additional recourses needed. The extra burden should be considered beforehand because it will hinder the efforts of public health authorities for improving general indicators related to health and diseases.

4.6.9 Population and settlements

The Vjosa River basin contains three prefectures: Gjirokastër (60%), Vlore (25%), Fier (15%). The population in the Vjosa basin is about 130,000 inhabitants, concentrated in eight cities (Gjirokastër, Libohovë, Përmet, Këlcyrë, Tepelenë, Memaliaj, Vlorë and Selenicë), and several small villages. The average density of population in the Vjosa basin is lower than in other parts of Albania. In the western part of the basin (Vjosa downstream area) the population density is about 100-250 inhabitants/km², while in the upstream area of the basin is about 10-15 inhabitants/km².

Table 71: Population county level of VRB76

Regions	Year	2015	2016	2017	2018	2019	2020
Fier	Female	149,143	147,475	146,983	146,409	145,373	143,256
	Male	158,871	157,633	155,524	151,735	149,374	146,633
	Total	**308,014**	**305,108**	**302,507**	**298,144**	**294,747**	**289,889**
Gjirokaster	Female	34,133	33,403	32,748	31,843	31,365	30,453
	Male	35,424	34,617	33,191	31,109	30,058	28,928
	Total	**69,557**	**68,020**	**65,939**	**62,952**	**61,423**	**59,381**
Vlore	Female	92,359	92,257	92,945	94,077	94,332	94,113
	Male	96,040	95,776	95,850	95,205	94,979	94,809
	Total	**188,399**	**188,033**	**188,795**	**189,282**	**189,311**	**188,922**

Source: INSTAT demographic database 2015-2020

[76] In the VRB in the area is included the municipality of Kolonje, as part of the district of Korca, but it constitutes a very small , so, it is not considered. The data for Fieri belong to the entire prefecture, not that part of VRB.

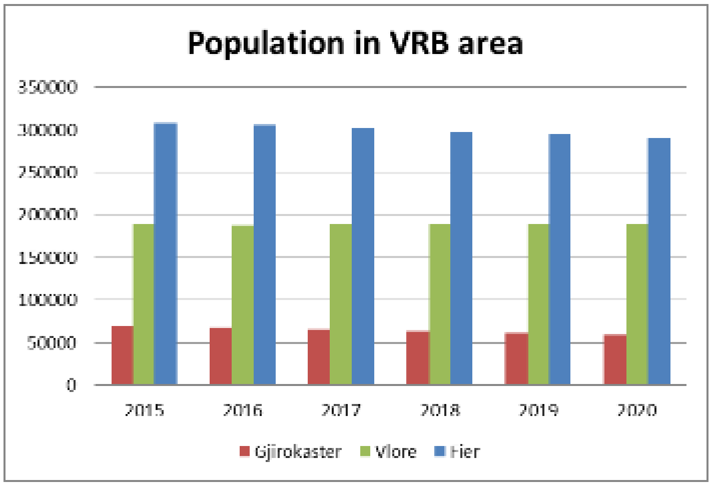


Figure 98: Population changes at prefecture level

After the 1990s, the population in the Vjosa Basin has been steadily declining (Table 71, Figure 98). This is mostly due to migration and emigration, but also due to reduced fertility.

An increase about 10-15% of the population in the main cities situated in the west side of Vjosa basin is registered, due to the migration of the population from the mountains to the hilly and plain areas. In the meantime, this urban migration caused a 70% decrease of the population in the mountainous areas.

These changes are expected to affect people's health, their living processes and their economic and recreative activities, but the accurate forecasting of the impact is difficult and, in some cases, impossible.

Taking into account the expected changes in climate, increase in maximum temperatures, heat waves and the intensification of droughts, people's living processes are expected to become more difficult and stressful, leading gradually to a deceleration of the rhythm and of the efficiency of social and economic activities, with an unavoidable impact in life quality (see also section 4.6.8- Health). Some main effects on population are summarized in Table 72.

Table 72: Summary of potential effects of changes in climate-related variables on population

Factor	Effects/Risks	Effects on population
Temperature	• Increased evaporation, • Increase in cooling degree days, • Increased occurrence of heat waves.	• Increased demand for electricity to cool down houses/buildings, • Increased demand for drinking water in the summer, • Accelerated decomposition of organisms and substances that pollute waters and food, favoring the spread dangerous diseases.
Precipitation	• Increased frequency of droughts	• Decreased water level in the water supply system,
	• Increased occurrence of floods, especially during winter, but also during fall and spring months.	• Destruction of settlements, infrastructure and natural environment.
Sea Level Rise	• Salinization of coastal aquifers, • Increased exposure of coastal areas to floods from storm surges and erosion.	• Decreased availability of freshwater, • Destruction of settlements, infrastructure and natural environment from floods and shoreline regression in low lying coastal areas and riverbeds, • Destruction of settlements, infrastructure and natural environment related to erosion and landslides in coastal areas.

Source: NDC

The increase of the number of days with high temperature (≥35°C) and heat wave and the intensification of dryness is expected to accelerate the decomposition of organisms and substances that pollute waters and food, favoring the presence of microbes, parasites and insects that cause and spread dangerous diseases.

Table 73: Summary of the vulnerability to and risks from changes in climate variables of population

Sectoral vulnerability factors	Risks for the sector
Lives and livelihoods • High population density in coastal areas, including in high-prone risk areas, • Vulnerability of settlements (detailed above).	Lives and livelihoods Climate related disasters may cause: • Loss of life and injury, • Destruction or damage to homes, • Limited access to services (water, electricity, health, education, etc.), • Loss and/or disruption of livelihoods resulting from climate-related disasters directly (e.g., flooding of plants) or indirectly (e.g., loss of access to essential services like electricity or transport).

Source: NDC

The most endangered by flooding from river and storm surges are the settlement areas located along the Vjosa River discharge (see section 4.6.7, Table 68 and Figure 95).

Table 74 and Table 75 show respectively summaries of potential effects of changes in climate-related variables and vulnerability to and risks from these changes on settlements.

Table 74: Summary of potential effects of changes in climate-related variables on settlements

Factor	Effects/Risks	Effect on settlement sector
Temperature	• Increased evaporation, • Increase in cooling degree days.	• Increased demand for electricity to cool down houses/buildings, • Increased demand for drinking water in the summer, • Decreased water level in hydroelectric reservoirs.
Precipitation	• Increased frequency of droughts • Increased occurrence of floods, especially during winter, but also during fall and spring months.	• Decreased water level in hydroelectric reservoirs and in the water supply system, • Destruction of settlements, infrastructure and natural environment.
Sea Level rise	• Salinization of coastal aquifers, • Increased exposure of coastal areas to floods from storm surges and erosion.	• Decrease availability of freshwater, • Destruction of settlements, infrastructure and natural environment from floods and shoreline regression in low lying coastal areas and riverbeds, • Destruction of settlements, infrastructure and natural environment related to erosion and landslides in coastal areas.

Table 75: Summary of the vulnerability to and risks from changes in climate variables of settlements

Sector	Sectoral vulnerability factors	Risks for the sector
Settlements	Infrastructure and built environment • Flatness of coastal area, • Density of housing, buildings, infrastructure, agricultural land, coastal historic/cultural sites, • Occupation of particularly flood and erosion high-prone coastal areas, • Limited flood prevention infrastructure • Poor maintenance of flood prevention infrastructure, • Erosion related to limited sediments from dammed rivers.	Infrastructure and built environment • Disasters cause settlements to lose access to essential services such as shelter, electricity, drinking water, transport, health and educational facilities, industries, touristic infrastructure, etc., • Loss of life and livelihoods from climate-related disasters, • Loss of land for future development.
	Water • Important losses in current water supply system, • Demand is naturally increasing.	Water • Diminished capacity to provide water to the population and industry / unfulfilled demand for water in the summer.
	Energy • High dependence on hydropower • Poor maintenance of energy, infrastructure / High rate of loss in distribution network.	Energy • Diminished capacity to provide power to the population and industry / unfulfilled demand for power in the summer.

4.6.10 Tourism

The total number of foreign visitors has increased significantly in recent years (Table 76), with an increase of 80% in 2016 compared to 2011 (total 4.58 million visitors in 2016 from 2.53 million visitors in 2011 (TNC data)[77]. In 2016, there was a 16% increase in foreign tourists visiting Albania compared to 2015. Tourism revenues in 2016 reached 1.528 billion euros, with a 13% increase compared to 2015. Travel and tourism investments in 2016 were ALL 28.9 billion[78].

Table 76: Arrivals of visitors in Albania by purpose of travel, 2014-2019

	2014	2015	2016	2017	2018	2019
Arrivals of foreign citizens	3,672,591	4,131,242	4,735,511	5,117,700	5,926,803	6,406,038
I. Personal	3,624,422	4,089,105	4,676,762	5,049,173	5,839,626	6,304,845
1. Holidays, visit to relatives, etc.	3,415,550	3,900,646	4,516,492	4,865,841	5,639,818	6,094,889
2.Health treatment	1,503	1,554	663	634	276	658
3. Religious	2,543	1,600	1,034	601	778	794
4.Tranzit	204,826	185,305	158,573	182,097	198,754	208,504
II. Business and professional	48,169	42,137	58,749	68,527	87,177	101,193

Source: INSTAT 2014-2019

[77] There is no specific available data according to municipalities since Census 2011, including the VRB area. Establishment of a monitoring, recording and archiving system for tourist movements by municipalities would greatly help in conducting more comprehensive studies and planning more efficient strategies in the field of tourism.
[78] https://turizmi.gov.al/turizmi-at-a-glance/

During 2018, the entries of foreign citizens were 15.8% more than in 2017. In 2019, the highest number of overnight stays was realized[79]:

- by areas close to the coast in the "Coastal Zone"[80] (58.8%)[81];

- by regions in the "Southern Region"[82] (33.8% or around 2,072,300 tourist presences).

During 2020 the Ministry of Tourism and Environment realized the field verification for the accommodation structures of the "hotels" category, officially registered for the coastal area. The data for the Southern region area are shown in Table 77.

Table 77: Accommodation units in 2020[83]

	Region					
	Berat	**Gjirokaster**	**Fier**	**Vlore**	**Korce**	**Total**
Hotels	35	52	54	297	59	497
Rooms	1,057	1,565	1,620	8,910	1,770	14,922
Beds	2,642	3,443	4,050	22,275	4,071	36,481

According to these data, during the entire tourist season (11 tours of 10 days), around 36,481 tourists might be accommodated in hotels, for a total of 4,012,910 overnight stays.

A proportion of tourists (national and foreigners) are accommodated in the rooms rented by local families, most of which are not declared to avoid taxes and other obligations. An even greater part is accommodated in their residences or at their parenting.

Impacts on tourism

The tourism sector should be affected both favourably and unfavourably by projected climate change. The "sun and sea" tourism prevalent in the coastal area currently takes place essentially in the months of July and August, as these present the best temperature and precipitation conditions for this type of tourism. Changes in these variables will favour an extension of the touristic season (Table 78). Figure 99 shows the annual course of TCI values, baseline and projected from different scenarios up to 2050 for Vlora area.

[79] INSTAT 2019

[80] *Coastal areas*: Administrative units bordering the coastline or AU that have at least 50% of their area at 10 km from the coastline.

[81] In general, from previous studies or referring to available data is possible to consider the % of visitors visiting the coastal area in relation to the total number of visitors is around 55-65% (E.Laci report for NC4).

[82] The Southern Region defined in the INSTAT data, refers to the regions of Berat, Fier, Gjirokaster, Korca and Vlora, thus including the area that coincided with the Vjosa river basin until the Decision of the Council of Ministers of 2019, then the region of Berat is no longer included and in fact the Korca region is included with only 1%.

[83] Ibidem

Table 78: Projected evolution of the Tourism Climate Index (TCI) for the VRB coastal area

TCI		Baseline	2030	2050
Good conditions	**60-70**	mid-March to mid-October	early March to early November	mid-February to early November
Very good conditions	**70-80**	end March - beginning of October	mid-March - mid October	mid-March to early October
Excellent conditions	**80-90**	Mid-April - end September	early April - beginning of October	beginning of April to end September

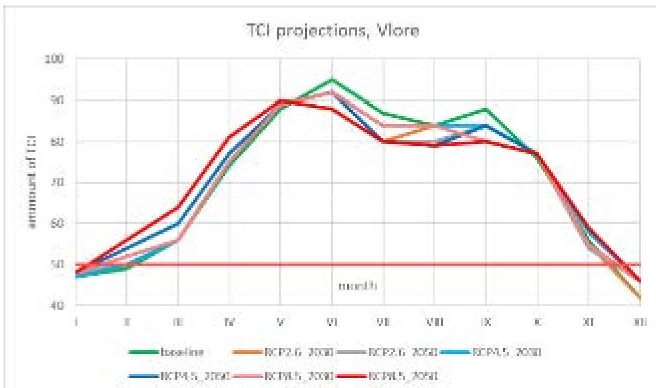


Figure 99: The annual course of TCI values, baseline and projected from different scenarios up to 2050

Similar projections result from the simulation of the TCI for the inner part of the VRB area. It is expected to have:

- good conditions: from end February mid-October to mid-February to early November (mid-November for RCP8.5)
- very good conditions from mid-March to early October
- and excellent conditions from beginning of April to end September.

A summary of potential impacts and risks from climate changes is given in Tables 79, 80).

Table 79: Summary of potential effects of changes in climate-related variables on tourism sector in the Albania coast

Factor	Effects/Risks	Effects on sectors
Temperature	• Increased evaporation, • Increase in cooling degree days. •	• Increased demand for electricity to cool down buildings, including hotels, restaurants, • Increased demand for drinking water in the summer, • Increased occurrence of heat waves.
Precipitation	• Increased frequency of droughts • Increased occurrence of floods, especially during winter, but also during fall and spring months.	• Decreased water level in the water supply system, • Destruction of settlements, infrastructure and natural environment.
SLR	• Salinization of coastal aquifers, • Increased vulnerability of coastal areas to floods from storm surges and erosion.	• Decreased availability of freshwater, • Destruction of settlements, infrastructure and natural environment from floods and shoreline regression in low lying coastal areas and riverbeds, • Destruction of settlements, infrastructure and natural environment related to erosion and landslides in coastal areas.

Table 80: Summary of the vulnerability to and risks from changes in climate variables tourism sector in the Albanian coast

Sectoral vulnerability factors	Risks for the sector
• Limited development of the tourism sector. • Touristic season concentrated in the months of July and August. • Touristic infrastructure (hotels, parks, etc.), supporting infrastructure (airports, roads, etc.) built in low-lying areas. • Vulnerability of settlements (detailed above).	• Decreased attractiveness of June-September due to high temperature, • Destruction or damage to touristic infrastructure (hotels, cultural sites, etc.), • Destruction or damage to supporting built environment (airports, roads, etc.), • Exposition of tourists to short term health effects (heat strokes, etc.), • Loss of beach area, • Damage to cultural heritage, • Destruction and degradation of biodiversity and natural landscapes.

Some potential impacts are detailed in Annex XI: Tourism. Referring the data for the Southern Region, are calculated the projections of tourists' number for VRB (Table 81).

Table 81: Prognosis of tourists' number in VRB during 2020-2050[84], [85]

Period	Mean annual rate	Change in tourists' number	Tourists by the end of the period
2019-2030	5.5 %	+113,977	3,326,050
2030-2050	0.5 %	+332.605	3,658,650

The potential lower increase in the number of visitors during 2030-2050 considers the following factors:

- the standards of accommodation structures and consequently the change of reception capacities for tourists (rooms with fewer beds, better conditions, increase of prices for accommodation, etc.[86]
- loss of beach area due to rising sea levels and marine erosion (esp. Vjosa discharge area along the Adriatic coast)
- change of beach standards (DCM 171, 2019), that will limit their carrying capacity (increasing their quality, space available for a tourist, additional services in addition to tourist, safety conditions and prices for use)
- through analysing the trend of visitors and accommodation capacities of neighbouring countries, which have gradually reached the point of saturation passing from mass tourism to quality and elite tourism.

In order to face the growing tourist fluxes in the future, it is necessary for the attending capacity to increase, following the rhythms of the increase of tourists' number, and to ameliorate, aiming to reach the EU countries' standards, Also mentioning the construction of Vlora airport, the completion of road

[84] E.Laci calculations, based on tourists' projection by Laci S. (TNC, 2014) and current developments in the tourism sector.
[85] In the calculation is not considered and will not be considered the year 2020, because it is an unusual year for the development of tourism
[86] in accordance with the decision No. 730, dated 20.10.2016 "On the Approval of the Regulation on Conditions, Criteria, Tariffs, Deadlines and Procedure for Classification of Accommodation Structures (Amended by DCM no. 370, dated 29.5.2019, no. 415, dated 19.6.2019)

axes that facilitate the movement of tourists, the construction of the yacht port and "Lungomare 3" in the Plazhi i Vjeter area and the conversion of this area into a tourist area (with new construction of hotels and resorts).

Compared to the one of hotels, the prognosis of rooms’ number is of a major interest since future tourists will have higher demands for accommodation and will prefer mostly single rooms and maximal commodity. This means that, under the conditions of climate changes and preparation of the country to attend a larger number of tourists from developed countries, the cost of the construction of tourist structures will increase, since it has to include a 24-hour water and electricity supply, thermo isolation, hydro isolation, energy for heating and cooling, facilities for sports and recreational activities, safe parking etc.

4.7 Adaptation Measures and Plans

In the period since the 3rd National Communication, Albania has continued its efforts to address the climate change adaptation in national and sector strategies and plans, legislation, management plans, etc. The analysis on the existing adaptation capacities is performed:

- At the country level, efforts to address the climate change adaptation in national and sector strategies and plans, legislation, management plans, etc. in Albania; and
- At the regional level, Vjosa River Basin, to cope with climate change impacts.

Annex XII indicates these efforts. Figure 100 shows the case of one implemented measure, the rehabilitation of the riverbank in Drinos River.

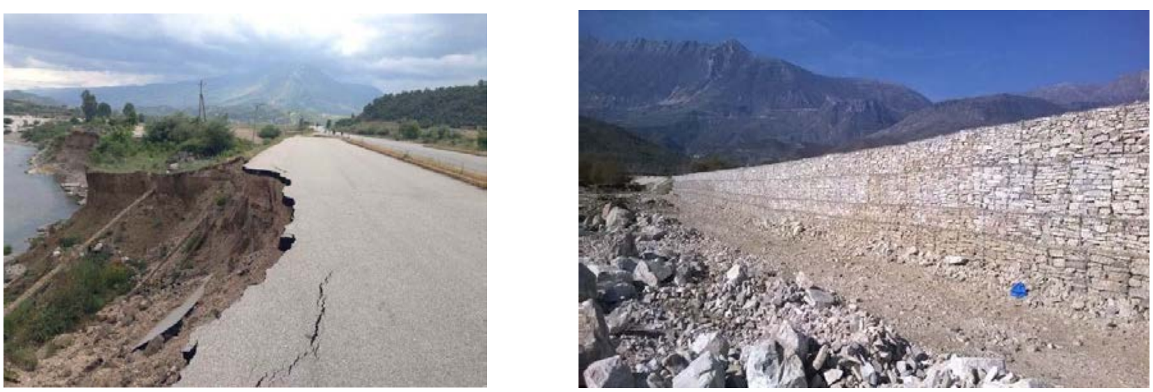


Figure 100: Riverbank erosion and flood protection on Drinos River

Source: EU Flood Protection Infrastructure Project – FPIP, Action 3rd

After the identification of expected impacts due to climate changes the vulnerability and adaptation team have proposed a long list of about 120 measures/actions economic sectors/ systems in VRB to cope with the expected changes of climate. An integrated adaptation plan is drafted for the VRB area using the prioritization methodology described in Annex IV.

Measures that strengthen the enabling environment have potential important development co-benefits, however their technical complexity and costs must be considered. Examples of such measures include:

- Policy and governance measures, such as:
  - Mainstreaming climate change adaptation into spatial/territorial development planning legislation, regulations, procedures and tools, including building codes (orientation of constructions in areas protected by floods and marine erosion)
  - New policies and regulations for the establishment of early warning systems for prevention and disaster risks and climate monitoring; the risk transfer through compensatory founding: Insurance, contingency funds etc.
  - Development/update the risk management plans at municipality level
- The increase of scientific, technical and social capacity, through research on and monitoring of physical, biological and social aspects, the erosion and degradation/desertification of forest/pastureland; vector-borne diseases, natural resources, etc.
- Provision of climate change delivery, including integrated Ecosystem-based Adaptation (EbA) and/or Nature-based Solutions (NbS), for example reforesting with vegetation resistant to high temperatures and humidity, such as forest belts of poplar, sallow, acacia etc. in the riversides, especially near the embankments to protect the soil from erosion; use of materials with high albedo and emissivity, cold roofs, cold materials in the construction of new housing complexes, hotels, service facilities;
- Strengthening of the disaster risk management, like the construction/rehabilitation of the drainage and irrigation systems.

Several measures that are very important for adaptation, such as those related to generating scientific evidence in support of decision-making, to climate-proofing infrastructure, or to disaster risk management are not highlighted as having a “very high priority” mainly due to their high technical complexity and costs.

Table 82: Integrated adaptation measures

Measures related to:			Actions	Potential implementation at scale	Importance
strengthening the enabling environment	policy governance	strengthen the institutional framework	Institutional and organizational strengthening of governmental structures, National Agencies (e.g., new established National Forestry Agency) and municipalities to mainstream climate change adaptation in their development plans.	National/VRB	**Very high**
		strengthen the policy framework	Implement National Climate Change Strategy and Action Plan.	National	**Very high**
			Develop a flood intervention strategy with a focus on the structural investments, like rehabilitation and modernization of existing infrastructure related to irrigation; of embankments, of the drainage system for the agriculture areas, other structural interventions in order to minimize the flood damages in the risked areas.	National/VRB	**Very high**
			Enforcement of (revised) national, territorial and sector level legislation and regulations (water resources, soil erosion, agriculture, forest and biodiversity protection building codes, etc.).	National/at municipality level in VRB	**High**
			Mainstreaming climate change adaptation into spatial/territorial development planning legislation, regulations, procedures and tools, including building codes (orientation of constructions in areas protected by floods and marine erosion).	National	**Very high**
			Mainstreaming climate change adaptation into national cross-sectoral development planning legislation, regulations, procedures and tools.	National	**High**
			New policies and regulations for the establishment of early warning systems for prevention and disaster risks and climate monitoring; the risk transfer through compensatory founding: Insurance, contingency funds etc.	National	**Very high**
			Development/update the risk management plans at municipality level.	VRB /National	**Very high**
			Integrate health prospective, approaches and issues at all current and future climate change policies so to ensure potentiating of benefits and minimizing harms.	National	**High**
strengthening the	policy	increase funding	Developing insurance schemes (including crop insurance schemes) and social	National	**High**

enabling environment	governance	for climate change adaptation, financing and fiscal planning	protection systems for climate change-related disasters.		
			Fiscal preparation, including an emergency fund for disaster risk response, recovery and reconstruction; including DR preparedness and for relocation).	National	**High**
			Establishment of incentives and subsidies for climate smart practices (e.g., climate proofing buildings, energy efficient technologies).	National	**Very high**
			Establishment of payment schemes on ecosystem services.	National	**High**
			Increase the financial support to municipalities for intervention in the secondary and tertiary drainage channels.	VRB	**High**
strengthening the enabling environment	scientific, technical and social capacity	generating scientific evidence to support decision-making on CCA	Support research on and monitoring of physical, biological and social aspects, including climate-related variables (climate trends, sea level and extreme weather events), the erosion (especially coastal erosion) and degradation/desertification of forest/pasture land; vector-borne diseases, natural resources (e.g. water and food quantity and quality, air quality), the built environment (e.g. location, density) and socio-economic and demographic aspects, including the modernization of monitoring equipment and systems.	National & VRB	**Very high**
			Improve the data infrastructure for the data collection, validations, conservation, and analysis.	National & VRB	**Very high**
			Support research on assessment of the climate related vulnerability & risks; develop the risk maps, at the territorial and sectoral levels.	National & VRB	**Very high**
			Ensure effective communication of monitoring information to relevant sectoral and territorial actors, including through the development of end-to-end, people-centred and multi-hazard early warning (MHEW), including on floods; education and training of farmers via extension services (new technology and knowledge-based farming practices to cope with climate change).	National & VRB	**Very high**
			Monitor and assess the implementation and results of adaptation programmes, projects and actions, ensuring the engagement of women in this process.	National & VRB	**Very high**
			Adapting and integrating surveillance and control systems for selected communicable diseases and vectors likely to be affected by climate change.	National & VRB	**Medium**

strengthening the enabling environment	scientific, technical and social capacity	enhancing technical capacity	Build/enhance the capacities of local and national institutions, stakeholders (including the private sector), through trainings, best practices and lessons learnt on climate change and integrated adaptation actions in different sectors/systems to cope with climate change impacts (e.g., water resources and energy, ecosystems, buildings, tourism, health, disaster risk reduction).	national and local scale	**Very high**
		awareness raising	Increase the public awareness on climate changes, its related impact/risks and the design, implementation, monitoring and evaluation of adaptation actions (e.g., heat waves related, disaster risk management, waste recycling, etc.).	National/Vjosa River Basin, especially in the frequent flooded areas.	**Very high**
	climate change delivery	water	Rehabilitation, expansion and creation of infrastructure for water supply considering the climate change. Water demand management through reuse, securing new water reserves, rainwater, desalination, etc	National/Vjosa River Basin	**Very high**
		agriculture	Monitoring of coastal erosion, sea saltwater intrusion, groundwater quality, vegetation change on coastal area of VRB.	Vjosa coastal area, national	**Very high**
			Improving water efficiency, irrigation infrastructure, fertilization and soil moisture conservation considering the impacts of climate change.	National & VRB	**Very high**
			Improve crop variety for most important crops, planting salt tolerant trees;	National & VRB	**Medium**
		forests	Monitoring of vegetation shifts and species composition	VRB area: Dhembel, Nemercke, Bureto, Mali I Gjere. Cike	**Medium**
			Improvements in fire detection, pest and diseases management on pine and plan trees;	VRB area: Kelcyre, Virua, Hotove, Sotire;	**Very high**
			management of invasive and alien species	National & VRB	**Medium**
			Priority afforestation and regeneration of burned forests, non-regenerated cutting areas, forest fertile areas, erosion and infertile terrains which are close to living areas;	VRB area: Langarica, Benca, Shushica	**High**
			Promote agroforestry practices and windbreak planting.	VRB area: Kardhiqi, Vergo, Syri I Kalter	**High**
			Facilitate the migration of forest tree species at higher altitude providing sylvicultural activities.	VRB area: Cika, Shendelli, Nemercke, Bureto	**Medium**

		Implementation of new forest management methods which have optimal ecological and economic effect (sylviculture through constant forest cover, close to nature forest management, ecological forestry and management of riparian forests;	VRB, National	**High**
		Use of appropriate forest practices in wetland afforestation.	Narta wetland and lagoons	**High**
	settlements	Use of materials with high albedo and emissivity, cold roofs, cold materials in the construction of new housing complexes, hotels, service facilities.	Urban/rural area of VRB; Coastal area of VRB, especially in coastline building	**Very high**
		Landscape restoration in river basins.	National	**High**
	protected areas	Strengthen the system of protected areas, including coastal and marine ecosystems; increase the surface of the surface of Protected Areas of the territory through the enhancement and their integrated management;	esp. coastal area and VRB area;	**High**
	adopt integrated EbA and/or NbS	Encourage afforestation and reforestation activities in abandoned and uncultivated land;	Whole VRB area;	**High**
		Reforesting with vegetation resistant to high temperatures and humidity, such as forest belts of poplar, sallow, acacia etc. in the riversides, especially near the embankments to protect the soil from erosion;	Whole VRB area;	**Very high**
		Managing current flood risks by maintaining green areas and natural buffers around streams in urban settings; building of natural and semi-natural areas; public green spaces, parks and gardens, etc.	VRB area: rivers and streams and wooded areas in urban areas, with special attention in the urban settlements of coastal VRB area	**Very high**
strengthening of the disaster risk management		Construction/rehabilitation of the drainage system.	National and whole VRB area	**Very high**
		Construction/rehabilitation of the irrigation system.	National & VRB area: from Mifoli bridge to the Vjosa mouth	**Very high**
		Construct/rehabilitate the embankments along Vjosa, Drino and Shushica rivers.	VRB area	**High**

	Engineering interventions for protection from coastal erosion, e.g. beach restoration, particularly beach nourishment and dune management to slow erosion rates; and structural methods of sand retention.	along Vjosa river delta	**High**
	Design and implementation of a plan for the repair and construction of mountain ambushes, on steep slopes;	Whole VRB area	**Medium**
	Control of watercourses deviation from small hydro power plants.	VRB area: Shushice, Pavlo, Bistrice, Bence	**High**
	Maintenance and deepening of the network of drainage channels in the Vjosa delta;	VRB area: Narta lowland	**High**

4.8 Constraints and Gaps in vulnerability and adaptation assessments

Like in the previous NCs, the climate change impact assessment remains one of the main challenges. Issues such as the lack of historical data for different sectors, lack of indicators and data regarding different hazards and disaster events obstruct a comprehensive and a cross cutting vulnerability and risk assessment.

It is quite evident that, in Albania, more than 90% of disasters are closely connected with meteorological conditions. Moreover, climate change is expected to increase the frequency and duration of extreme events, and it is still difficult to determine the exact extent of the impact that can be attributed solely to human induced climate change. This requires a multi-disciplinary framework and a cross cutting analyses that will allow to adopt the best adaptation options.

Table 83 summarizes some important constrains met by V&A team while conducting the vulnerability and adaptation assessment.

Table 83: Summary of constraints and gaps in vulnerability and adaptation assessments

Vulnerable area	Type of constraint/gap[a]	Description of constraint/gap	Future improvements
Addressing climate issues in different sectors/ systems	Data availability, especially gaps/lack of historical data.	Issues with completing analysis e.g., unable to fully use the sectorial data to run recommended software for the climate impact assessment.	Could work with line ministries, public institutions and local government to improve capacities on the collation of the required data.
	Lack of indicators and data regarding different hazards and disaster events	Difficulties in making a comprehensive and cross cutting vulnerability and risk assessment.	Increase the research capacities within public /academia/local institutions to undertake analysis related to the preparation of NCs.
Disaster Risk Reduction	Specific data availability.	Difficult to determine the exact extent of the impact that can be attributed solely to the impacts of human induced climate change.	Improve the capacities for collecting data on climate change impacts. Upgrade the existing national early warning systems with new and updated infrastructure.
Sea Level Rise	Challenge to predict the impacts of sea level rise along the Adriatic coast.	The area is tectonically active, and local uplift or subsidence could have a greater influence on coastal dynamics than climate induced sea level rise.	Continuous monitoring of the sea level.
Adaptation measures/ actions	Costing of measures.	Costing of proposed adaptation measures/actions goes beyond the scope of NC4.	Increase the capacities within relevant institutions to deal with costing of integrated measures proposed.

Research and Systematic Observation

5 Research and systematic observation

5.1 Systematic Observation

The Ministry of Tourism and Environment is responsible for Albania's climate change related activities, scientific evaluations, and leadership. An inter-ministerial Working Group on Climate Change (iMWGCC) was established as a permanent coordinating body for climate change issues. It is headed by the Deputy Minister of Environment at the political level and supported by nominated technical focal points in every related institution. Ministry of Tourism and Environment is also the national UNFCCC focal point and collaborates with an interdisciplinary and inter-institutional technical team established to fulfil Albania's duties as a UNFCCC member.

The national competent authority responsible for the task of compiling the GES inventory, is the National Environment Agency (AKM)[87]. The AKM collects and maintains climate-related data and information in the areas of energy, manufacturing, construction, fuel, mining and geology industries, forestry, agriculture and breeding, water management, waste management, health, transport, infrastructure (including road and rail infrastructure, ports, airports, pipelines, dams, water and sanitation), urban planning, land administration, tourism, education, emergencies and natural disasters.

AKM was established as a restructuring of the Environment and Forestry Agency in 2019. AKM mission is protecting, preserving and improving the environment as a vital asset for present and future generations, preventing and reducing risks to human life and health, ensuring and improving the quality of life, prudent and rational use of natural resources in the framework of sustainable development of the country. The functions of the National Environmental Agency are a) Ensuring environmental performance; b) Research and environmental knowledge; c) Environmental impact assessment and licensing; and d) Thematic inspection and control for compliance with legal requirements and environmental conditions.

The AKM laboratory has been fully renovated in accordance with the required standards of the iSO 170 25 quality manual. The number of air monitoring stations has been increased to 6 stations in 2014 enabling provision of a better picture of air quality across the country. Its River Monitoring Stations cover the Drini, MAti, Ishëm-Erzen, Shkumbin, Seman, and Vjosa Basins. Its Lake Monitoring Stations cover the Lakes of Shkodra, Oheri, Prespa, and Butrinti Lagoon. Finally, its coastal monitoring stations cover the coastal areas of Velipoja, Shengji , Tale, Gjiri i Lalzit, Durres-Kavaja, Qerret – Spille, Divjake – Seman, Zvernec, Vlora, Orikum, Dhërmi, Himara, Qeparo, Borsh, Saranda, and Ksamil. Maps of different environmental monitoring aspects are available at the Agency webpage[88].

The first organized hydro-meteorological network was established in Albania in the early 1930's, although the first meteorological data had been recorded in October 1868 at the Durrës Station and in 1888 at Shkodra station. In 1949 the Directorate of Hydro-meteorological Service was created under the jurisdiction of the institute of Sciences, followed by the Hydro-meteorological institute (HMI), under the Albanian Academy of Sciences. Since 2011 the monitoring task has been held by the Institute of Geosciences, Energy, Water and Environment (IGJEUM) under the Polytechnic University of Tirana, which was created through the merger of some research institution[89].

The national meteorological network in the republic of Albania consists of 120 meteorological stations, of which 23 are climatological stations, 23 pluviometric posts, 74 thermometric posts, and a

[87] The National Climate Change Strategy (2019) describes the monitoring and reporting system of emissions in Albania.

[88] https://akm.gov.al/monitorime/

[89] More information on IGJEUM, its climate research and monitoring activities are included in the next session.

simple meteorological radar center. 13 phenological stations measure periodic biological phenomena. In the recent years the monitoring system has been upgraded with the addition of 29 automated meteorological stations. In addition, the hydro-meteorological archive contains around 480 long term meteorological and hydrological series, a part of which is still in analogue form and not digitized. Through the project Climate change adaptation in the Western Balkans (2012-2018), 9 Hydro-meteorological stations have been purchased and installed in the Albanian part of the Drin Basin to enable early flood warning in the Drin-Buna catchment area.

A global knowledge platform on climate change is the Climate Change Knowledge Portal. The CCKP provides global data on historical and future climate, vulnerabilities, and impacts. It presents data on every country of the world on climate profile, climate projections and other indicators. It summarizes high-level information for Albania's climate zones and its seasonal cycle for mean temperature and precipitation for the latest climatology, for the period 1991-2020.

Several types of constraints and gaps have been noted in the observation and monitoring system. It is critical to perform comparative analysis of the existing institutional and legislative arrangements for hydro-meteorological services, and upgrade and modernize hydro-meteorological observation networks, data management and forecasting systems, as well as providing sustainable organizational, human and technical resources to maintain and operate them. To support risk assessment and early warning systems, and promote operational monitoring, warning, forecasting and mapping of meteorological, hydrological and climate-related hazards, there is a need to establish and invest in fully operational 24/7 hydro-meteorological services (technical and human resources). It is also necessary to strengthen the early warning capacity with a multi-hazard approach and engender enhanced cooperation with the National Agency for Civil Protection and other key stakeholders. The World Bank Report Climate Risk Albania Profile further highlights the need for the increase of available data and modelling capabilities to support continued monitoring, reporting and verification of greenhouse gas reduction efforts and CDM activities.

5.2 Research on climate change

Research on climate change in Albania is still at its pioneering phase. Even though climate has entered the lexicon of the research community, especially through the education system, research outputs in the field of climate, energy efficiency, and environmental management in general are very limited.

Anyhow, some developments within the research communities have created more space and motivation for embracing a research path in the field. EU assistance programs in the field of research and education, such as Erasmus +, Horizon etc., strongly emphasize proposals in the field of the climate change, innovation, technological development, energy efficiency, etc. In fact, climate action is at the heart of the European Green Deal– an ambitious package of measures ranging from ambitiously cutting greenhouse gas emissions, to investing in cutting-edge research and innovation, to preserving Europe's natural environment. The European Climate Pact is an EU-wide initiative inviting people, communities and organisations to participate in climate action and build a greener Europe. The Pact is an EU-wide initiative that invites people, communities and organizations to connect and share knowledge, learn about climate change and develop, implement and scale up solutions. The New European Bauhaus is a creative and interdisciplinary initiative that connects the European Green Deal to our living spaces and experiences. The New European Bauhaus initiative calls on different kinds of stakeholders to imagine and build together a sustainable and inclusive future. In Albania, one important step towards enhancing research and projects in the field, is the signing of the agreement for the full participation of Albanian research institutions in the "Horizon Union" program focused on research and innovation in December 2021. It opens new paths for engaging in and initiating projects with EU assistance.

The National Agency for Scientific Research, Technology and Innovation (NASRI) is a public legal institution under the Ministry of Education, Sports and Youth. NASRI was established based on DCM no. 607, dated 31.08.2016 "On the Establishment, Composition, Organization and Functioning of the National Agency for Scientific Research, Technology and Innovation". The establishment of NASRI public entity for supporting research community aimed at building a modern system of science, strengthen scientific and technological research, and integrate them into the higher education system. It also aims at supporting research communities in Albania and abroad in applying in EU programs, such as the Horizon. The collaboration enhanced through NASRI aims at serving the sustainable development of the country, in accordance with national priorities, development of scientific and technological policies and management of Research and Development of line institutions. In its yearly call for national projects, biodiversity, environment, water and energy are claimed as priority fields for application by research institutions.

The main research institutions in Albania include the Academy of Sciences and Universities (public and private), including their affiliated entities. In addition, national and International NGOs have influenced the establishment of the national innovation, technology transfer and R&D infrastructure through awareness raising in climate change and sustainable development.

The Academy of Sciences is the highest public institution that represents and carries the best values of science, scientific research, creativity and debate and interaction of scientific communities throughout the country. The Academy is an autonomous institution in the field of research, which supports its activity in scientific evidence and for the benefit of the country. It produces its own autonomous publications as well as a scientific journal, entitled: Journal of Natural and Technical Sciences. This Journal is a multidisciplinary publication devoted to all field of Natural and Technical Sciences. The types of contributions published in the Journal include research papers, shorts communications, reviews and book reviews, discussions and announcements. From a systematic review of publications from the Academy since 2016, it can be observed a stronger focus on sciences such as linguistics, seismology, history, literature and geography. Few publications related to climate change can be highlighted:

- Group of Authors (2020) The Alternative of renewable energy (Alternativa të energjisë së ripërtëritshme). ISBN: 978-9928-339-22-5. Pp. 545
- Alfred Frasheri, Salvatore Bushati (2017) Geothermal energy use for space heating & cooling in Albania and the directives of european union. JNTS (2) XXII (44), http://akad.gov.al/ash/pdf/periodike/07_jnts_2_2017_new.pdf
- Ylber Muceku, Vasil Leka, Klaudio Peqini, Edmond Goskolli, Olgert Jaupaj (2019) Ground Subsidence triggered by Mining Activity in Urban and Rural Areas of Albania, Analysis and Geoenvironmental Impacts. JNTS, 2, ISSN 2409-0484) http://akad.gov.al/ash/pdf/periodike/JNTS-2019-v49-02-Muceku+.pdf
- Enida Sheme, Neki Frashëri (2016) Using renewable energy to supply datacenters: A case study for Albania, XXI (1) http://akad.gov.al/ash/pdf/periodike/JNTS%202016-1-web.pdf

The role of education institutions in producing valuable research is continuously being recognized and required within national strategies. According to the national Strategy for Development and integration 2016-2020 endorsed on 11th May 2016, improvements have been achieved in the legal and institutional framework with the adoption of the Law on Higher Education and the revision of the Law on the Academy of Sciences. Reforming the Academy of Sciences enabled the integration of research institutes of the Academy of Sciences and of line ministries into public universities. The higher education system was integrated with the research system by creating a modern institutional framework for rapid development of research and technology and knowledge transfer.

Based on a systematic review of doctoral (PhD) thesis published in the three main Universities of Albania since 2016, some conclusions on the role of public universities in producing research on climate change can be drawn. The systematic review followed some main principles: it listed the thesis from 2016 and looked through the title and content for selected key words, such as climate, energy efficiency, renewables and disasters.

The Polytechnic University of Tirana has published more PhD thesis related to climate change compared to the other two universities. The topics are mostly related to energy efficiency, even though selected works on sustainable urban planning and disaster modelling refer to climate, mitigation and adaptation action. In addition, the Institute of Geosciences, Energy, Water and Environment (IGJEUM) is a research institute of the Polytechnic University of Tirana. In terms of organization it is divided into four main departments: Department of Hydrology, Department of Geology, Department of Climate and Environment and the Department of Seismology. The Department of Climate and Environment mission is to monitor and study the climate assets of Albania, for a more rational and complex use of them, preserving the ecological values. This department also deals with the study of air and water quality in Albania. It includes three research groups: the research group of climate studies; the operational meteorology research group; and the research group of environmental assessment. A Monthly Climate Bulletin[90] is prepared by the Department of Climate and Environment of IGJEUM, which aims to provide scientific information on the meteorological situation of each month, as well as, in the climatic context, to provide estimates on climate change and its impact in Albania. Other Bulletins, the Wildfire Risk Bulletin and the Hydro-Meteorological Risk Bulletin are also published by IGJEUM and relate to climate risks and their impacts.

The University of Tirana has published some thesis in economics, which refer to sustainable economic development, as well as environmental management. The relationship with climate change is discussed within these theses. Finally, the Agriculture University of Tirana has published more specific theses on climate change and its impact in several areas on Albania. In addition, at AUT some PhD programs have a particular focus on environment, hydrology, climate impacts and natural disasters. A list of the PhD theses selected and reviewed for the purposes of this analysis are summarized in Table 84 (2016-2022)[91].

Table 84: List of PhD Thesis related to climate change, energy efficiency and renewables published by Public Higher Education Institutions in Albania (2016-2022)

Title of dissertation	Original title	Year of Publication	URL	Research Institution
Assessment of the level of anthropogenic aerosols in the atmosphere of Tirana and their impact on the potential of solar energy	Vlerësimi i nivelit të aerosolëve antropogjenë në atmosferën e Tiranës dhe ndikimi i tyre në potencialin e energjisë diellore	2016	https://www.upt.al/images/stories/phd/Disertacioni_Urim%20Buzra.pdf	Polytechnic University of Tirana
Optimizing energy efficiency in data centers using renewable energies	Optimizimi i efiçencës energjitike në qendrat e të dhënave duke përdorur energjitë e rinovueshme	2016	https://www.fti.edu.al/data/pages/47/attach/enida_sheme_disertacioni.pdf	Polytechnic University of Tirana
Study of regional potentials of solar	Studimi i potencialeve rajonale të energjisë	2016	https://www.upt.al/images/stories/ph	Polytechnic University of

[90] https://www.geo.edu.al/newweb/?fq=brenda&gj=gj1&kid=4
[91] The list is not exhaustive

Title of dissertation	Original title	Year of Publication	URL	Research Institution
energy: solar collectors, the impact of physical and technological parameters on the effectiveness of their use in different regions of Albania	diellore: mbledhësit diellorë, ndikimi i parametrave fizikë e teknologjikë në efektivitetin e përdorimit të tyre në rajone të ndryshme të shqipërisë		d/Disertacion_Daniela%20Halili.pdf	Tirana
Network integration of 5kw photovoltaic system in the city of Tirana. Opportunities, energy potentials and feasibility	Integrimi në rrjet i sistemit fotovoltaik 5kw në qytetin e Tiranës. Mundësitë, potencialet energjitike dhe fisibiliteti	2016	https://www.upt.al/images/stories/phd/Dizertacion_Irma%20Berdufi.pdf	Polytechnic University of Tirana
Basic norms of the design process, their application in the realization of eco-neighborhoods in Albania through the zmeo methodology	Normativat bazë të procesit projektues aplikimi i tyre në realizimin e eko-lagjeve në shqipëri me anë të metodologjisë zmeo	2016	https://www.upt.al/images/stories/phd/Disertacion_Ermir%20Gjoka.pdf	Polytechnic University of Tirana
Network integration of 5 kW photovoltaic system in the city of Tirana: opportunities, energy potentials and feasibility:	Integrimi në rrjet i sistemit fotovoltaik 5 kW në qytetin e Tiranës : mundësitë, potencialet energjitike dhe fisibiliteti	2016	N/A	Polytechnic University of Tirana
On improving the energy performance of the housing stock in Tirana	Mbi përmirësimi e performancës energjitike të stokut të banesave në Tiranë	2017	https://www.upt.al/images/stories/phd/Disertacion_DritanProfka.pdf	Polytechnic University of Tirana
Study of energy potential, analysis of characteristics and assessment of feasibility of wind power generation in the Karaburun region	Studimi i potencialit energjetik, analiza e karakteristikave dhe vlerësimi fisibilitetit të prodhimit të energjisë elektrike me anë të erës në rajonin e karaburunit	2017	https://www.upt.al/images/stories/phd/Disertacioni_Eduart%20Serdari%2018.09.2017.pdf	Polytechnic University of Tirana
Energy behavior of buildings in Albania. Case study: stock, typology, consumption, optimal cost and the need for changes in the energy code for buildings under renovation	Sjellja energjitike e ndërtesave në shqiperi. Rast studimi: stoku, tipologjia, konsumi, kosto optimale si dhe nevoja për ndryshime në kodin energjitik për ndërtesat që rinovohen	2020	https://www.upt.al/images/stories/phd/disertacion%20gjergji%20simaku.pdf	Polytechnic University of Tirana
Study of flood forecasting in the western lowlands of Albania by means of hydrological modelling	Studimi i parashikimit të përmbytjeve në ultësirën perëndimore të shqipërisë me anën e modelimit hidrologjik	2020	https://www.upt.al/images/stories/phd/Disertacion%20Klodian_Zaimi.pdf	Polytechnic University of Tirana

Title of dissertation	Original title	Year of Publication	URL	Research Institution
Determining the dynamics of the flood map in the Buna River Basin	Përcaktimi i dinamikës së hartës së përmbytjeve në pellgun e lumit buna	2021	https://www.upt.al/images/stories/phd/Disertacion_Freskida%20Abazaj.pdf	Polytechnic University of Tirana
Mathematical modelling of floods from riverbeds, case study river Buna	Modelimi matematik i përmbytjeve nga shtretërit e lumenjve, rast studimi lumi Buna	2021	https://www.upt.al/images/stories/phd/Disertacion_Elona%20Abazi.pdf	Polytechnic University of Tirana
Improving urban thermal comfort in the built environment of coastal cities with Mediterranean climate	Përmirësimi i komfortit termik urban në ambientin e ndërtuar të qyteteve bregdetare me klimë mesdhetare	2022	https://www.upt.al/images/stories/phd/Teze%20Doktorate_Ani%20Tola.pdf	Polytechnic University of Tirana
Environmental aspects in the main regions of the oil and gas extraction and refining industry	Aspekte mjedisore në rajonet kryesore të industrisë nxjerrëse dhe përpunuese të naftës e gazit	2021	https://www.upt.al/images/stories/phd/Disertacion_Esmeralda%20_Zeqo.pdf	Polytechnic University of Tirana
Consumption and sustainable development – Case study of Tirana	Konsumi dhe zhvillimi i qëndrueshëm -Rast studimor Tirana	2017	https://unitir.edu.al/konsumi-dhe-zhvillimi-i-qendrueshem-rast-studimor-tirana/	University of Tirana
Analysis of risk management and uncertainty in oil projects	Analizae menaxhimit tëriskut dhe pasigurisë në projektet e naftës	2019	https://unitir.edu.al/analiza-e-menaxhimit-te-riskut-dhe-pasigurite-ne-projektet-e-naftes/	University of Tirana
Economic-environmental interaction in a comparative analysis Albania-countries of the region	Ndërveprimi ekonomi-mjedis në një analizë krahasuese Shqipëri-vendet e rajonit	2020	https://unitir.edu.al/nderveprimi-ekonomi-mjedis-ne-nje-analize-krahasuese-shqiperi-vendet-e-rajonit/	University of Tirana
Assessing the impact of climate change on the Kune-Vain-Tale & Patok-Fushëku-Ishëm coastal protected areas and determining measures to mitigate them	Vlerësimi i ndikimit të ndryshimeve klimatike në zonat e mbrojtura bregdetare Kune-Vain-Tale & Patok-Fushëkuqe-Ishëm dhe përcaktimi i masave për zbutjen e tyre	2016	https://drive.google.com/file/d/0B_JyotQ0Et9bMTlnNFpVbEhkcVE/edit?resourcekey=0-Yv_drBrDnujc4FnSpgCSuw	Agricultural University of Tirana

Title of dissertation	Original title	Year of Publication	URL	Research Institution
Energy balance, thermal comfort and respect for the environment when using windows and their materials	Bilanci energjitik, komforti termik dhe respektimi i mjedisit gjatë përdorimit të dritareve dhe materialeve të tyre	2016	https://drive.google.com/file/d/0B_JyotQ0Et9bUDBTUlVMVG1wZUE/edit?resourcekey=0-Tio5-bgSbdVGQkNHmAOuGw	Agricultural University of Tirana
Challenges of Albanian farmers in adapting to the effects of climate change (focus of the study-Shkodra Region)	Sfidat e fermerëve shqiptarë në përshtatjen ndaj efekteve të ndryshimit të klimës (fokusi i studimit-Rajoni i Shkodrës)	2018	N/A	Agricultural University of Tirana
Study of climate change and analysis of variability and climate trends through climate indicators in some areas of Albania	Studim i ndryshimeve klimatike dhe analiza e ndryshueshmerisë dhe tendencave të klimës nëpërmjet treguesve klimatikë në disa zona të Shqipërisë	2019	N/A	Agricultural University of Tirana
Albanian energy sector management and the impact of reforms - The 3rd energy package	Menaxhimi i sektorit energjitik shqiptar dhe ndikimi i reformave – Paketa 3-të energjitike	2021	https://www.uamd.edu.al/wp-content/uploads/2017/11/Ines-Jaho_Dizertacioni.pdf	Aleksander Moisiu University
Effects of decentralization policies in the field of natural resources - Forests and pastures	Efektet e politikave decentralizuese në fushën e burimeve natyrore - Pyje dhe kullota	2016	https://www.uamd.edu.al/new/wp-content/uploads/2016/08/final-TEMA_Zoica-ZHARKALLI.pdf	Aleksander Moisiu University
Climate change and Albania's challenge to Europe: From the perspective of International Law	Ndryshimi i klimës dhe sfida e Shqipërisë drejt Evropës : në këndvështrimin e së drejtës ndërkombëtare	2016	N/A	European University of Tirana

Finally, a review of publication listed in the research database google scholar since 2016, using the key words: climate change and Albania, shows lists of over 17500 results of contributions from the national and international research community referring (as main topic or complementary) to climate change policy, developments, and impacts in Albania. However, there are only 13 results of research work where the words climate change and Albania are in the title of the publication. Publications include journal articles, articles included in conference proceedings, books or book sessions and review articles.

Universities and their affiliated entities as well as other public and private institutions, such as the National Agency of Territorial Planning and other NGOs, have been engaging in research projects through EU programs and initiatives. Some of the projects addressing and contributing to research in the climate change and energy efficiency field include:

- Regional cooperation for the transnational ecosystem sustainable development - https://reconnect.hcmr.gr/
- BRIGAID Bridging the gap for innovations in disaster resilience (2016-2020) - http://brigaid.eu/
- FLEXITRANSTORE An Integrated Platform for Incresed FLEXIbility in smart TRANSmission grids with STORage Entities and large penetration of Renewable Energy Sources (2017-2021) - http://www.flexitranstore.eu/
- EUREMnext – Taking European EnergyManagers to next efficiency levels by implementing energy audit recommendations (2018-2021) - https://energymanager.eu/en/euremnext-project/
- EmpowerMed Empowering women to take action against energy poverty in the Mediterranean (2019-2023) - https://www.empowermed.eu/
- FARCROSS FAcilitating Regional CROSS-border Electricity Transmission through Innovation (2019-2023) - https://farcross.eu/
- ARSINOE Climate Resilient-Regions through Systemic Solutions and Innovations (2021-2025) - https://arsinoe-project.eu/

The partial progress in the research field of Albania highlights many gaps that must be addressed in the future. The World Bank Report on Albania Climate Risk Country Profile (2021) has identified some of these gaps, addressing the following recommendations:

- Conduct targeted research to define the economic and environmental impacts of Albania's carbon tax to determine effectiveness and scope for expansion
- Develop a risk transferring mechanisms for catastrophic events, which could be used to mobilize the private sector to address post-disaster costs or household recovery efforts
- Improve energy generating capabilities for hydropower by increased understanding of impacts to river flow due to precipitation reduction
- Enhance identification and validation of possible mitigation policies and measures in the target sectors in agreement with the sector policies and planning documents, as well as with the European Policy on Climate and Energy
- Education, awareness raising and information share

Education, awareness raising and information share

6 Education, awareness raising and information share

6.1 Education Framework on Climate Change

The National Strategy on Climate Change (2019) has recognized the need to work towards raising public awareness of climate change. It highlights that climate change still does not get the proper appreciation in public opinion, as climate awareness at all levels remains low and cooperation between all relevant stakeholders requires further strengthening. The approaches foreseen in the strategy aiming at increasing climate change awareness and communication, training and education, call for further major interventions. This includes capacity development activities at the central and local levels, as well as a communication strategy on climate change issues, addressed to the central and local levels, as well as public and private stakeholders. Achieving awareness through educational institutions is considered a priority of the development, outreach and engagement strategy on climate change. This includes designing educational modules on climate change and introducing campaigns in schools and incorporating knowledge on climate change into relevant curricula.

Education systems are much affected by climate change and its challenges. Climate change affects both the demand and supply side of education. The less developed communities are the ones who bear the costs of a damaged environment, and this also affects education provision. The changing climate affects the quality of education and jeopardizes the security of students and teachers involved in the process of teaching and learning. Disasters induced by climate change can damage or destroy school facilities and educational systems, threatening the physical safety and psychological well-being of communities. Migration of population due to climate threats, also causes the interruption of education supply. Furthermore, the economic impacts of disasters reduce school enrolment, as children are kept out of school to help their families cope with disaster consequences.

Despite being threatened by climate change, the education sector involves many adaptive capacities. Higher Education Institutions are the place where tomorrow's leaders are trained. Therefore, they have the chance to guide the action toward sustainability and climate change adaptation. Education has already been proven to have an impact on key issues of global importance, therefore it is important that its role is not overlooked.

There are many ways how sustainable development and climate change adaptation issues can be mainstreamed into education system. Education for Sustainable Development is a comprehensive and multidisciplinary tool that includes not only relevant content knowledge on climate change and other sustainability topics, but also focuses on the capacity of schools and education systems to become climate-proofed and resilient as well as sustainable and green. Sustainability education offers many opportunities, but at the same time poses many challenges. Education is a critical component of adaptive capacity. The way that people are educated and the content of education can provide the knowledge and skills needed for making informed decisions about how to adapt our lifestyle and choices to a changing environment. Teaching sustainability involves the interdisciplinary nature of the problems at stake. Moreover, teaching sustainability implies not only focusing on course content, but also to new ways of teaching that content. Pedagogy in sustainability field is therefore a complex issue. Finally, schools and education institutions should be made sustainable through green policies that promote sustainability through building and site design and maintenance, reducing this way their own ecological footprint. In summary, education system can affect climate change action by improving climate change literacy, addressing teaching and learning methodologies that foster a problem solving and critical thinking approach, and by making university services more sustainable and greener.

Although the role of education in addressing the challenges of climate change is being increasingly recognized, the capacity of education to contribute to adaptation and mitigation measures has yet to penetrate mainstream development thinking. This is particularly true for the Balkan region, including Albania. Western Balkan countries share a communist past which, to various extents, continues to affect their education systems. Cultural inflexibility, a traditional education system, and a generally restricted labour market are barriers for implementing such requirements in education system.

The concept of education on climate change and sustainable development is relatively new in Albania. The topics remain partially incorporated into different levels of the educational system. The need for Education for sustainable development and global citizenship has been recognized and highlighted in the 2030 Agenda for Sustainable Development. Environmental education and climate change are integrated into teaching and other school activities at pre-university levels of education. Climate change content is included within the subjects: education about society, biology, and geography. In addition, several extracurricular activities aim at raising environmental and climate awareness of pupils.

The Higher Education system presents further challenges in education on climate change. Currently, there are no higher education study programs in the field of Climate Change or Sustainable Development in Albania. However, in post-communist era (1990 to the present) higher education curricula have been heavily revised to incorporate the principles set forth in the Bologna Process. In addition, entirely new courses have been devised. The European Union has supported the higher education sector in the region through a broad range of projects and financing schemes, and most countries have reciprocated by = embracing western education practices, such as multidisciplinary or interdisciplinarity. The experience of EU countries in the sustainability field, has been a driver in enrolling a sustainability path in higher education in Albania. Joint initiatives, bringing together higher education institutions from EU and the Balkans, fostering collaboration and networking in the region and beyond, address both the integration goals of each country and serve the needs of joint, integrated, common action for sustainability. Some of the projects implemented at Higher Education Institutions addressing sustainability and climate action within the education system since 2016 include:

- Knowledge for a resilient society (2016-2020) - http://www.kforce.gradjevinans.net/
- Capacity building for Blue Growth and curriculum development of Marine Fishery in Albania (2019-2022) - http://almars-project.eu/
- Knowledge Triangle for Low Carbon Economies (2020-2023) - https://kalcea.com/
- Engineering curricula modernization in renewable energy in Albanian Universities 2020-2023 - https://engineproject.eu/
- Promoting Climate Change Adaptation and Disaster Risk Management in the framework of EU Integration (2020-2023) - https://climateanddisasters.feut.edu.al/
- Sustainable Development of Blue Economies through higher education and innovation in WBC (2020-2023) - https://www.bluewbc.eu/

While bachelor programs tend to be more traditional in terms of content and focus, postgraduate programs are making a concerted effort to diversify their content. The creation of master programs that straddle across faculties is evidence of that. This shift reflects the achievement of new skills, able to meet new community, government, and industry needs. To give some evidence on the development in the field, an overview of education content related to climate change offered in the three larger universities in Albania, namely University of Tirana, Polytechnic University of Tirana and Agricultural University of Tirana is given next.

One of the programs of study of interdisciplinary nature at The University of Tirana, Faculty of Economy, University of Tirana, was implemented in 2018 in the framework of an EU project called Knowledge for a Resilient Society. It includes sustainability topics in its curricula. The program of study is called Master of Science in Risk Management and includes topics related indirectly and directly to sustainability, such as disaster risk management, climate change adaptation, financial resilience toward hazards, disaster risk modelling, disaster risk evaluation, etc. This program of study is the only program in the country that includes a course on Climate Change Adaptation (Table 85). In addition, the Faculty of History and Philology, Department of Geography have several subject related to climate change in its program of studies. Under the Curriculum of the Bachelor Program in Geography a subject on Climato-geography and a subject on Environmental Policy are included. At Master Level, under the Curriculum of Master of Science in Geography, some subjects related to climate change are shown. Also at Master level, in other programs of studies, subjects related to Evaluation and Management of Natural Risks and Environmental Management are offered from the Department of Geography. Finally, the Faculty of Natural Sciences has several topics related to climate change under the curriculum of Master of Science in Environmental Biology and Professional Master of Environmental Biotechnology. Renewables and other environmental management topics are included in the curriculum of Bachelor and Master programs in Chemistry field.

Table 85 Programs of studies that include climate change topics at University of Tirana

Faculty	Study Program	Duration of studies:	ECTS	Website	Subjects related to climate change
Faculty of Economics	Master of Science in Risk Management	2 year (4 semesters)	120	https://feut.edu.al/programe-studimi/master/master-shkencor/161-manaxhim-risku	Disaster Risk Management (6 ECTS). Climate Change Adaptation (5 ECST). Energy Markets (5 ECTS)
Faculty of History and Philology	Bachelor in Geography	3 year (6 semesters)	180	https://www.fhf.edu.al/plani-mesimor-ne-gjeografi/	Climato-Geography Environmental Policy
Faculty of History and Philology	Master of Science in Geography	2 year (4 semesters)	120	https://www.fhf.edu.al/master-i-shkencave-ne-gjeografi/	Global Problems Geography. Valuation and Management of Environmental Resources. Environmental Problems in Albania Policies and Strategies for Sustainable Development. Management of Coastal Areas. Management of Protected Areas. Valuation and Management of Natural Risks;
Faculty of Natural Sciences	Master of Science in Environmental Biology	2 year (4 semesters)	120	https://fshn.edu.al/info/cikli-i-ii-master-shkencor	Ecosystem Ecology (5 ECTS). Biodiversity and its preservation (5 ECTS). Environmental Valuation and Management (6 ECTS)
Faculty of Natural Sciences	Professional Master of Environmental Biotechnology	1 year (2 semesters)	60	https://fshn.edu.al/info/cikli-i-ii-master-profesional	Marine environmental management and rehabilitation (6 ECTS). Evolution and conservation of biodiversity (7 ECTS)

The Polytechnic University of Tirana, within Environmental Engineering programs of studies at master level have several subjects related to the field (Table 86). Other courses related to environmental management and protection, renewables, natural resources engineering and natural resources management are included in the curriculum of the Faculty of Geology and Mining, under the Bachelor Diplomas of Earth Science Engineering, Natural Resources Engineering and Geoinformatics Engineering. Selected topics, indirectly related to climate change, such as urban regeneration and environmental planning, can be found in the content of the programs of studies of the Urban Planning Profile at the Faculty of Architecture and Urban Planning.

Table 86: Programs of studies that include climate change topics at Polytechnic University of Tirana

Faculty	Study Program	Duration of studies	ECTS	Website	Subjects related to climate change
Faculty of Civil Engineering	Master of Science in Environmental Energy	2 years (4 semesters)	120	www.fin.edu.al	Sustainable use of energy (5 ECTS). Environmental Risk Assessment (4 ECTS). Renewable energy (5 ECTS)
Faculty of Civil Engineering	Master of Science in Water Management and the Environment	2 years (4 semesters)	120	www.fin.edu.al	Coastal Protection (5 ECTS)
Faculty of Civil Engineering	Professional Master of Environmental Engineering	1 year (2 semesters)	60	www.fin.edu.al	Environmental Risk Assessment (2.5 ECTS). Renewable energy (5 ECTS). Sustainable use of energy (5 ECTS)

At the Agriculture University of Tirana, the Bachelor Program "Management of Natural Resources" includes several topics related to global change, ecosystem impact, pollution, renewables etc.). Within the Master Program in Renewable Energies, there is one subject dedicated to Climate Change and several related to renewables. In addition, within the curriculum of the Professional Master Rural and Environmental Sustainable Development and on the Professional Master of Environmental Management, some topics are indirectly related to Climate Change. Finally, other courses across different programs of studies related to the environment in general, forestry, sustainable tourism, and sustainable economic development touch upon climate change related issues, such as biodiversity, environmental protection, sustainable use of resources, etc.

Table 87: Programs of studies that include climate change topics at Agriculture University of Tirana

Faculty	Study Program	Duration of studies	ECTS	Website	Subjects related to climate change
Faculty of Agriculture and Environment	Bachelor in Natural Resources Management	3 years (6 semesters)	180	https://ubt.edu.al/bachelors/	Management of biological resources (6 ECTS) Aquatic systems and water resources management (6 ECTS) Global Changes and Ecosystem Adaptation (6 ECTS) Renewable energy (6 ECTS). Protected areas management (6 ECTS).

					Management of lagoons, wetlands and basins (4 ECTS)
Faculty of Agriculture and Environment	Master of Science in Renewable Energies	2 years (4 semesters)	120	https://ubt.edu.al/master-phd/	Renewable Energy Systems (6 ECTS). Environmental Impact and Climate Change (6 ECTS)
Faculty of Agriculture and Environment	Professional Master of Environmental Management. Professional Master in Sustainable Rural and Environmental Development	2 years (4 semesters)	120	https://ubt.edu.al/master-phd/	Sustainable energy planning (6 ECTS). Environmental Management and Auditing (6 ECTS). Management of Natural Resources (6 ECTS)

Other Public and Private Universities have also made progress in addressing climate change in their curriculum. I A review of the programs of studies in six public universities located in the main cities of Albania (Durres, Vlora, Gjirokastra, Korca, Elbasani and Shkodra) and in three private universities, identified the areas and programs of studies where climate issues are discussed. A summary of these programs and their relevant topics is given in table 88.

Table 88: Programs of studies that include climate change topics in other Higher Education Institutions in Albania

Higher Education Institution	Program of Studies	Subjects related to climate change
"Aleksander Xhuvani" University Elbasan	Bachelor in Business Administration and Engineering	Technology and Transport Economics (6 ECTS) Technology and Energy Economics (6 ECTS)
	Bachelor in Environmental Studies	Green Energy (3 ECTS) Socio-economic development in the environment (3 ECTS) Ecosystem Services and protected areas (5 ECTS)
	Master of Science in Environmental Protection	Protected areas sustainable development
"Aleksander Moisiu" University Durres	Sea / land transport manager Master Program	Climatology (5 ECTS)
	Bachelor in Economics	Environmental Economics (3 ECTS)
Luigj Gurakuqi" University Shkoder	Bachelor in Geography	Natural Risk Management (4 ECTS)
	Master of Science in Environmental Biology	Environmental Valuation and Management (7 ECTS)
	Master of Science Regional Studies in Geography	Atmospheric analysis (3 ECTS) Territorial Environmental Management (7 ECTS) Tourism space and sustainable development (4 ECTS)
POLIS University	Bachelor in Environmental Studies	Climatology (6 ECTS) Climate Change Workshop (3 ECTS) Environmental Policy (6 ECTS)

		Environmental and Sustainable Development Projects (3 ECTS) Energy Resources (3 ECTS)
	Master in Urban Environmental Management	Green Transition and Technology (6 ECTS) Environmental Impact Assessment (6 ECTS) Climate Change Workshop (3 ECTS) Coastal Zone Management (6 ECTS)
EPOKA University	Professional Master in Disaster Risk Management and Fire Safety in Civil Engineering	Flood Risk Assessment (7.5 ECTS)
Albanian University	Professional Master in Energy Systems	Modern renewable energy technologies (3 ECTS)

Further integration of the concepts of education for sustainable development in higher education in Albania has still a way to go. Initiatives and progress in this path have already started. Further development in this field, in line with EU experience in the education system, is strongly needed to support awareness raising and action towards climate change and its impacts.

6.2 Raising Awareness and Information Share

Current legislation and respectively Law no. 10431, dated 09.06.2011 "On Environmental Protection" has given great importance to the right to information by highlighting:

1. The right of the public to request environmental information and the obligation of the authorities to provide this information in a timely manner.

2. The obligation of public authorities to ensure that the public has every opportunity to be informed without making a request in advance, to be able to participate in the procedures for identifying the state of the environment, drafting and approving strategies, plans and programs related to environmental protection.

Chapter VII of the law stipulates the purpose, functioning of the environmental information system and the manner of its issuance. The establishment of the environmental information system serves for the protection and integrated management of the environment and its components, for the monitoring of the implementation of environmental policies, mutual reporting, at national and international level, and the provision of public information. This system is administered by the National Environmental Agency. The data contained in the environmental information system are guaranteed by the information collected by public authorities which are obliged to submit it periodically to the National Environmental Agency.

Environmental information is presented to the public in audio, visual, electronic, written or otherwise. Specifically, environmental information made public relates to:

- The state of the components of the environment, such as: air and atmosphere, water, land, landscape and natural areas
- Factors such as substances, energy, noise, radiation, vibration, unpleasant odours or waste, including radioactive waste, discharges into the air and water, and other discharges into the environment, which have or may have an impact on environmental components, referred to previous point

- Measures such as policies, legislation, plans, programs, environmental agreements, as well as activities that have or may have an impact on the components and factors referred to above, as well as measures or activities defined to protect these components
- Reports on the implementation of environmental legislation
- Cost-benefit analysis and other economic analysis, as well as forecasts used within the framework of measures and activities, referred to above
- The state and safety of human health

NGOs and International Organizations, and occasionally private companies, have been most active in the awareness raising campaign in the field of climate change and in general public information. One recent campaign (2021) led by The Ministry of Tourism and Environment, UNDP and One Telecommunication is the "Don't Chose Extinction" campaign. The centrepiece of the campaign is a short film that brings a ferocious, talking dinosaur called Frankie, to the United Nations' headquarters to urge more climate action from global leaders. Bursting into the iconic General Assembly Hall, famous for history-making speeches by leaders from around the world, the imposing dinosaur tells an audience of shocked and bewildered diplomats and dignitaries that "it's time humans stop making excuses and start making changes" to address the climate crisis. "At least we had an asteroid," the dinosaur warns, referring to the popular theory explaining dinosaurs' extinction 70 million years ago. "What's your excuse?".

Work to raise public awareness of climate change has contributed positively to the process of integrating climate change issues. However, the importance of climate change still does not get the proper appreciation in public opinion. Climate awareness at all levels remains low and cooperation between all relevant stakeholders requires further strengthening. The Climate Change Strategy of Albania (2019) claims the need for other major interventions regarding raising awareness. The need to improve awareness and understanding of projected climate change impacts within key sectors and with policy makers, commission risk assessments, and expand early warning systems is highlighted also as an information gap in the World Bank Risk Profile of Albania (2021). Capacity development activities at the central and local levels, as well as a communication strategy on climate change issues, addressed to the central and local levels, as well as public and private stakeholders is needed. This approach requires a comprehensive strategy for capacity development, outreach and engagement. The Action Plan for Climate Change (2019) lists the following areas of intervention:

1. Capacity development for state institutions.

- Providing institutional support for capacity building in the field of climate change at the Ministry of Tourism and Environment
- Improving communication between public institutions and disseminating climate information to them
- Conduct a training needs assessment and provide targeted training contributions to relevant staff of public institutions

2. Approaching work through educational institutions.

- Designing educational modules on climate change and introducing campaigns in schools
- Incorporating knowledge of climate change into relevant curricula.

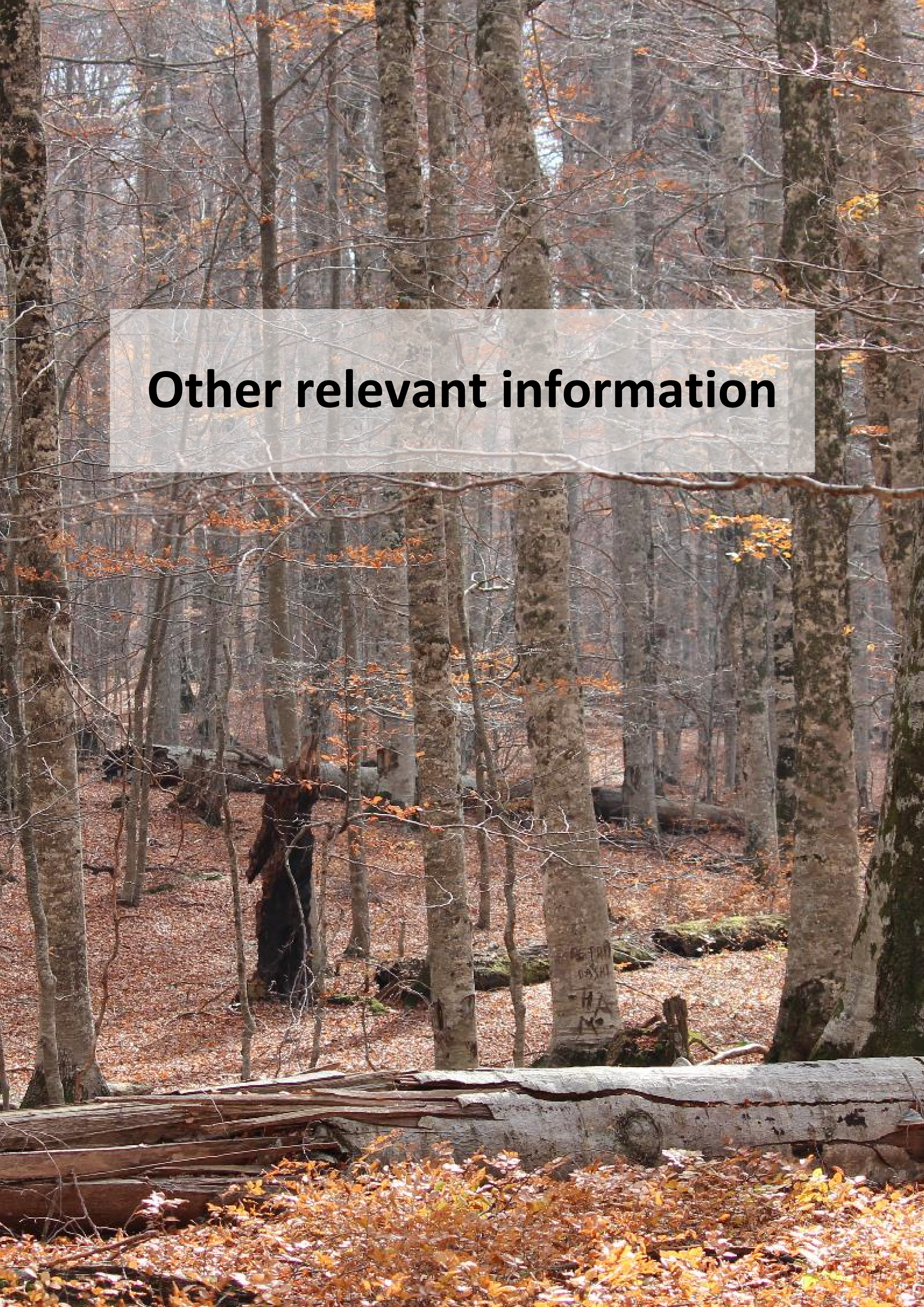
3. Approaching work and engagement with civil society.

- Development of an action plan for participation and approach work with the public
- Organizing public engagement and debate on adaptation-related activities
- Strengthening awareness through campaigns (media, civil society organizations, etc.)
- Development of concrete promotion activities (through competitions, public activities)

5. Dissemination of information to relevant economic sectors.

- Inclusion of climate information in support services for farmers.

Other relevant information



7 Other relevant information

7.1 Characteristics of mitigation policies

OECD (2008) outline the characteristics that mitigation policies should comprise: comprehensiveness, both in terms of addressing all GHG gases and in engaging the largest possible number of sectors, credibility and flexibility. When endorsed, the mitigation related strategy needs to be implemented as soon as possible. Some policy priorities directly related to mitigation efforts include:

- **Continuing to promote market reforms, such as more realistic market pricing in the energy and transportation sectors, that can accelerate economic growth while reducing growth in emissions.**

One way of addressing this priority is through environmental taxation. Environmental taxes are fees levied for the purposes of raising revenues and/or altering the behaviour of economic agents vis-à-vis the environment. They are the main market-based instruments of environmental policy. Examples of environmental taxes include fees on pollution emissions by factories, gasoline taxes, charges on environmentally damaging products and taxes on production inputs that damage the environment. The use of environmental taxes is believed to create a double dividend effect: (1) produce incentives for polluters to reduce environmental damages at lower costs – through the creation of a dynamic effect in market prices in the presence of competition, and (2) reduce the level of other distortionary taxes, such as income, payroll, and sales taxes, which distort labour supply and saving decisions.

- **Working together with other developing countries (non-annex 1 countries) through bilateral and multilateral programs aiming to improve investment environments and create stronger incentives for joint climate-friendly investments.**

EU assistance programs in the field of research, innovation and technology transfer strongly emphasize proposals in the field of the climate change and energy efficiency. In fact, climate action is at the heart of the European Green Deal, The European Climate Pact and the New European Bauhaus New paths for public institutions, public agencies and for the higher education community for engaging in and initiating projects with EU assistance is needed to address mitigation needs.

- **Creating cross-sector strategies between climate mitigation and other development priorities that will support policies which address both climate and local environmental needs.**

National strategies development needs a higher degree of collaboration between line institutions, as well as an understanding of the separate and joint nature of the process. Training and capacity building within the responsible institutions is needed for this purpose.

- **Improving and supporting renewable energy and energy efficiency strategies.**

Some developments related to the improvement and support of renewable energy and energy efficiency are listed in the next section, where a short description of relevant technological projects and developments is given.

7.2 Improvements and support of renewable energy and energy efficiency

7.2.1 Wind parks

There are many priority producers in Albania composed of small hydro power plants, solar PvPPs and Wind PPs, some of which are already in operation, while others are in the planning phase. Based on data collected by MIE supported by the EU Project "Support in the Energy Efficiency Sector and the

Renewable Energy Sources (RES) Development with Contract No: CNP-SER-2018-01", there are currently 173 HPPs, 11 PvPps and 0 WPPs in operation. Concessions/authorisations have been issued for 358 HPPs, 17 PvPps and 11 WPPs.

By the end of 2020, 11 companies have been licensed by the ERE to generate electricity from wind parks, with an installed capacity of about 886 MW, mainly in the coastal area from north of Lezha up to south of Saranda. No investment has started yet.

7.2.2 Photovoltaic Plants

The first bidding procedure (auction) was carried out for selecting the bidder for the development of the project for the construction of the photovoltaic plant for the generation of electricity with installed capacity of 50 MW, as part of the Support Measures, in the Akërni Zonë (Vlora) and the construction of additional capacity of 50 MW, which will not be part of the support measures.

The winning bid provides a 50 MW energy price of 59.9 euro/MW for 15 years and an additional capacity of 50 MW (100 MW in total) without support for energy purchases. The project will have a value of about 70 million euro and will generate additional employment. This project will be an important step in the diversification of energy resources in Albania.

Albania's state-owned power utility KESH plans to install a 12.9 MW floating solar power plant on the Vau i Dejes reservoir. The Vau i Dejes reservoir is part of HPP Vau i Dejes, one of three HPPs on the Drin River Cascade. KESH seeks to diversify its energy mix, which is almost entirely dependent on hydropower plants (HPPs). In August 2020, Albania signed a contract for the 140 MW Karavasta project with Voltalia, which would now be the biggest photovoltaic power plant of its kind in South-eastern Europe. The price achieved on auction for Karavasta is the lowest solar power price in Balkans. Voltalia has offered to sell electricity for just EUR 24.89 per MWh as the fixed price for half of the 140 MW for 15 years, while the contract is for 30 years.

During the first half of 2021, Albania will launch the third auction for the construction of a solar photovoltaic park, with a planned capacity of 100 MW located in Spitalla.

7.2.3 Photovoltaic energy supply as back up for three National park centres (2019)

This project was managed by INCA and funded by GEF SGP. The objective was to use solar energy at the Protected Areas information centers (Divjaka-Karavasta, Llogara and Theth). Photovoltaic solar panels will be installed on the roofs of the centres thus promoting not only the natural values of PAs but also the use of renewable energy by reducing CO_2 emissions and helping to mitigate climate change impacts.

7.2.4 Waste to Energy Plants

When the National Waste Management Strategy and Plan 2010-2025 was adopted, there were no incinerators in Albania. In 2017, the first Waste to Energy Plant was built and started to operate in Elbasan (140 ton/day). The Draft Strategic Policy Document and National Integrated Waste Management Plan 2018-2033 foresees the construction of two other incinerators: Fier (200 ton/day) and Tirana (920 tons/day). The incineration capacity installed and designed together is estimated at about 459,900 tonnes/year, i.e. at least 40% of the total waste generated in 2016 in the country.

Mitigation measures include all sectors described in previous parts of this report. The growth of the industry sector implies the identification of special mitigation measures. There are examples where policy has been effective, for instance, policy efforts to eliminate deforestation and boost reforestation are considered to contribute significantly to achieving the required mitigation goals.

While in the transport sector a serious reform, that would alter behaviour of the population in relation to their transport modalities, has not yet started. Most of the transportation problems originate in Tirana, the capital. After the fall of communism, the shift from public transportation and non-motorized modes towards private cars has led to a host of problems including enormous health and environmental damage. The capital was not designed to accommodate cars and is choked with traffic much of the day. The urban population endures high levels of air and noise pollution. Despite the mild weather and flat topography, for all but a few inhabitants bicycling is no longer considered an option, due to the heavy traffic. Recently, steps have been taken to deal with urban traffic and transport issues. Curb ramps for the handicapped and speed bumps are being installed, a few streets in the centre have been pedestrianized, and bicycle lanes and a low-tech bikesharing scheme have been introduced. However, low budgets, corruption, and an extremely politicized planning environment dominated by political parties are barriers to carrying out sustainable urban transport planning.

While discussing technological development and energy efficiency, it must be considered that future technologies could significantly alter the costs of mitigation policies. However, there is still much uncertainty regarding both the costs and the impacts of such policies and, therefore, the success of such policy efforts is difficult to quantify and evaluate, even in studies related to other countries.

7.3 Characteristics of vulnerability and adaptation assessment

Obviously, climate change is contributing to raising disaster risk. Analysing climate change risk in Albania is a significant challenge because more than 90% of all natural events that have taken place in Albanian over the last decades were caused by hydro-meteorological hazards. There is a very close link between climate change and disaster risk reduction given that climate change is expected to increase the incidents of extreme events. Climate change affects disaster risk in two ways: short-term climate variability and its extremes influence the range and frequency of shocks that society absorbs or adjusts to, whereas longer-term variability can lead to changes in the productive base of society, particularly in natural resource dependent economies (Parry and Carter, 1985). Adaptation strategies under these circumstances require a multi-disciplinary framework and a cross cutting analyses that will allow the country to adopt the best adaptation options.

Disasters are causing economic losses in Albania and the number of events is increasing in frequency leading to ever greater economic losses and environmental impact, as well as stretching the capacity of the national system (ministries, prefectures, and communes) to manage the growing number of emergencies, especially flooding events. It is known that heavy precipitation events cause flooding, but most floods are exacerbated by bad management of infrastructure and by secondary impacts. In fact, economic impacts of a disaster are usually grouped into three categories: direct, indirect, and macroeconomic effects (often called also secondary effects) (Menchler, 2005).

Direct economic damages are mostly the immediate damages or destruction of assets or "stocks", due to the event per se. The effects can be divided up into those to the private and public economic sectors. Another category of direct damages is the extra outlays of the public sector in matters of emergency spending to help the population during and immediately after a disaster event. The direct stock damages have indirect impacts on the "flow" of goods and services, i.e. indirect economic losses occur because of physical destruction affecting households and firms. Most important indirect economic impacts include diminished production/service due to interruption of economic activity; increased prices due to interruption of economic activity leading to reduction of household income; increased costs because of destroying roads, e.g. due to detours for distributing goods or going to work; loss or reduction of wages due to business interruption

It should also be considered that the social and environmental consequences also have economic repercussions. The reverse is also true for loss of business and livelihoods can affect human health and well-being. This makes it difficult to determine the exact extent of the impact that can be attributed solely to the impacts of climate change.

The ability of the legislative systems to keep pace with identifying and implementing adaptive measures is a challenge. This is evidenced by the national Strategy for DRR, which is waiting to be approved by the Parliament together. Current constraints centre on how to:

- Incorporate disaster risk reduction concerns into future planning and development.
- Develop effective national early Warning Systems for emergency plans for health risks of climate change.
- Raise awareness of the health risks from extreme weather and climate change.
- Enact and enforce legislation.
- Increase the capacity of adaptation and protection systems
- Implement a sustainable financial strategy that will affect the economic resilience capacity of an economy.

In fact, the economic resilience is conditioned by all the possible internal and external resources available to the government to respond to the event. Access to these resources has limitations and costs that must be considered depending on the macroeconomic and financial conditions of the country. The availability of the following options in case of a disaster event determines the economic resilience level:

- The insurance and reinsurance payments
- The reserve funds for disasters that the country has available during the evaluation year
- The funds that may be received as an aid and donations, public or private, national or international
- The possible value of new taxes that the country could collect in case of disasters
- The margin for budgetary reallocations of the country, which usually corresponds to the margin of discretion expenses available to the government
- The feasible value of external credit that the country could obtain from multilateral organisms and in the external capital market
- The internal credit the country may obtain from commercial and, at times, the Central Bank, signifying immediate liquidity.

Financial strategies for coping with the consequences of a climate related disaster are intended to ensure that individuals, businesses and governments have the resources necessary to manage the adverse financial and economic consequences of disasters, thereby enabling the critical funding of disaster response, recovery and reconstruction. The analysis of financial exposure of a country to disasters is an important part of its disaster risk and climate adaptation strategy. However, it is only one component of a comprehensive risk management strategy. Risk financing instruments against disaster risks can be categorized into risk transfer and risk spreading instruments. While the dominant risk financing instrument is a risk transfer by insurance and reinsurance, other non-market risk transfer instruments, e.g., collective loss sharing, are also available. In addition to traditional means of a financial strategy, today a strong emphasis is posed on the implementation of market-based instruments. The development and implementation of innovative environmental financing means, such as tradable population permits and payment for ecosystem services mechanism, is today at the core of international environmental financing policies.

Finally, the biggest challenge in the vulnerability and adaptation assessment is identifying the most appropriate adaptation measures due to the considerable uncertainty regarding future climate change impacts. Some measures to be considered is the incorporation of climate change and disaster risk reduction considerations into all aspects of policy planning and development, by:

- Developing a comprehensive climate change national adaptation plan and integrate such a plan at all levels and identify strategies at national, local levels
- Upgrading the existing national early warning systems with new and updated infrastructure (hardware and software). It is also imperative to develop emergency plans according to accurate assessment of the national hazards
- Improving coordination between government ministries responsible for CC and DRR
- Improving data availability and accessibility for all national institutes; institute of Geosciences, energy, Water and environment (hydrometer logical data), Albanian Geographical Survey, etc
- Building capacity to engage in policy dialogue and ensure participation of vulnerable groups in decision-making
- Bringing DRR and climate change adaptation into the educational system at all levels (awareness-raising)
- Mainstreaming climate change considerations into all economic activities
- Strengthening regional and international cooperation on DRM and CCA initiatives.

7.4 Capacity strengthening and needs

The capacity strengthening needs for various sectors were highlighted in each respective chapter of this National Communication. Many capacity needs were identified in innovation, R&D and technology transfer related to climate change. Due to Albania's pressing social and developmental needs, resources for climate change related activities remain scarce. The lack of qualified expertise within the country calls for support from international programs and organisations. This limited capacity in terms of human resources contribute to the inadequate public policies development, law implementation, and institutional coordination. As climate change is an interdisciplinary field, working in the field is therefore a complex issue. Usually, experts involved in climate change policy and action are required to work outside their own areas of expertise. They need to bring new content and methodologies to the process, to promote critical thinking and a needed problem-solving approach. Capacity strengthening should be focused in areas that improve climate change literacy, address new methodologies that foster a problem solving and critical thinking approach, and contribute to the development of more sustainable and greener goods and services.

Several project and international assistance programs have been implemented in Albania, dealing with legislation development, monitoring system development, risk assessment models, public awareness and education and other relevant fields have contributed to building capacities in the country. The next sessions describe shortly some of these projects and address how each of them has contributed to address the capacity strengthening need.

IBECA Project

This EU funded project (2015-2018) aimed to support the sustainable development of the country via improved environmental and climate change requirements and management by enabling Government Institutions to develop, implement and enforce environmental and climate change legislation to EU standards. Its component A was dedicated to increasing effectiveness of environmental and climate change strategy implementation by building and implementing a sector plan, as well as transposition and implementation of priority EU environmental and Climate Change Acquis. It also provided capacity building to the MoTE and NEA on the EU ETS Directive, MMR Regulation, etc.

This project included numerous discussions on the preparation of the Draft Climate Change Mitigation Strategy and Plan[92], Draft Law "On climate change", draft DCM "On monitoring and reporting of GHGs and other climate related information at the national level" until their finalisation.

ECRAN Project

Financed by the EU and managed by the European Commission in the period October 2013-September 2016, ECRAN assisted the beneficiary countries[34] in exchange of information and experience related to preparation for accession. It helped to strengthen regional cooperation between the EU candidate countries and potential candidates in the fields of environment and climate action and assisted their progress in the transposition and implementation of the EU environmental and climate Acquis.

ECRAN built on experience gained and results achieved by the RENA (Regional Environmental Network for Accession). The activities under its climate action component were implemented through a system of Working Groups and tasks as follows:

Group 1: Climate Policy Development and Building Climate Awareness: Capacity building on modelling, scenario development; capacity building on selected climate Acquis; national High-level seminars; practical hands-on assistance on low-carbon policy and legislative development.

Group 2: GHG Inventory Systems and the EU Monitoring Mechanism Regulation: Capacity building on GHG inventory process for the Energy Sector (CRF Sector 1) in line with the MMR and the UNFCCC; Capacity building on GHG inventory process for the other Sectors (CRF Sectors 2 - 6) in line with the MMR and the UNFCCC requirements.

Group 3: Emissions Trading: Regional Training Programme on the EU MMR and A&V Regulations; Training missions to EU Member States; ETS Implementation and ETS strategy and roadmap development

Group 4: Adaptation: Best practices on adaptation and regional training on vulnerability assessments; Support for the identification of adaptation options.

RIPAP Project

This EU funded project (August 2017-October 2018) supported the beneficiary countries[93] in the development of resource-efficient, low-emissions and climate-resilient economies. It provided capacity building in understanding and implementing climate mitigation actions, their impacts and co-benefits. It was designed to help beneficiaries understand and work towards meeting the Paris Agreement goals. It also acted as a regional focal point, enhancing cooperation through the exchange of information, best practices and relevant experiences.

The project had 3 components:

- Identifying climate policies and strategies to support implementation of IPA beneficiaries' commitments under the Paris climate agreement
- Assistance in preparing plans for capacity building on national GHG inventories

[92] Approved as part of the Strategic Documents and Plans on mitigation of GHGs and adaptation to climate change
[34] Albania, Bosnia and Herzegovina, Croatia, FyROM, Kosovo, Montenegro, Serbia and Turkey.
[93] Albania, Bosnia and Herzegovina, FyROM, Kosovo, Montenegro, Serbia and Turkey

- Strengthening Monitoring, Reporting, Verification and Accreditation (MRVA) for the EU ETS.

PRO NEWS Programme

The EU funded Programme for Improving National Early Warning System and Flood Prevention in Albania (PRO NEWS) (2017-2020) is a project managed by the EU Delegation to Albania. It aims to increase Albania's resilience to floods by strengthening its National Early Warning System, improving disaster prevention in line with EU practices, and assisting the country to access the European Union Civil Protection Mechanism. It provides training and capacity building to the Albanian General Directorate for Civil Emergencies (GDCE). Since the NC3 the following training activities have taken place in Albania:

Technical assistance workshop *(September 11th, 2019):* Experts from the PRO NEWS implementing consortium discussed and worked together on some of the main aspects concerned with countries' membership in the Union Civil Protection Mechanism, including joint hands-on exercise with the purpose to trigger reflections on the functioning of the Mechanism and improve knowledge of key operational features involving Albania as future participating state, including mission cycle implications, based also on the recently approved new civil protection law, and preparation for official meetings.

National Workshop on New Guidelines and Emergency Planning *(28 June 2018):* Besides GDCE, representatives of Albanian Prefectures and other national stakeholders on Emergency Planning in Albania, together with Consortium Partners (DPC, CIMA, REC) participated. The final version of the Guidelines for Prefectural Emergency Planning was presented and discussed, and final draft of Plans was completed.

Guidelines for the new Emergency Planning (*12-13 March 2017):* Besides GDCE, 12 representatives from Prefectures and other national stakeholders on Emergency Planning in Albania, together with Consortium Partners (DPC, CIMA, REC) participated. The final report on the Assessment on Emergency Plans to all the 12 Albanian Prefectures was presented. The results and the score cards related to the assessment of respective existing emergency plans were discussed with the purpose to jointly identify areas in need of attention and gaps to be filled. The workshop focused on the finalisation of the new guidelines for prefectural emergency planning. Participants jointly finalised the index of the proposed guidelines and discussed the envisaged contents in collaboration with relevant institutions.

National workshop Levelling up on Emergency Planning (*October 5th-6th, 2017):* Besides GDCE, representatives of the Albanian prefectures and other national stakeholders participated. They exchanged views and increased awareness on relevant good practices and finalise the assessment of existing emergency plans through a participatory approach. This workshop contributed to the overall goal of improving Albania's legal and institutional framework on Early Warning, Flood Management, Civil Protection and Emergency Planning.

Training course on the use of myDewetra 2.0 platform *(27th September 2017):* The training course was organised for the personnel of GDCE. The myDewetra 2.0 platform is a real-time integrated system for hydro-meteorological and marine environmental monitoring and forecasting, created by CIMA foundation, on behalf of the Italian Civil Protection Department). Since 2012, Dewetra platform is promoted by the Commission of Hydrology of the World Meteorological Organization as a system for improving flood forecasting and warning. Participants were given access to the platform and its operational tools (observational, forecasts and static data already available on the Dewetra) that can help to the procedures currently in place at GDCE for prediction, prevention and mitigation of natural disasters, with a particular emphasis to the early warning system.

SANE27 Project

This project (2018-2020) funded and implemented by the Swedish Environment Protection Agency "Supporting Negotiations for Environmental Chapter 27 (environment and climate change)" is supporting the GoA and the MoTE in particular to prepare for screening and the EU negotiation process on environment and climate change. It is also supporting the enhancement of the role of CSOs/NGOs within EU accession negotiations related to Environment and Climate Change. The work carried on Climate Change sub-chapter (preparation of Tables of Concordance, Screening Pre-Assessment documents, etc.) was done in full cooperation with MoTE staff and other related line ministries.

EU Flood Protection Infrastructure Project

This EU/UNDP financed project, implemented by UNDP was carried in the period September 2015-July 2017, covering the territories of Vlore, Fier, Gjirokaster, Berat, Korce, Selenice, Himare, Libohove. Project partners were the Ministry of Agriculture Rural Development and Water Administration (MARDWA) Institute of Geosciences, Energy, Water and Environment (IGEWE) National Territory Planning Agency (NTPA) Local government authorities in the respective flood-affected areas.

The overall objective is to strengthen resilience and disaster risk preparedness and prevention in southeast Albania in line with the post-disaster needs assessment following the February 2015 floods. Specifically, the Action will aim to:

- Restore key flood protection infrastructure to pre-floods levels to ensure protection of agricultural land and livelihoods and enable the resumption of economic activities and agricultural production in the identified priority regions of Vlore, Fier, Gjirokaster Berat and Korca
- Local authorities become aware of specific social impacts of disasters on vulnerable categories and capable to strengthen participatory preparedness and resilience capacities that respond to community expectations
- Local government actors, relevant institutions and communities in Vjosa area are informed and capable to understand climate related risks and undertake adaptive measures.

Biomass energy for productive use for small and medium enterprises (SMEs) in the olive oil sector

The objective of this GEF funded project (2016-2019) was to increase the use of biomass in industrial energy consumption for productive use through demonstrated use of modern biomass technologies in Small and Medium-sized Enterprises (SMEs) in the olive oil industry. Project Components include:

- Technology demonstrated for use of modern biomass technologies in industrial processes in Albania
- The enabling market and regulatory environment for biomass technology in industry created in Albania
- Monitoring and Evaluation and Knowledge Management.

The outcomes for the project were: 1) introducing the state-of-the-art olive pomace technologies for 15 pilot enterprise with an total investment of approximately 3 MUSD; preparing 50 bankable projects for other enterprises which are in negotiation with different banks for getting loans to implement the respective olive pomace technologies; and 3) the increased utilisation of industrial biomass waste for energy purposes through technological innovation to trigger transformation of the olive oil industry. Also the strengthened capacities on the application of modern biomass technologies for key actors in the policy and industrial sectors in the olive oil and other sectors with high replication potential. The project also developed a detailed assessment of the biomass potential for industrial uses and the way forward for replication and create a subsequent pipeline of projects helping to develop a supportive regulatory environment.

Building the resilience of Kune – Vaini Lagoon through ecosystem-based adaptation (EbA)

This is a GEF funded project (2016-2020). Its main objective is to increase the capacity of government and local communities living near the Kune – Vaini Lagoon System (KVLS) to adapt to climate change using an integrated suite of adaptation interventions, including Ecosystem-based Adaptation (EbA) approaches. The main components of the project are:

- Technical capacity to address climate change risks through EbA
- Demonstration of best practice and concrete EbA interventions in the Kune – Vaini lagoon system
- Awareness and knowledge on effective EbA.

Some of results that will be achieved are the increased national and local technical capacity to address climate change risks in coastal areas through EbA, and the increased ecosystem and livelihood resilience from flood and drought risk through pilot EbA demonstration activities in the Kune-Vaini lagoon system. The project aims to enhance the awareness of local and national stakeholders of climate change risks and the potential of EbA to increase the resilience of local communities to climate change.

Climate-friendly Integrated Solid Waste Management and Circular Economy Project (DKTI)

This is a BMZ-GIZ funded project (November 2016-2019). Its main objective is to improve solid waste management systems with particular consideration of climate aspects. The main project components are drafting and updating the National Integrated Solid Waste Management Strategy, including the waste management plan and potential cost sharing opportunities. It will also provide advice on the development of inspection and licensing tools for solid waste treatment plants as well as carry out human capacity development measures on national level and local level (Himara, Peqin and Rrogozhina).

Regional Project "Support Establishment and Advancement of Pollutant Release and Transfer Registers (PRTR) in Western Balkan Countries and in Moldova"

Funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, supervised by the German Environment Agency (UBA), and implemented by the Regional Environmental Center (REC), with the participation of Four Parties to PRTR Protocol: Albania, Serbia, FyROM[94], and Moldova. March 1, 2015 -February 28, 2017. The project provided training and study tours to the NEA.

Project objectives included the strengthening of the transparency and efficiency of PRTR reporting, and to build capacities of authorities responsible for regular reporting and operators. The project aimed to share experience and practical knowledge in sub-regional workshops to improve their practices in operating PRTRs. The project also provided support launching regular PRTR reporting in Albania by updating, testing and activating the formerly developed online reporting tool to start regular reporting and develop a publicly accessible PRTR website. The project improved implementation capacities by providing training to authorities and operators, developing guidance for operators and reporting entities.

[94] Today North Macedonia

Establishing Albania's Environmental Information Management and Monitoring System Aligned with the Global Reporting

This project (GEF and GoA funded) started in September 2019. The project is designed to strengthen the environmental monitoring and information management capacities in Albania by establishing an operational environmental information management and monitoring system (EIMMS). It will develop national capacities to align the national environmental information management and monitoring system with global environmental monitoring and reporting priorities, including compliance with the Multilateral Environment Agreements reporting obligations.

The main expected project outcome is to improve institutional and technical capacities to meet and sustain Rio Convention objectives and those of other MEAs. The project will work in the three following areas:

- Development of an EIMMS that will be able to integrate global environment commitments into planning and monitoring processes
- Development and application of standard indicators encompassing UNFCCC, CBD and CCD concerns and global environmental threats
- Enhancement of stakeholder capacity for information management (data collection and processing) of key global environment data and information utilisation (interpretation and reporting) at the national and local level.

The project has prepared the following documents: ROADMAP for establishing an operational environmental information management and monitoring system EIMMS; Assessment of Albania's National Capacities on Environmental Monitoring, developed the Technical Sheets for environmental indicators related to the three MEAs.

TRATOLOW (Transition towards low emissions and climate-resilient economy in the Western Balkans and Turkey)

The overall objective of the project is to contribute to climate change mitigation and adaptation and the development towards a resource-efficient, low emissions and climate-resilient economy. With the help of a European consortium, the European Commission is supporting the countries of the Western Balkans and Turkey in the areas of climate protection and adaptation to climate change.

NDC ASSIST II

Commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ), the GIZ project NDC Assist II supports selected member countries and actors of the NDC Partnership in financing and implementing their NDCs in a gender-inclusive manner. To this end, the project provides technical assistance and strategic advice on NDC financing and implementation strategies and on integrating climate aspects into economic stimulus programmes. Furthermore, the project will offer support to tailor made country needs such as climate mainstreaming in public finances, pilot activities that support the NDC implementation etc. Another key component of the project is the dissemination of knowledge and experience gained from activities at the country level with public and private partners, primarily using existing formats of the NDC Partnership. Finally, the project will provide tailored advice to partner countries on the design of green recovery instruments in response to the COVID-19 pandemic. As governments around the globe mobilize large volumes of public investment to combat economic damages caused by the pandemic, it is crucial to ensure that they do not sacrifice environmental and social benefits for a short-lived economic stimulus. Instead, they should reconcile economic recovery and the just transition to an environment friendly, gender-sensible and socially inclusive society and economy, thus reaping a two-fold benefit from the massive public investments and creating a long-term perspective of sustained green growth.

SANE27 II

This project comes as a continuation of SANE 27 first phase. The new phase called "Supporting Albanian Environmental Negotiations, Chapter 27 (Sane27) - Phase 2" is implemented by Brooks Hannas & Partners, funded by Sida and has essentially the same approach as in the first phase. The new program started on September 1st, 2021, with a two-month preparation period and a twenty-six-month implementation period. The purpose of the program is:

- Provide technical assistance to the Ministry of Tourism and Environment (MTE) for the review and negotiation of Chapter 27
- Provide technical assistance to the Ministry of Tourism and Environment (MTE) to identify planning needs and support the implementation of strategic planning documents.

The main beneficiary of the program will be the Ministry of Tourism and Environment with a special focus on the Department for Integration, Coordination, Agreements and Assistance (DICAA). However, all institutions and persons involved in the integration processes related to Chapter 27 will benefit from the program. The program will continue to have a close working relationship with all stakeholders and will also strive to establish sustainability. The program will engage a combination of international and national experts who will support project staff and beneficiaries in achieving results.

Advancing Albania's planning for medium and long-term adaptation through the development of a national adaptation planning (NAP) process

This project is designed to help the Government of Albania increase its capacity to address the country's climate change vulnerabilities. Specifically, this funding request will support Albania to develop a national plan for CCA through:

- The strengthening of a national mandate, strategy and steering mechanism that focuses on assessing and addressing capacity gaps (particularly in the priority sectors of tourism, urban development, agriculture, transport, and energy) – Outcome 1,
- The development of a NAP Strategy action plan document and its implementation plan – Outcome 2, and
- The development of financing, monitoring and evaluation strategies to ensure that capacities and funding options are institutionalized for the long-term sustainability of adaptation planning beyond the life of the project – Outcome 3.

7.5 Financing mechanisms

Together with the submission of Albania NDC Action Plan, the funding needs for its implementation were assessed through a large consultation process with the individual ministries and institutions that have the main responsibility concerning the accomplishment of the planned activities. The funding needed to implement the actions of the NDC Action Plan 2021 -2030 is estimated to be at 153.5 billion Lekë or 1,496 billion EUR. A summary of the costs and financial resources is presented in Table 89.

Table 89: Total estimated cost of implementing the NDC Action Plan 2021-2030 (000 ALL)

1	Cost of Adaptation Measures	Total Incremental Costs
1.1	Policy and governance	498,070.2

1.2	Scientific, technical, and societal capacity	2,511,509.9
1.3	Climate proofing residential and productive infrastructure, touristic accommodation and assets and health (and other social) facilities	984,000.0
1.4	Adapting the supporting built environment	192,468.5
1.5	Adopt integrated, ecosystem-based approaches (EbA) and/or nature-based solutions (NbS)	1,522,963.2
1.6	Promote climate-smart and sustainable agriculture, forestry, and fisheries	-
1.7	Strengthening disaster risk management	-
1.8	Promote gender equality in terms of climate change adaptation	45,509.4
	Sub-total	**5,754,521.1**
2	**Cost of Mitigation Measures**	
2.1	Energy	112,607,424.14
2.2	IPPU	32,717.00
2.3	Waste	13,611,435.40
2.4	Agriculture	152,858.50
2.5	LULUCF	21,361,832.99
	Sub-total	**147,766,268.03**
	Total	**153,520,789.12**

As noted in the table above, the mitigation measures account for 96% of the total estimated costs of the NDC Action Plan. The larger part of the cost is generated from the energy sector, which in total accounts for 76.2% of the mitigation measures, or 73% of the total NDC Action Plan. Measures in the energy sector are followed by the measures under the Emissions of the Land Use Change and Forestry area, which represent 14% of the total cost of the NDC Action Plan. This is explained by the fact that both energy and LULUCF involve big infrastructure investment projects. Funding the implementation of the NDC Action Plan will be realized through three sources, ***(i) the state budget (Government of Albania), (ii) donor contribution, and (iii) the private sector***.

Funding of adaptation and mitigation measures differs substantially. Per stakeholder, the private sector represents the greatest source of funds for the implementation of the NDC Action Plan, followed by the donors and the state budget, providing 54%, 24% and 22% of the total funds available. Per area, 90% of available funds are for mitigation and 10% for adaptation. The state budget and funding from the private sector focus on mitigation: 99.9% of the state budget available for the implementation of NDC Action Plan goes to mitigation; all the funding available from the private sector for the implementation of the NDC Action Plan goes to mitigation. The contribution of donors is more balanced regarding areas: 59% of their contribution goes to mitigation and 41% to adaptation. As a result of these shares, available funding on adaptation relies almost exclusively on donors, while available funding on mitigation comes from different sources: the private sector, the state budget and donors (15%, 6% and 4% of the required budget).

Overall, available financial resources represent 27% of the financial resources needed to implement the NDC Action Plan. This means that there is a funding gap of 73%. The funding gap is greater on mitigation than on adaptation: the funding gap represents 74% of the funds required to implement the mitigation measures in the NDC Action Plan, while it represents 28% of the funds required to implement the adaptation measures in the NDC Action Plan.

Such funding gap needs to be addressed through implementing a sustainable financing strategy.

Some selected financial instruments implemented in the country which aim at motivating investments in energy efficiency and renewables, are described in the following two sessions. Finally, some innovative financing mechanism for the purposes of raising funding through the private sector are described next.

Green Economy Financing Facility (GEFF)

In Autumn 2018, the GEFF was established in Albania, aiming to decrease energy consumption in the housing sector, reduce air pollution and improve the comfort of living by extending loans through partner banks to support investments in green technologies. The EU has allocated over €1.8 million for incentives for the GEFF Programme while the Union Bank and Fondi BESA have signed up as the first two local partner financial institutions, with credit lines worth in total €9 million.

Albanian households can select the technologies they wish to invest in items such as thermal insulation, double-glazed windows, high-efficiency boilers, heat pumps, solar collectors/solar water heaters and photovoltaic systems.

By investing in these measures, households will be eligible to apply for an EU grant of up to 20 per cent of their investment. Vendors and producers of energy efficient solutions for the residential sector can also access such financing. In addition, the programme will Austria's Federal Ministry of Finance has pledged to provide funding for technical assistance, including energy audits for the renovation of apartment buildings.

GEFF in Albania is part of the EBRD's €85 million Western Balkans Green Economy Financing Facility. The programme is a joint initiative of the EU, the Austrian Federal Ministry of Finance and beneficiary countries cooperating under the Western Balkans Investment Framework (WBIF). It is implemented under the umbrella of the Regional Energy Efficiency Programme for the Western Balkans (REEP Plus), funded by the EU and implemented in partnership with the Energy Community Secretariat. REEP Plus has also delivered policy support for harmonising the country's law on energy efficiency and regulations for energy efficiency in buildings with the relevant European Directives.

On December 2018, the first disbursement was made to Fondi BESA, Albania's largest microfinance institution, of €1.5 million for on-lending to support investments in energy efficiency technologies, materials and measures in privately-owned residential dwellings or buildings. The total loan amount is €3 million.

Green for Growth Fund (GGF)

The GGF (Green for Growth Fund) is a public-private partnership that leverages risk-capital provided by public institutions with additional private capital. It is implemented by Finance in Motion and provides medium to long-term financing for energy efficiency and renewable energy products/projects to strong and reputable commercial banks, micro-finance institutions leasing companies, and other non-bank financial institutions committed to the same energy saving objectives. The financial institutions on-lend these funds to sub-borrowers such as households, household associations, small and medium enterprises, large business, municipalities, public sector entities and renewable energy projects. GGF offers the following financing instruments:

- Medium to long-term senior loans
- Subordinated loans
- Syndicated loans
- Letters of credit

- Guarantees
- Mezzanine debt instruments
- Local debt securities.

Albania is at an early stage of implementation, and the Fund is looking for areas of interest by Banks in the country.

Innovative financing mechanism for environmental protection

While environmental degradation, along with the climate risk, are becoming the most salient issues in current international debates, the role of developed and developing countries in these matters differ. While coordinated action is needed both in developed and developing countries, the focus of national governments in the developing world is on lowering poverty and improving living conditions for their citizens, rather than employing massive measures toward lowering emissions of GHGs[95]. Developing countries usually rely in financial international assistance in pursuing their environmental goals. Consequently, international support in these countries is critical and indispensable. International donors, such as the EU, have been providing grants, promoting cooperation, and fostering actions in developing countries to protect the global environment. However, despite their core scope, the funding from bilateral and multilateral development assistance have been insufficient relative to the global demands for conservation of environmental services[96]. Therefore, the need for developing new, sustainable financing means for environmental protection is becoming a necessity in the developing world.

Recent years have witnessed significant raise in awareness in relation to ecosystem services and environmental protection. This has led to the improvement of the ways the environmental issues are treated and reflected in decision-making. Traditionally governments have taken the lead in the environmental protection sector. The reason why governments are the main providers of financial resources for the purposes of environmental protection is the public good nature of most environmental services as well as the environmental externalities produced by industry and other economic sectors. The most common instruments used by Governments are the so-called command and control measures, which aim to put in place the environmental quality objectives, creating the regulatory framework in the environment field[97]. Fiscal instruments, such as environmental taxes, are another tool used by governments to control the behaviour of economic actors towards the environment. The use of environmental taxes is thought to create incentives for reducing the level of pollution by the emitters[98]. However, despite their popularity, there are a number of cons arguments in relation to environmental taxation. The market imperfections and criticism toward environmental taxes, together with the increasing research on the monetary value of ecosystem services, have led to the development and implementation of innovative environmental financing means[99]. Today a strong emphasis is rather posed to the involvement of the private sector for conceiving new, innovative environmental financing means.

[95] Lattanzio, R. K. (2012). International Environmental Financing. The Global Environment Facility (GEF), Congressional Research Service, 7-5700, R41165

[96] Panayotou, T. (2002), Innovative financial mechanisms for sustainable sector financing, Testing New Policy Approaches, United Nations Publications, New York, NY, pp. 303-315

[97] Xu, X. L., & Liu, C. K. (2019). How to keep renewable energy enterprises to reach economic sustainable performance: From the views of intellectual capital and life cycle. *Energy, Sustainability and Society*, 9(7), 1–10.

[98] Bluffstone, R. A. (2003). Environmental Taxes in Developing and Transition Economies, *Public Finance and Management*. Vol. 3(1), pp. 143-175

[99] Xuan To P., Dressler W., Mahanty S. (2013). The Prospects for Payment for Ecosystem Services (PES) in Vietnam. A Look at Three Payment Schemes, *Human Ecology,* Vol 40. Pp. 237–249, DOI 10.1007/s10745-012-9480-9

Several of these new environmental financing means are again market-based instruments that create economic incentives for protecting environmental resources. Trading systems for instance are one of this innovative means that have been in place for several years now, based on the principle of clearly defining property rights. The premise of this mechanism is that damage caused in a region by an actor, is compensated by improving the environmental conditions elsewhere. The best known in these schemes is the carbon market born in the 2000s. In fact, the 2005 EU emissions trading system represents the underlying policy of the EU for addressing climate change[100]. The success of the carbon market has inspired other countries and regions to launch their trading schemes. Earlier forms of tradable permits to pollute also existed[101].

Entry fees are another example of instruments used mainly as a financing source for parks, protected areas and other similar recreational sites. Usually the value of the entry fee is defined as a result of a willingness to pay survey of visitors of these areas. Ideally, the funds collected from entry fees, should be allocated for the maintenance of the environmental resources used for recreational purposes. Alternative forms of entry tariffs are fees for diving or sailing, license fees for tour operators, fees for passengers on cruise ships, as well as airport taxes and hotel room taxes[102].

The concession model is another mechanism used for achieving conservation objectives in protected areas. It is based on the successful cooperation between public authorities, NGOs and the private sector. The main idea behind such schemes is that a concessionary contract between public authorities and a private investor defines several conditions posed to the private investor in relation to its obligations toward the environment, such as payment of concession fees, and fulfilment of the environmental and social objectives set to them by the public authority. If the concessionary conditions are met, they were allowed to develop private activities within the area.

Debt for Nature Swaps are a financial mechanism designed to generate funds for environmental protection through the purchase of external debt. They were conceived in 1980 with the aim of achieving two goals: reducing the debts of developing countries and increasing environmental protection activities. The mechanism has had its critics. The main concerns raised were that this financial agreement was equivalent to eco-colonialism, which included a loss of state sovereignty, higher external control of the economy, and the deformation of internal monetary systems, with the potential to cause inflation, or rising interest rates[103].

Entry permits, development approval and the provision of conditional loans are other tools used for environmental financing. The approach of all these mechanisms is simple but effective: if a company makes a request, either for an entry permit, or for a project approval or funding, it must meet the conditions set at the required level in order to complete its development proposal[104]. Finally, certification schemes, bioprospecting contracts, and Payment for Ecosystem Services (PES) schemes are other market-based instruments aiming at achieving sustainable financing goals.

Payment for environmental services is becoming an increasingly widespread instrument among businesses. The private sector prefers this instrument when they recognize the values of ecological

[100] European Commission (2021). EU Emissions Trading System (EU ETS), retrived from: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en

[101] Gómez-Baggethun, E., de Groot R., Lomas P.L., Montes C., (2009). The history of ecosystem services in economic theory and practice. from early notions to markets and payment schemes, *Ecological Economics*, doi.10.1016/j.ecolecon.2009.11.007

[102] Miles, K. (2005) Innovative Financing. Filling in the Gaps on the Road to Sustainable Environmental Funding, RECIEL, vol. 14 (3), pp202-211

[103] Webb, E. (1994). Debt for Nature Swaps: The Past, the Present and Some Possibilities for the Future, *Environmental and Planning Law Journal*, Vol.11(3) pp. 222

[104] Foloni Ferraz, C. (2003). Institutional Solutions for the Financing of Protected Areas in Brazil, *Fifth World Parks Congress*, Sustainable Finance Stream, Durban, South Africa

services provided by environmental assets, including flood prevention and land stabilization, biodiversity conservation, quality and water flow, sedimentation reduction, and carbon reserve. The basic idea behind PES is that those who provide ecosystem services should be compensated for doing so. In practice, PES often involves a series of payments to providers of ecosystem services, with the expectation that they would provide the ecosystem service in question over-and-above what would otherwise be provided in the absence of payment. PES therefore provides an opportunity to put a price on previously un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for wildlife and, in doing so, brings them into the wider economy.

Payments are made by the beneficiaries of the services in question, for example, individuals, communities, businesses or government acting on behalf of various parties. The novelty of PES arises from its focus on the '*beneficiary pays principle'*, as opposed to the '*polluter pays principle*' applied for justifying the use of taxes or tradable pollution permits[105].

7.6 Additional training workshops

A list of additional trainings/workshops contributing to capacity strengthen, is given next.

- 17th Meeting on "Emissions inventory". EEA and TFEIP. (*May 2016).*
- Multi-beneficiary sectoral workshop focussing on priority GHG emission and removal categories. *(5-6 June 2018. Skopje. FyROM*[106]*.)*
- GHG and LRTAP inventories. Albanian and Austrian Environment Agency. (November 2016.)
- Capacity building on climate change mitigation, adaptation and climate finance. Austrian Environment Agency. *(12-15 December 2016. Vienna. Austria)*
- Capacity Building on Climate Change Mitigation, Adaptation & Climate Finance –National Inventory System. Austrian Environment Agency*. (26th - 30th of September 2016. Vienna. Austria)*
- 18th Joint EIONET and UNECE Task Force on "Emissions inventories and projections". *(11-12 May 2017. Krakow, Poland)*
- Technical Working Group on Energy and Climate. Energy Community. *(21 November 2019. Vienna. Austria)*
- Sustainability Forum. Energy Community. *(27 June 2019. Vienna. Austria)*
- 3rd Energy and Climate Technical Working Group. Energy Community. *(21 March 2019. Vienna. Austria)*
- Workshop on Modelling options for NECPs in the Energy Community. Energy Community. *(20 March 2019. Vienna. Austria)*
- Capacity Development for MoE/CCU and National Environmental Agency. GIZ. *(July 2016. Pogradec. Albania).*
- Training Seminar on Inventory of Greenhouse Gas Emissions according to the methodology of the 2006 IPCC Guidelines. UNDP. (*15-17 May 2019)*
- Training Seminar on Inventory of Greenhouse Gas Emissions according to the methodology of the 2006 IPCC Guidelines Waste sector. UNDP. (*28 October, 20 November and 2 December 2020*)
- Training Seminar on Inventory of Greenhouse Gas Emissions according to the methodology of the 2006 IPCC Guidelines Energy sector. UNDP. (*December 2020*)
- Training Seminar on Monitoring, Reporting and Verification on Climate Change. UNDP. (*29 October 2020*)
- Training Seminar on NDCs revision. UNFCCC. (*21-23 September 2020*)

[105] DEFRA (2013) Payments for Ecosystem Services. A Best Practice Guide, London, 85 pp.

[106] Today North Macedonia

- Training Seminar on the Risk Reduction from Natural Catastrophises. UNDP. (*30 September 2020*)
- Training Seminar on Gender and Climate Change. UNDP. (*27 July 2020*)
- Training Seminar on NDC Revision of Albania. UNDP. (*25 January 2021*)
- Training Seminar on Climate Change and Communication. UNDP. (*12 March 2021*)
- Public consultation on the revised NDC. UNDP. (13-14 April 2021)
- Public consultation on the Implementation Plan of the revised NDC. UNDP. (28 June 2021)
- Training Seminar on Climate Change Mitigation and Adaptation and 2006 IPCC methodology with focus on LULUCF sector, targeting the Tirana Agriculture University. UNDP. (26-27 May 2022)
- Training Seminar on Climate Change Mitigation and 2006 IPCC methodology with focus on Energy, IPPU and Waste, targeting the Tirana Polytechnic University. UNDP. (7 June 2022)
- Training Seminar on Climate Change Mitigation and Adaptation and 2006 IPCC methodology targeting the public institutions. UNDP. (14-15 July 2022).

7.7 Gender and climate change

Vulnerability to climate change is differentiated by gender. The UNFCCC reports have highlighted the important linkages between climate action and gender equality. Subsequently, the 2015 Paris Agreement referred to gender-responsive approaches, as well as to the goals of gender equality and empowerment of women (UNFCCC, 2015). Moreover, the government efforts for achieving Sustainable Development Goals in 2030 are requiring progress towards gender equality as a stand-alone goal and a cross-cutting issue across a number of other goals (United Nations, 2015).

Albania reports lower gender inequality levels than the world average[107]. However, women still face obstacles for enjoying their equal rights, such as a more limited access to assets, lower paying jobs, less land ownership and less representation in decision-making instances. In relation to climate change, and its impacts, the burden carried by women is much higher. In fact, according to a survey conducted under the 4NC in relation to gender impacts, 39% of respondents believe there are differences in men's and women's ability to react to climate change, and among them, 53% believe men are more able to address climate change challenges. Moreover, the results of the analysis show that women are more affected by climate risk compared to men due to a higher engagement in farming especially in livestock activities. Survey findings are consistent with previous studies carried on women in agriculture such as UNWOMEN, (2017), Gerdoci and Mece, (2017), Dauti and Zhllima (2017), Zhllima (2018). The data from another survey with local experts, show that, in terms of access to services and information from advisory services, men have more access than women. Men are also in the vast majority when representing the farm as an administrative unit. Investment and other financial decisions within the household are mostly carried out and managed by men. Respondents indicate that mostly men have the right to move free outside the village.

Where considering a catastrophic event, it is observed that women are affected differently by climate impacts. As an example, during flood events, women face increased violence, and see their workload increase, their income decrease and suffer from a disruption in services. Climate-related disasters also affect more significantly women's health, especially among pregnant women. The increase in violence against women and that of time use for main household chores were identified as the main impacts of climate change on women's living conditions in the NC4survey. The survey also identified significant differences in access to information about adaptation to climate change between men and women.

[107] UNDP, 2020 Human Development Report. The GDI is the ratio of female to male Human Development Index values. http://hdr.undp.org/en/countries/profiles/ALB

In recent years, with the Albanian ratification of international conventions and agenda in relation to climate change, progress has been made in the design of policy and legal strategic documents for addressing climate change. The Government of Albania has adopted, by DCM 466, date 3.07.2019 the National Strategy on Climate Change (NSCC) and its two annexes, the National Action Plan on Mitigation (NAPM) and the National Adaptation Plan (NAP). The National Integrated Energy and Climate strategy was formulated, as an engagement of Albania at the Ministerial Meeting of the Energy Community in 2017. However, policy steps to bring gender mainstreaming into climate change policies are not yet thoroughly addressed by national policies. Despite the development of guidelines on mainstreaming gender in climate change mitigation and adaptation programs and plans in the TNC, and the development of the Gender and Climate Action Plan in the BUR1, gender has not been reflected in any of the recent climate-related policies and laws. Except gender considerations inserted at the legal components related to climate change (Law no. 45/2019 "On civil protection" approved on 18/07/2019 and the Law on Climate change approved by DCM 499 date 17.7.2019), there are no separate gender sensitive objectives and actions and the language used especially in the narrative description of these strategies is almost gender blind. Neither do gender-related strategies, such as the Third National Strategy on Gender Equality (NSGE) and its Action Plan 2016-2020, consider climate change issues. In contrast, climate change is identified in five Municipal Council's Gender Equity Local Action Plans 2018-2020.

Therefore, consideration has to be taken in addressing gender issues when designing programs and projects at community level, especially within the agriculture sector. Involving women in decision making on agricultural practices and financing is needed considering their high impact and involvement in farming. Capacity building interventions should consider the constraints hampering women's efforts on participating in capacity building events such as training and field demonstration. Low time availability due to being too burdened with homecare, low access to transport for meetings at administrative units and low financial access requires a careful selection of timing and location for events. Moreover, weak awareness to climate change impact and weak financial support increases the need for a provision of awareness campaign and budgetary support (grants and investments) related to capacity building interventions. To overcome these challenges, support with technology packages (protocols, demonstration equipment, laboratory kits for land and water analyses), support of transport costs and support of advisory services and coaching in groups are recommended.

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Annex I: Reporting tables for GHG emissions inventory

Table A1.1: IPCC Software Summary Table of the GHG inventory

2009	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	7100.212867	100.1349	3.2875	0	7.04	0	0	0	0	0	0	0
1 - Energy	4120.616895	7.755159	0.1792	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	4117.040866	2.963769	0.1696	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	330.732516	0.012536	0.0025						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	801.028728	0.045717	0.0079						0	0	0	0
1.A.3 - Transport	2299.643146	0.365864	0.1162						0	0	0	0
1.A.4 - Other Sectors	499.667154	2.451096	0.0344						0	0	0	0
1.A.5 - Non-Specified	185.969322	0.088557	0.0086						0	0	0	0
1.B - Fugitive emissions from fuels	3.576028637	4.79139	0.0096	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.487812693	8.72E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088215944	4.791389	0.0096						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1357.641519	0	0	0	7.04	0	0	0	0	0	0	0
2.A - Mineral Industry	671.445906	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	585								0	0	0	0
2.A.2 - Lime production	86.445906								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0

2009	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	671.35148	0	0	0	7.04	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	635.10438	0							0	0	0	0
2.C.2 - Ferroalloys Production	35.4471	0							0	0	0	0
2.C.3 - Aluminium production	0.8				7.04			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	14.84413333	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	14.84413333								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0

2009	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1618.1364	66.93668	2.6006	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	66.9017	0.2719	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		57.255							0	0	0	0
3.A.2 - Manure Management		9.6467	0.2719						0	0	0	0
3.B - Land	1592.056133	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1425.626866								0	0	0	0
3.B.2 - Cropland	72.92926667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0

2009	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	26.08026667	0.034977	2.3288	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.034977	0.0029						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	26.08026667								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.6481						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.5483						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.1295						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.818052947	25.44306	0.267	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	20.14298	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.212	0.0127	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.818052947	0.418423	0.008	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.669649	0.2463	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.2407	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.2407	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2009	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	61.858524	0.001822	0.0017	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	45.97593	0.000322	0.0013						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	15.882594	0.0015	0.0004						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2010	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	6846.181242	102.4387	3.2596	0	0	0	0	0	0	0	0	0
1 - Energy	4125.981736	7.922212	0.1753	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	4122.40563	3.130186	0.1657	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	335.195415	0.012759	0.0026						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	835.4485925	0.035432	0.0066						0	0	0	0
1.A.3 - Transport	2325.475453	0.397707	0.1165						0	0	0	0
1.A.4 - Other Sectors	569.9607234	2.657467	0.0374						0	0	0	0
1.A.5 - Non-Specified	56.3254461	0.026822	0.0026						0	0	0	0
1.B - Fugitive emissions from fuels	3.576106207	4.792026	0.0096	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.487889553	8.51E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088216654	4.792026	0.0096						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	967.3204937	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	872.404467	0	0	0	0	0	0	0	0	0	0	0

2010	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.1 - Cement production	837.7371								0	0	0	0
2.A.2 - Lime production	34.667367								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	80.03376	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	50.13856	0							0	0	0	0
2.C.2 - Ferroalloys Production	29.2734	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.6218								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	14.88226667	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	14.88226667								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0

2010	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1749.060959	67.27062	2.553	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	67.22804	0.2728	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		57.53877							0	0	0	0

2010	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.A.2 - Manure Management		9.689271	0.2728						0	0	0	0
3.B - Land	1726.055559	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1559.626842								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	23.0054	0.042585	2.2802	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.042585	0.0033						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	23.0054								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.6115						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.5355						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.1299						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.818052947	27.24588	0.2718	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	21.8658	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.292	0.0175	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.818052947	0.418423	0.008	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.669649	0.2463	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.2594	0	0	0	0	0	0	0	0	0

2010	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	0	0	0.2594	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	62.158668	0.001838	0.0017	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	46.1175	0.000323	0.0013						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.041168	0.001515	0.0004						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2011	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	9803.532962	104.3780201	3.413170496	0	0	0	0	0	0	0	0	0
1 - Energy	4175.474661	7.898389048	0.182366378	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	4171.898538	3.10626553	0.172775057	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	332.254725	0.01257929	0.002556493						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1061.309432	0.049367215	0.009006106						0	0	0	0
1.A.3 - Transport	2327.040923	0.378529619	0.116903608						0	0	0	0
1.A.4 - Other Sectors	257.2415387	2.57338373	0.035348299						0	0	0	0
1.A.5 - Non-Specified	194.0519196	0.092405676	0.00896055						0	0	0	0
1.B - Fugitive emissions from fuels	3.57612348	4.792123518	0.009591321	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.487906462	8.32944E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088217018	4.792123434	0.009591321						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1124.810667	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1011.37896	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	976.5								0	0	0	0
2.A.2 - Lime production	34.87896								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2011	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	98.44384	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	60.72104	0							0	0	0	0
2.C.2 - Ferroalloys Production	37.0526	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.6702								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2011	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	14.98786667	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	14.98786667								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2011	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	4499.48797	67.07158252	2.694553976	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	66.743196	0.27186052	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		57.074765							0	0	0	0
3.A.2 - Manure Management		9.668431	0.27186052						0	0	0	0
3.B - Land	4469.27977	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	4302.851053								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	30.2082	0.328386524	2.422693455	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.328386524	0.025579817						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2011	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	30.2082								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.703147936						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.564242323						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.129723379						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.75966353	29.40804852	0.271350142	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	23.99566547	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.292	0.01752	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.75966353	0.413230215	0.007919422	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.707152829	0.24591072	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.2649	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.2649	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2011	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	63.101675	0.00185852	0.00174918	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	46.89971	0.00032797	0.00131188						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.201965	0.00153055	0.0004373						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2012	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	10549.34766	107.2805296	3.392592272	0	0	0	0	0	0	0	0	0
1 - Energy	3919.567955	7.857771514	0.175073579	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	3915.991716	3.06480022	0.165482154	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	332.386685	0.01258149	0.002558233						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	761.4109269	0.039315748	0.006984854						0	0	0	0
1.A.3 - Transport	2217.254191	0.352587323	0.111454814						0	0	0	0
1.A.4 - Other Sectors	407.0069852	2.566061885	0.035344493						0	0	0	0
1.A.5 - Non-Specified	197.9329275	0.094253775	0.00913976						0	0	0	0
1.B - Fugitive emissions from fuels	3.576239389	4.792971294	0.009591425	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.488021752	8.15256E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088217637	4.792971212	0.009591425						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1153.717764	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1056.891288	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	1039.5								0	0	0	0
2.A.2 - Lime production	17.391288								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2012	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	82.09932	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	50.40152	0							0	0	0	0
2.C.2 - Ferroalloys Production	31.2234	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.4744								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2012	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	14.57866667	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	14.57866667								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2012	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0.148489528	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0.148489528	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	5472.630782	67.96838946	2.681434366	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	67.833016	0.275475423	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		58.064765							0	0	0	0
3.A.2 - Manure Management		9.768251	0.275475423						0	0	0	0
3.B - Land	5444.204582	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	5277.775865								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	28.4262	0.135373464	2.405958944	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.135373464	0.01151312						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2012	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_X	CO	NMVOCs	SO_2
3.C.3 - Urea application	28.4262								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.698653078						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.56455191						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.131240836						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.431155088	31.45436861	0.268254326	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	25.91198324	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.252	0.01512	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.431155088	0.376902495	0.007223606	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.913482884	0.24591072	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.26783	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	0	0	0.26783	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2012	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	64.370059	0.001895845	0.00178434	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	47.842795	0.000334565	0.00133826						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.527264	0.00156128	0.00044608						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2013	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	6645.362789	139.2638703	3.819375062	0	0	0	0	0	0	0	0	0
1 - Energy	3939.571507	37.85199562	0.577657662	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	3935.995114	33.05889667	0.568066185	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	335.931665	0.01272105	0.002586145						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	698.8888685	0.037458912	0.006614488						0	0	0	0
1.A.3 - Transport	2278.287565	0.367705772	0.114457966						0	0	0	0
1.A.4 - Other Sectors	420.9953947	32.54487207	0.435085029						0	0	0	0
1.A.5 - Non-Specified	201.8916207	0.096138867	0.009322557						0	0	0	0
1.B - Fugitive emissions from fuels	3.57639372	4.793098952	0.009591478	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.488175472	7.97568E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088218247	4.793098872	0.009591478						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1244.832633	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1145.924271	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	1128.6								0	0	0	0
2.A.2 - Lime production	17.324271								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2013	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	77.5068	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	44.9812	0							0	0	0	0
2.C.2 - Ferroalloys Production	32.11	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.4156								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2013	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	13.8072	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	13.8072								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2013	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	7.594362428	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	7.594362428	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1457.538178	68.19309745	2.697086584	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	68.184576	0.275348449	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		58.463765							0	0	0	0
3.A.2 - Manure Management		9.720811	0.275348449						0	0	0	0
3.B - Land	1428.770978	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1262.342261								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	28.7672	0.008521448	2.421738135	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.008521448	0.000712086						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2013	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	28.7672								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.717335825						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.572917803						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.130772421						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.42047084	33.21877728	0.266980816	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	27.63938028	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.244	0.01464	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.42047084	0.37572099	0.007200976	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.959676005	0.24513984	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.27765	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.27765	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2013	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	65.013637	0.0019148	0.00180218	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	48.32113	0.00033791	0.00135164						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.692507	0.00157689	0.00045054						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2014	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	6895.021971	113.3798731	3.562974859	0	0	0	0	0	0	0	0	0
1 - Energy	4352.734063	10.18871337	0.215782401	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	4349.157669	5.395614421	0.206190923	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	336.385265	0.01273665	0.002589265						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1006.534347	0.046806492	0.008478974						0	0	0	0
1.A.3 - Transport	2383.351042	0.379643427	0.119842873						0	0	0	0
1.A.4 - Other Sectors	420.9953947	4.860288985	0.065957254						0	0	0	0
1.A.5 - Non-Specified	201.8916207	0.096138867	0.009322557						0	0	0	0
1.B - Fugitive emissions from fuels	3.57639372	4.793098951	0.009591478	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.488175472	7.83096E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088218247	4.793098872	0.009591478						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1193.812525	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1065.0051	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	1044.9								0	0	0	0
2.A.2 - Lime production	20.1051								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2014	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	102.38878	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	56.50208	0							0	0	0	0
2.C.2 - Ferroalloys Production	45.3661	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.5206								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2014	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	10.46906667	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	10.46906667								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2014	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	15.94957804	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	15.94957804	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1345.247229	68.86023507	2.764114829	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	68.856346	0.278119385	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		58.999565							0	0	0	0
3.A.2 - Manure Management		9.856781	0.278119385						0	0	0	0
3.B - Land	1314.080562	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1147.651845								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	31.16666667	0.003889073	2.485995444	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.003889073	0.000324939						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2014	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	31.16666667								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.764445862						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.588915861						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.132308783						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.228154377	34.33092464	0.24909763	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	29.08614436	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.184	0.01104	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.228154377	0.3544539	0.00679363	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.70632638	0.231264	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.33398	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.33398	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2014	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	65.013637	0.0019148	0.00180218	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	48.32113	0.00033791	0.00135164						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.692507	0.00157689	0.00045054						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2015	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	7004.672174	112.4465287	3.614359073	0	0	0	0	0	0	0	0	0
1 - Energy	4478.215502	7.703683963	0.187233435	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	4474.638993	2.910357353	0.177641905	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	336.701765	0.01274865	0.002591665						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1019.28544	0.048546027	0.008797414						0	0	0	0
1.A.3 - Transport	2462.939212	0.38933931	0.123908125						0	0	0	0
1.A.4 - Other Sectors	445.6644839	2.359700465	0.032645511						0	0	0	0
1.A.5 - Non-Specified	210.0480921	0.100022901	0.00969919						0	0	0	0
1.B - Fugitive emissions from fuels	3.57650962	4.793326609	0.00959153	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.488290762	7.68624E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088218858	4.793326532	0.00959153						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1105.500508	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	974.2929	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	954.1125								0	0	0	0
2.A.2 - Lime production	20.1804								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2015	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	95.0679	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	37.88	0							0	0	0	0
2.C.2 - Ferroalloys Production	56.7697	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.4182								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2015	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	11.47666667	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	11.47666667								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2015	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	24.6630417	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	24.6630417	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1417.834851	69.33969654	2.772293112	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	69.324766	0.279170851	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		59.454765							0	0	0	0
3.A.2 - Manure Management		9.870001	0.279170851						0	0	0	0
3.B - Land	1385.934851	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1219.506135								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	31.9	0.014930537	2.49312226	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.014930537	0.001310601						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2015	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	31.9								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.768263522						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.590988452						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.132559686						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.121311898	35.4031482	0.240202526	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	30.28206844	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.168	0.01008	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.121311898	0.34263885	0.006567326	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.610440905	0.2235552	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.41463	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.41463	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2015	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	65.664443	0.001934	0.00182022	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	48.80447	0.00034129	0.00136516						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.859973	0.00159271	0.00045506						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2016	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	7044.751734	112.840443	3.646692933	0	0	0	0	0	0	0	0	0
1 - Energy	4558.728432	7.691061448	0.189325035	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	4555.151923	2.89773484	0.179733505	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	337.053575	0.01276215	0.002594365						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1072.970191	0.051368455	0.009393473						0	0	0	0
1.A.3 - Transport	2489.41558	0.379025269	0.125469557						0	0	0	0
1.A.4 - Other Sectors	445.6644839	2.354556065	0.032576919						0	0	0	0
1.A.5 - Non-Specified	210.0480921	0.100022901	0.00969919						0	0	0	0
1.B - Fugitive emissions from fuels	3.57650962	4.793326608	0.00959153	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.488290762	7.54152E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088218858	4.793326532	0.00959153						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1019.891209	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	894.2499	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	880.47								0	0	0	0
2.A.2 - Lime production	13.7799								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2016	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	76.82254	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	18.57864	0							0	0	0	0
2.C.2 - Ferroalloys Production	57.9163	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.3276								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2016	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	14.27653333	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	14.27653333								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2016	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	34.54223573	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	34.54223573	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1463.036423	68.85946525	2.788169797	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	68.828196	0.276253851	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		59.039765							0	0	0	0
3.A.2 - Manure Management		9.788431	0.276253851						0	0	0	0
3.B - Land	1430.40309	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1263.974373								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	32.63333333	0.031269245	2.511915946	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.031269245	0.002686839						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2016	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	32.63333333								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.781931443						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.596301471						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.130996193						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.095669703	36.28991635	0.238058101	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	31.16452955	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.164	0.00984	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.095669703	0.339803238	0.006513013	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.621583564	0.221705088	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.43114	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.43114	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2016	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	65.664443	0.001934	0.00182022	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	48.80447	0.00034129	0.00136516						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	16.859973	0.00159271	0.00045506						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2017	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	7686.449559	113.394642	3.611934896	0	0	0	0	0	0	0	0	0
1 - Energy	5010.335535	7.492502215	0.195209693	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	5006.754947	2.682389695	0.185583258	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	252.112775	0.00942715	0.001932065						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1157.660888	0.078880543	0.012599987						0	0	0	0
1.A.3 - Transport	2566.851795	0.388218896	0.129158343						0	0	0	0
1.A.4 - Other Sectors	585.9582172	2.064785525	0.029242392						0	0	0	0
1.A.5 - Non-Specified	444.1712709	0.141077581	0.012650471						0	0	0	0
1.B - Fugitive emissions from fuels	3.580588051	4.81011252	0.009626435	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.492133762	7.54152E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088454289	4.810112444	0.009626435						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1209.981931	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1046.60289	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	1029.4119								0	0	0	0
2.A.2 - Lime production	17.19099								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2017	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	108.16326	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	42.46256	0							0	0	0	0
2.C.2 - Ferroalloys Production	65.2587	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.442								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2017	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	9.890173333	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	9.890173333								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2017	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	45.32560795	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	45.32560795	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1463.036423	68.85946525	2.788169797	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	68.828196	0.276253851	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		59.039765							0	0	0	0
3.A.2 - Manure Management		9.788431	0.276253851						0	0	0	0
3.B - Land	1430.40309	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1263.974373								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	32.63333333	0.031269245	2.511915946	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.031269245	0.002686839						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2017	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	32.63333333								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.781931443						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.596301471						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.130996193						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.095669703	37.04267453	0.237559573	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	31.94216543	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.1634	0.009804	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.095669703	0.339803238	0.006513013	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.597305862	0.22124256	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.390995833	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.390995833	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2017	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	67.31595	0.001982625	0.001866	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	50.032125	0.000349875	0.0013995						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	17.283825	0.00163275	0.0004665						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2018	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	7887.405926	114.162038	3.626761143	0	0	0	0	0	0	0	0	0
1 - Energy	5105.296096	7.447273115	0.194397608	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	5101.715276	2.637063307	0.184770981	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	251.706155	0.00941155	0.001928945						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1163.555732	0.100471662	0.015323937						0	0	0	0
1.A.3 - Transport	2493.845904	0.378211689	0.125435059						0	0	0	0
1.A.4 - Other Sectors	754.4853677	2.008707175	0.02948155						0	0	0	0
1.A.5 - Non-Specified	438.1221174	0.140261231	0.01260149						0	0	0	0
1.B - Fugitive emissions from fuels	3.580820568	4.810209808	0.009626627	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.492364342	7.3968E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.088456226	4.810209734	0.009626627						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1315.992695	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1033.32045	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	1012.5								0	0	0	0
2.A.2 - Lime production	20.82045								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2018	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	181.7191	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	60.64	0							0	0	0	0
2.C.2 - Ferroalloys Production	120.7063	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.3728								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2018	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	11.79801333	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	11.79801333								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2018	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	89.15513199	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	89.15513199	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1463.036423	68.85946525	2.788169797	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	68.828196	0.276253851	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		59.039765							0	0	0	0
3.A.2 - Manure Management		9.788431	0.276253851						0	0	0	0
3.B - Land	1430.40309	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1263.974373								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	32.63333333	0.031269245	2.511915946	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.031269245	0.002686839						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2018	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_X	CO	NMVOCs	SO_2
3.C.3 - Urea application	32.63333333								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.781931443						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.596301471						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.130996193						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.080711756	37.85529962	0.236851186	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	32.64565289	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.1624	0.009744	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.080711756	0.338149131	0.00648133	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.709097591	0.220625856	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.407342551	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	0	0	0.407342551	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2018	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	68.392428	0.00201433	0.00189584	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	50.83221	0.00035547	0.00142188						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	17.560218	0.00165886	0.00047396						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

2019	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	7961.047929	114.7974573	3.613420201	0	0	0	0	0	0	0	0	0
1 - Energy	5153.348703	7.525944553	0.19873003	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	5149.764203	2.619314338	0.18910335	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	258.784445	0.00966875	0.001983585						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	1028.543915	0.074427598	0.011758234						0	0	0	0
1.A.3 - Transport	2653.113478	0.40199929	0.133362844						0	0	0	0
1.A.4 - Other Sectors	764.7805935	1.99209112	0.029345216						0	0	0	0
1.A.5 - Non-Specified	444.5417709	0.141127581	0.012653471						0	0	0	0
1.B - Fugitive emissions from fuels	3.584500435	4.906630215	0.00962668	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	3.492594922	7.25208E-08	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0.091905513	4.906630142	0.00962668						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO_2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	1341.648334	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	1022.277561	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	1003.5								0	0	0	0
2.A.2 - Lime production	18.777561								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

2019	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	149.1882	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	62.37	0							0	0	0	0
2.C.2 - Ferroalloys Production	86.3226	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0.4956								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

2019	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	12.27013333	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	12.27013333								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0			0	0	0	0	0
2.E.4 - Heat Transfer Fluid					0			0	0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0				0	0	0	0	0
2.F.2 - Foam Blowing Agents				0				0	0	0	0	0
2.F.3 - Fire Protection				0	0			0	0	0	0	0
2.F.4 - Aerosols				0				0	0	0	0	0
2.F.5 - Solvents				0	0			0	0	0	0	0
2.F.6 - Other Applications (please specify)				0	0			0	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0		0	0	0	0	0

2019	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
2.G.2 - SF_6 and PFCs from Other Product Uses					0	0		0	0	0	0	0
2.G.3 - N_2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	157.9124395	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	157.9124395	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	1463.036423	68.85946525	2.788169797	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	68.828196	0.276253851	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		59.039765							0	0	0	0
3.A.2 - Manure Management		9.788431	0.276253851						0	0	0	0
3.B - Land	1430.40309	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	1263.974373								0	0	0	0
3.B.2 - Cropland	72.92871667								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	93.5								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO_2 emissions sources on land	32.63333333	0.031269245	2.511915946	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0.031269245	0.002686839						0	0	0	0
3.C.2 - Liming	0								0	0	0	0

2019	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
3.C.3 - Urea application	32.63333333								0	0	0	0
3.C.4 - Direct N_2O Emissions from managed soils			1.781931443						0	0	0	0
3.C.5 - Indirect N_2O Emissions from managed soils			0.596301471						0	0	0	0
3.C.6 - Indirect N_2O Emissions from manure management			0.130996193						0	0	0	0
3.C.7 - Rice cultivation		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	3.014469419	38.41204754	0.231897822	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	33.27896774	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0.16184	0.0097104	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	3.014469419	0.3308238	0.006341022	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	4.640415995	0.2158464	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0.394622551	0	0	0	0	0	0	0	0	0
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	0	0	0.394622551	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												

2019	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other gases	Other gases	NO_x	CO	NMVOCs	SO_2
International Bunkers	69.81	0.002103775	0.0019346	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	51.340575	0.000359025	0.0014361						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	18.469425	0.00174475	0.0004985						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

Annex II: Uncertainty analysis for GHG inventory

Table A2.1: IPCC Software calculation table of the GHG inventory uncertainty analysis for 2019

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO_2 equivalent)	Year T emissions or removals (Gg CO_2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T
1.A - Fuel Combustion Activities							
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO_2	0.0	0.0	5.0	6.1	7.9	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH_4	0.0	0.0	5.0	228.8	228.8	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N_2O	0.0	0.0	5.0	228.8	228.8	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	CO_2	0.0	0.0	5.0	12.4	13.4	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CO_2	0.0	0.0	5.0	6.1	7.9	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CH_4	0.0	0.0	5.0	228.8	228.8	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	N_2O	0.0	0.0	5.0	228.8	228.8	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CO_2	0.0	0.0	5.0	12.4	13.4	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	CO_2	20.3	14.0	1.0	5.3	5.4	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	N_2O	0.1	0.0	1.0	200.8	200.8	0.00
1.A.1.a.iii - Heat Plants - Solid Fuels	CO_2	5.0	6.3	5.0	5.5	7.4	0.00
1.A.1.a.iii - Heat Plants - Solid Fuels	CH_4	0.0	0.0	5.0	50.0	50.2	0.00
1.A.1.a.iii - Heat Plants - Solid Fuels	N_2O	0.0	0.0	5.0	200.2	200.3	0.00
1.A.1.b - Petroleum Refining - Liquid Fuels	CO_2	288.1	221.2	1.0	5.3	5.4	0.01
1.A.1.b - Petroleum Refining - Liquid Fuels	CH_4	0.2	0.2	1.0	50.8	50.8	0.00
1.A.1.b - Petroleum Refining - Liquid Fuels	N_2O	0.7	0.5	1.0	200.8	200.8	0.00
1.A.1.b - Petroleum Refining - Solid Fuels	CO_2	0.0	0.0	5.0	12.4	13.4	0.00
1.A.1.b - Petroleum Refining - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.1.b - Petroleum Refining - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.1.b - Petroleum Refining - Gaseous Fuels	CO_2	17.3	17.3	5.0	3.9	6.4	0.00
1.A.1.b - Petroleum Refining - Gaseous Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.1.b - Petroleum Refining - Gaseous Fuels	N_2O	0.0	0.0	5.0	200.0	200.1	0.00

1.A.2.a - Iron and Steel - Liquid Fuels	CO_2	105.0	111.0	1.0	5.3	5.4	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	CH_4	0.1	0.1	1.0	50.8	50.8	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	N_2O	0.2	0.2	1.0	200.8	200.8	0.00
1.A.2.a - Iron and Steel - Solid Fuels	CO_2	23.0	0.0	5.0	12.5	13.4	0.00
1.A.2.a - Iron and Steel - Solid Fuels	CH_4	0.1	0.0	5.0	200.0	200.1	0.00
1.A.2.a - Iron and Steel - Solid Fuels	N_2O	0.1	0.0	5.0	222.2	222.3	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CO_2	119.1	122.3	1.0	5.3	5.4	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CH_4	0.1	0.1	1.0	50.8	50.8	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	N_2O	0.3	0.2	1.0	200.8	200.8	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CO_2	24.4	0.0	5.0	12.5	13.4	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CH_4	0.1	0.0	5.0	200.0	200.1	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	N_2O	0.1	0.0	5.0	222.2	222.3	0.00
1.A.2.c - Chemicals - Liquid Fuels	CO_2	36.4	46.3	1.0	5.3	5.4	0.00
1.A.2.c - Chemicals - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.c - Chemicals - Liquid Fuels	N_2O	0.1	0.1	1.0	200.8	200.8	0.00
1.A.2.c - Chemicals - Solid Fuels	CO_2	5.2	0.0	5.0	12.5	13.4	0.00
1.A.2.c - Chemicals - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.c - Chemicals - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO_2	17.2	5.2	1.0	5.3	5.4	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N_2O	0.0	0.0	1.0	200.8	200.8	0.00
1.A.2.d - Pulp, Paper and Print - Solid Fuels	CO_2	7.0	0.0	5.0	12.5	13.4	0.00
1.A.2.d - Pulp, Paper and Print - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.d - Pulp, Paper and Print - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO_2	78.8	58.3	1.0	5.3	5.4	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH_4	0.1	0.0	1.0	50.8	50.8	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N_2O	0.2	0.1	1.0	200.8	200.8	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO_2	31.4	0.0	5.0	12.5	13.4	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH_4	0.1	0.0	5.0	200.0	200.1	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	N_2O	0.2	0.0	5.0	222.2	222.3	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CO_2	6.1	17.3	5.0	3.9	6.4	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	N_2O	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CO_2	15.3	33.1	5.0	18.7	19.4	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CH_4	0.1	0.2	5.0	245.5	245.5	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	N_2O	0.2	0.4	5.0	281.8	281.9	0.00

1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CO_2	17.2	7.0	1.0	5.3	5.4	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	N_2O	0.0	0.0	1.0	200.8	200.8	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CO_2	7.0	471.3	5.0	12.5	13.4	0.26
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CH_4	0.0	1.0	5.0	200.0	200.1	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	N_2O	0.0	2.2	5.0	222.2	222.3	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CO_2	0.0	0.0	5.0	18.7	19.4	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CH_4	0.0	0.0	5.0	245.5	245.5	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	N_2O	0.0	0.0	5.0	281.8	281.9	0.00
1.A.2.g - Transport Equipment - Liquid Fuels	CO_2	8.6	2.0	1.0	5.3	5.4	0.00
1.A.2.g - Transport Equipment - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.g - Transport Equipment - Liquid Fuels	N_2O	0.0	0.0	1.0	200.8	200.8	0.00
1.A.2.g - Transport Equipment - Solid Fuels	CO_2	3.5	0.0	5.0	12.5	13.4	0.00
1.A.2.g - Transport Equipment - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.g - Transport Equipment - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.2.h - Machinery - Liquid Fuels	CO_2	22.1	8.7	1.0	5.3	5.4	0.00
1.A.2.h - Machinery - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.h - Machinery - Liquid Fuels	N_2O	0.1	0.0	1.0	200.8	200.8	0.00
1.A.2.h - Machinery - Solid Fuels	CO_2	12.2	0.0	5.0	12.5	13.4	0.00
1.A.2.h - Machinery - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.h - Machinery - Solid Fuels	N_2O	0.1	0.0	5.0	222.2	222.3	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CO_2	105.8	145.6	1.5	5.3	5.5	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CH_4	0.1	0.1	1.5	50.8	50.8	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	N_2O	0.2	0.3	1.5	200.8	200.8	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels	CO_2	19.2	0.0	5.0	12.5	13.4	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels	N_2O	0.1	0.0	5.0	222.2	222.3	0.00
1.A.2.j - Wood and wood products - Liquid Fuels	CO_2	25.9	6.0	1.0	5.3	5.4	0.00
1.A.2.j - Wood and wood products - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.j - Wood and wood products - Liquid Fuels	N_2O	0.1	0.0	1.0	200.8	200.8	0.00
1.A.2.j - Wood and wood products - Solid Fuels	CO_2	10.5	0.0	5.0	12.5	13.4	0.00
1.A.2.j - Wood and wood products - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.j - Wood and wood products - Solid Fuels	N_2O	0.1	0.0	5.0	222.2	222.3	0.00
1.A.2.k - Construction - Liquid Fuels	CO_2	38.8	8.7	1.0	5.3	5.4	0.00
1.A.2.k - Construction - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.k - Construction - Liquid Fuels	N_2O	0.1	0.0	1.0	200.8	200.8	0.00

1.A.2.k - Construction - Solid Fuels	CO_2	15.7	0.0	5.0	12.5	13.4	0.00
1.A.2.k - Construction - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.k - Construction - Solid Fuels	N_2O	0.1	0.0	5.0	222.2	222.3	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CO_2	27.8	14.8	1.0	5.3	5.4	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	N_2O	0.1	0.0	1.0	200.8	200.8	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CO_2	8.7	0.0	5.0	12.5	13.4	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.l - Textile and Leather - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CO_2	17.2	4.0	1.0	5.3	5.4	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CH_4	0.0	0.0	1.0	50.8	50.8	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	N_2O	0.0	0.0	1.0	200.8	200.8	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CO_2	7.0	0.0	5.0	12.5	13.4	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO_2	46.0	51.3	1.0	6.0	6.1	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH_4	0.0	0.0	1.0	100.0	100.0	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N_2O	0.4	0.4	1.0	150.0	150.0	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO_2	10.7	28.6	1.0	6.0	6.1	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH_4	0.0	0.0	1.0	100.0	100.0	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N_2O	0.1	0.2	1.0	150.0	150.0	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO_2	1249.9	1440.5	1.0	5.1	5.2	0.37
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH_4	2.8	3.1	1.0	100.7	100.7	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N_2O	20.1	23.2	1.0	150.9	150.9	0.08
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO_2	113.6	147.7	1.0	5.1	5.2	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH_4	0.3	0.4	1.0	100.7	100.7	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N_2O	1.8	2.3	1.0	150.9	150.9	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO_2	568.2	637.0	1.0	5.0	5.1	0.07
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH_4	1.3	1.3	1.0	100.0	100.0	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N_2O	9.1	10.3	1.0	150.7	150.7	0.02
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO_2	70.8	77.2	1.0	5.0	5.1	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH_4	0.6	0.7	1.0	100.0	100.0	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way	N_2O	0.9	1.0	1.0	150.7	150.7	0.00

catalysts - Liquid Fuels							
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO_2	214.4	245.9	1.0	5.0	5.1	0.01
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH_4	2.1	2.3	1.0	100.0	100.0	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N_2O	3.1	3.3	1.0	150.0	150.0	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO_2	42.9	47.7	1.0	4.1	4.2	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH_4	0.4	0.5	1.0	100.7	100.7	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N_2O	0.6	0.7	1.0	150.9	150.9	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CO_2	0.0	0.0	5.0	3.1	5.9	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CH_4	0.0	0.0	5.0	244.7	244.7	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	N_2O	0.0	0.0	5.0	209.9	210.0	0.00
1.A.3.c - Railways - Liquid Fuels	CO_2	9.5	6.7	1.0	5.0	5.1	0.00
1.A.3.c - Railways - Liquid Fuels	CH_4	0.1	0.1	1.0	100.6	100.6	0.00
1.A.3.c - Railways - Liquid Fuels	N_2O	0.1	0.1	1.0	150.0	150.0	0.00
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CO_2	15.9	18.5	1.0	4.5	4.6	0.00
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CH_4	0.0	0.0	1.0	100.0	100.0	0.00
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	N_2O	0.1	0.2	1.0	140.0	140.0	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO_2	19.5	21.8	1.0	4.5	4.6	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH_4	0.0	0.0	1.0	100.0	100.0	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N_2O	0.2	0.2	1.0	140.0	140.0	0.00
1.A.3.e.i - Pipeline Transport - Liquid Fuels	CO_2	0.0	0.0	5.0	5.0	7.1	0.00
1.A.3.e.i - Pipeline Transport - Liquid Fuels	CH_4	0.0	0.0	5.0	5.0	7.1	0.00
1.A.3.e.i - Pipeline Transport - Liquid Fuels	N_2O	0.0	0.0	5.0	5.0	7.1	0.00
1.A.3.e.ii - Off-road - Liquid Fuels	CO_2	0.0	0.0	5.0	3.9	6.3	0.00
1.A.3.e.ii - Off-road - Liquid Fuels	CH_4	0.0	0.0	5.0	150.2	150.3	0.00
1.A.3.e.ii - Off-road - Liquid Fuels	N_2O	0.0	0.0	5.0	200.0	200.1	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO_2	158.6	246.0	1.0	5.3	5.4	0.01
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH_4	0.4	0.5	1.0	50.0	50.0	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	N_2O	0.3	0.4	1.0	200.8	200.8	0.00
1.A.4.a - Commercial/Institutional - Solid Fuels	CO_2	0.0	0.0	5.0	12.5	13.4	0.00
1.A.4.a - Commercial/Institutional - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.4.a - Commercial/Institutional - Solid	N_2O	0.0	0.0	5.0	217.8	217.8	0.00

Fuels							
1.A.4.a - Commercial/Institutional - Biomass	CO_2	48.5	84.5	5.0	18.7	19.4	0.02
1.A.4.a - Commercial/Institutional - Biomass	CH_4	2.7	4.8	5.0	227.3	227.3	0.01
1.A.4.a - Commercial/Institutional - Biomass	N_2O	0.5	0.9	5.0	297.7	297.8	0.00
1.A.4.b - Residential - Liquid Fuels	CO_2	202.1	273.4	1.0	5.3	5.4	0.01
1.A.4.b - Residential - Liquid Fuels	CH_4	0.4	0.5	1.0	50.0	50.0	0.00
1.A.4.b - Residential - Liquid Fuels	N_2O	0.1	0.2	1.0	200.4	200.4	0.00
1.A.4.b - Residential - Solid Fuels	CO_2	0.0	0.0	5.0	12.5	13.4	0.00
1.A.4.b - Residential - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.4.b - Residential - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.4.b - Residential - Biomass	CO_2	822.0	570.3	5.0	18.7	19.4	0.80
1.A.4.b - Residential - Biomass	CH_4	46.2	32.1	5.0	227.3	227.3	0.35
1.A.4.b - Residential - Biomass	N_2O	9.1	6.3	5.0	297.7	297.8	0.02
1.A.4.c.i - Stationary - Liquid Fuels	CO_2	138.9	233.7	1.0	5.3	5.4	0.01
1.A.4.c.i - Stationary - Liquid Fuels	CH_4	0.4	0.7	1.0	50.0	50.0	0.00
1.A.4.c.i - Stationary - Liquid Fuels	N_2O	0.3	0.6	1.0	200.4	200.4	0.00
1.A.4.c.i - Stationary - Solid Fuels	CO_2	0.0	0.0	5.0	12.5	13.4	0.00
1.A.4.c.i - Stationary - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.4.c.i - Stationary - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.4.c.i - Stationary - Biomass	CO_2	25.0	56.2	5.0	18.7	19.4	0.01
1.A.4.c.i - Stationary - Biomass	CH_4	1.4	3.2	5.0	227.3	227.3	0.00
1.A.4.c.i - Stationary - Biomass	N_2O	0.3	0.6	5.0	297.7	297.8	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CO_2	0.0	1.1	1.0	5.3	5.4	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CH_4	0.0	0.0	1.0	50.0	50.0	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	N_2O	0.0	0.0	1.0	200.4	200.4	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Solid Fuels	CO_2	0.0	0.0	5.0	12.5	13.4	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO_2	0.0	10.7	1.0	6.1	6.2	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH_4	0.0	0.0	1.0	200.0	200.0	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N_2O	0.0	0.0	1.0	236.4	236.4	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Solid Fuels	CO_2	0.0	0.0	5.0	12.5	13.4	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Solid Fuels	CH_4	0.0	0.0	5.0	200.0	200.1	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Solid Fuels	N_2O	0.0	0.0	5.0	222.2	222.3	0.00
1.A.5.a - Stationary - Liquid Fuels	CO_2	0.0	206.8	1.0	5.0	5.1	0.01
1.A.5.a - Stationary - Liquid Fuels	CH_4	0.0	0.6	1.0	5.0	5.1	0.00

1.A.5.a - Stationary - Liquid Fuels	N_2O	0.0	0.5	1.0	5.0	5.1	0.00
1.A.5.a - Stationary - Solid Fuels	CO_2	0.0	0.0	5.0	5.0	7.1	0.00
1.A.5.a - Stationary - Solid Fuels	CH_4	0.0	0.0	5.0	5.0	7.1	0.00
1.A.5.a - Stationary - Solid Fuels	N_2O	0.0	0.0	5.0	5.0	7.1	0.00
1.A.5.b.i - Mobile (aviation component) - Liquid Fuels	CO_2	0.0	0.0	5.0	4.2	6.5	0.00
1.A.5.b.i - Mobile (aviation component) - Liquid Fuels	CH_4	0.0	0.0	5.0	100.0	100.1	0.00
1.A.5.b.i - Mobile (aviation component) - Liquid Fuels	N_2O	0.0	0.0	5.0	150.0	150.1	0.00
1.A.5.b.ii - Mobile (water-borne component) - Liquid Fuels	CO_2	0.0	0.0	5.0	4.3	6.6	0.00
1.A.5.b.ii - Mobile (water-borne component) - Liquid Fuels	CH_4	0.0	0.0	5.0	50.0	50.2	0.00
1.A.5.b.ii - Mobile (water-borne component) - Liquid Fuels	N_2O	0.0	0.0	5.0	140.0	140.1	0.00
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	CO_2	186.0	237.8	1.0	5.0	5.1	0.01
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	CH_4	1.9	2.4	1.0	100.0	100.0	0.00
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	N_2O	2.7	3.4	1.0	150.0	150.0	0.00
1.B.1.b - Uncontrolled combustion and burning coal dumps - Solid Fuels	CO_2	0.0	0.0	5.0	8.3	9.7	0.00
1.B.1.b - Uncontrolled combustion and burning coal dumps - Solid Fuels	CH_4	0.0	0.0	5.0	5.0	7.1	0.00
1.B.1.b - Uncontrolled combustion and burning coal dumps - Solid Fuels	N_2O	0.0	0.0	5.0	5.0	7.1	0.00
1.A.3.b.vi - Urea-based catalysts	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
1.B.1 - Fugitive Emissions from Fuels - Solid Fuels							
1.B.1.a.i.1 - Mining	CO_2	2.4	2.4	0.0	0.0	0.0	0.00
1.B.1.a.i.1 - Mining	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CO_2	1.1	1.1	0.0	0.0	0.0	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
1.B.1.a.i.3 - Abandoned underground mines	CH_4	0.0	0.0	5.0	0.0	5.0	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO_2	CH_4	0.0	0.0	5.0	0.0	5.0	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO_2	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.1.a.ii.1 - Mining	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
1.B.1.a.ii.1 - Mining	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
1.B.2 - Fugitive Emissions from Fuels - Oil and Natural Gas							
1.B.2.a.iii.1 - Exploration	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.1 - Exploration	CH_4	1.0	1.1	5.0	0.0	5.0	0.00
1.B.2.a.iii.1 - Exploration	N_2O	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.2 - Production and Upgrading	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.2 - Production and Upgrading	CH_4	6.8	6.8	5.0	0.0	5.0	0.00

1.B.2.a.iii.2 - Production and Upgrading	N_2O	1.7	1.7	5.0	0.0	5.0	0.00
1.B.2.a.iii.3 - Transport	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.3 - Transport	CH_4	86.0	86.3	5.0	0.0	5.0	0.00
1.B.2.a.iii.3 - Transport	N_2O	1.3	1.3	5.0	0.0	5.0	0.00
1.B.2.a.iii.4 - Refining	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.4 - Refining	CH_4	5.7	5.7	5.0	0.0	5.0	0.00
1.B.2.a.iii.4 - Refining	N_2O	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.5 - Distribution of oil products	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.a.iii.5 - Distribution of oil products	CH_4	1.1	1.1	5.0	0.0	5.0	0.00
1.B.2.a.iii.5 - Distribution of oil products	N_2O	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.i - Venting	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.i - Venting	CH_4	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.i - Venting	N_2O	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.ii - Flaring	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.ii - Flaring	CH_4	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.ii - Flaring	N_2O	0.0	0.0	5.0	0.0	5.0	0.00
1.B.2.b.iii.2 - Production	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
1.B.2.b.iii.2 - Production	CH_4	0.0	2.0	0.0	0.0	0.0	0.00
1.B.2.b.iii.2 - Production	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
1.C - CO_2 Transport Injection and Storage							
1.C.1.a - Pipelines	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.C.1.b - Ships	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.C.1.c - Other (please specify)	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.C.2.a - Injection	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.C.2.b - Storage	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
1.C.3 - Other	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
2.A - Mineral Industry							
2.A.1 - Cement production	CO_2	585.0	1003.5	10.0	5.0	11.2	0.83
2.A.2 - Lime production	CO_2	86.4	18.8	6.0	2.0	6.3	0.00
2.A.3 - Glass Production	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
2.A.4.a - Ceramics	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
2.A.4.b - Other Uses of Soda Ash	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
2.A.4.c - Non-Metallurgical Magnesia Production	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
2.A.4.d - Other (please specify)	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
2.B - Chemical Industry							
2.B.1 - Ammonia Production	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
2.B.2 - Nitric Acid Production	N_2O	0.0	0.0	2.0	0.0	2.0	0.00
2.B.3 - Adipic Acid Production	N_2O	0.0	0.0	5.0	0.0	5.0	0.00
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0.0	0.0	10.0	0.0	10.0	0.00
2.B.5 - Carbide Production	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
2.B.5 - Carbide Production	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
2.B.6 - Titanium Dioxide Production	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
2.B.7 - Soda Ash Production	CO_2	0.0	0.0	5.0	0.0	5.0	0.00

2.B.8.a - Methanol	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.a - Methanol	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.b - Ethylene	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.b - Ethylene	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.d - Ethylene Oxide	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.d - Ethylene Oxide	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.e - Acrylonitrile	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.e - Acrylonitrile	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.f - Carbon Black	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.B.8.f - Carbon Black	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.B.9.a - By-product emissions	CHF3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CH2F2	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CH3F	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CF3CHFCHFCF2CF3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CHF2CF3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CHF2CHF2	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CH2FCF3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CH3CHF2	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CHF2CH2F	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CF3CH3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CF3CHFCF3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CF3CH2CF3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CH2FCF2CHF2	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CF4	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	C2F6	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	C3F8	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	C4F10	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	c-C4F8	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	C5F12	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	C6F14	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	SF_6	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CHCl3	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.a - By-product emissions	CH2Cl	0.0	0.0	1.0	0.0	1.0	0.00

	2						
2.B.9.a - By-product emissions	CF3 I	0.0	0.0	1.0	0.0	1.0	0.00
2.B.9.b - Fugitive Emissions	CHF3	0.0	0.0	1.0	0.0	1.0	0.00
2.C - Metal Industry							
2.C.1 - Iron and Steel Production	CO_2	635.1	62.4	10.0	0.0	10.0	0.00
2.C.1 - Iron and Steel Production	CH_4	0.0	0.0	10.0	0.0	10.0	0.00
2.C.2 - Ferroalloys Production	CO_2	35.4	86.3	4.0	0.0	4.0	0.00
2.C.2 - Ferroalloys Production	CH_4	0.0	0.0	4.0	0.0	4.0	0.00
2.C.3 - Aluminium production	CO_2	0.8	0.0	1.0	9.0	9.1	0.00
2.C.3 - Aluminium production	CF4	5.2	0.0	1.0	0.0	1.0	0.00
2.C.3 - Aluminium production	C2F6	1.8	0.0	1.0	0.0	1.0	0.00
2.C.4 - Magnesium production	CO_2	0.0	0.0	5.0	0.0	5.0	0.00
2.C.4 - Magnesium production	SF_6	0.0	0.0	5.0	0.0	5.0	0.00
2.C.5 - Lead Production	CO_2	0.0	0.5	10.0	50.0	51.0	0.00
2.C.6 - Zinc Production	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.D - Non-Energy Products from Fuels and Solvent Use							
2.D.1 - Lubricant Use	CO_2	14.8	12.3	10.0	0.0	10.0	0.00
2.D.2 - Paraffin Wax Use	CO_2	0.0	0.0	10.0	0.0	10.0	0.00
2.E - Electronics Industry							
2.E.1 - Integrated Circuit or Semiconductor	C2F6	0.0	0.0	10.0	0.0	10.0	0.00
2.E.1 - Integrated Circuit or Semiconductor	CF4	0.0	0.0	10.0	0.0	10.0	0.00
2.E.1 - Integrated Circuit or Semiconductor	CHF3	0.0	0.0	10.0	0.0	10.0	0.00
2.E.1 - Integrated Circuit or Semiconductor	C3F8	0.0	0.0	10.0	0.0	10.0	0.00
2.E.1 - Integrated Circuit or Semiconductor	SF_6	0.0	0.0	10.0	0.0	10.0	0.00
2.E.2 - TFT Flat Panel Display	CF4	0.0	0.0	10.0	0.0	10.0	0.00
2.E.2 - TFT Flat Panel Display	SF_6	0.0	0.0	10.0	0.0	10.0	0.00
2.E.3 - Photovoltaics	CF4	0.0	0.0	10.0	0.0	10.0	0.00
2.E.3 - Photovoltaics	C2F6	0.0	0.0	10.0	0.0	10.0	0.00
2.E.4 - Heat Transfer Fluid	C6F14	0.0	0.0	10.0	0.0	10.0	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances							
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF3	0.0	0.0	0.0	0.0	0.0	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	0.0	0.0	0.0	0.0	0.0	0.00
2.F.1.b - Mobile Air Conditioning	CH2FCF3	0.0	0.0	5.0	0.0	5.0	0.00
2.F.3 - Fire Protection	CH2FCF3	0.0	0.0	0.0	0.0	0.0	0.00
2.F.4 - Aerosols	CH2FCF3	0.0	0.0	10.0	10.0	14.1	0.00
2.F.4 - Aerosols	CH3CHF2	0.0	0.0	10.0	10.0	14.1	0.00
2.F.4 - Aerosols	CF3CHFCF3	0.0	0.0	10.0	10.0	14.1	0.00
2.F.4 - Aerosols	CF3CHFCHFC	0.0	0.0	10.0	10.0	14.1	0.00

	F2CF3						
2.F.5 - Solvents	CF3CH FCHFC F2CF3	0.0	0.0	10.0	50.0	51.0	0.00
2.F.5 - Solvents	C6F14	0.0	0.0	10.0	50.0	51.0	0.00
2.F.6 - Other Applications (please specify)	CHF3	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CH2F2	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CH3F	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CF3CH FCHFC F2CF3	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CHF2C F3	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CHF2C HF2	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CH2FC F3	0.0	0.0	10.0	50.0	51.0	0.00
2.F.6 - Other Applications (please specify)	CH3C HF2	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CHF2C H2F	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CF3CH 3	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CF3CH FCF3	0.0	0.0	10.0	50.0	51.0	0.00
2.F.6 - Other Applications (please specify)	CF3CH 2CF3	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CH2FC F2CHF 2	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	CF4	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	C2F6	0.0	0.0	10.0	50.0	51.0	0.00
2.F.6 - Other Applications (please specify)	C3F8	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	C4F10	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	c-C4F8	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	C5F12	0.0	0.0	10.0	0.0	10.0	0.00
2.F.6 - Other Applications (please specify)	C6F14	0.0	0.0	10.0	0.0	10.0	0.00
2.G - Electrical Equipment							
2.G.1.a - Manufacture of Electrical Equipment	SF_6	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.a - Manufacture of Electrical Equipment	CF4	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.a - Manufacture of Electrical Equipment	C2F6	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.a - Manufacture of Electrical Equipment	C3F8	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.a - Manufacture of Electrical Equipment	C4F10	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.a - Manufacture of Electrical Equipment	c-C4F8	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.a - Manufacture of Electrical	C5F12	0.0	0.0	30.0	30.0	42.4	0.00

Equipment							
2.G.1.a - Manufacture of Electrical Equipment	C6F14	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	SF_6	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	CF4	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	C2F6	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	C3F8	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	C4F10	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	c-C4F8	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	C5F12	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.b - Use of Electrical Equipment	C6F14	0.0	0.0	30.0	30.0	42.4	0.00
2.G.1.c - Disposal of Electrical Equipment	SF_6	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	CF4	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	C2F6	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	C3F8	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	C4F10	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	c-C4F8	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	C5F12	0.0	0.0	40.0	40.0	56.6	0.00
2.G.1.c - Disposal of Electrical Equipment	C6F14	0.0	0.0	40.0	40.0	56.6	0.00
2.G.2.a - Military Applications	SF_6	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	CF4	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	C2F6	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	C3F8	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	C4F10	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	c-C4F8	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	C5F12	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.a - Military Applications	C6F14	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	SF_6	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	CF4	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	C2F6	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	C3F8	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	C4F10	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	c-C4F8	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	C5F12	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.b - Accelerators	C6F14	0.0	0.0	10.0	0.0	10.0	0.00
2.G.2.c - Other (please specify)	SF_6	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	CF4	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	C2F6	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	C3F8	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	C4F10	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	c-C4F8	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	C5F12	0.0	0.0	0.0	0.0	0.0	0.00
2.G.2.c - Other (please specify)	C6F14	0.0	0.0	0.0	0.0	0.0	0.00
2.G.3.a - Medical Applications	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
2.G.3.b - Propellant for pressure and aerosol	N_2O	0.0	0.0	0.0	0.0	0.0	0.00

products							
2.G.3.c - Other (Please specify)	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
2.H - Other							
2.H.1 - Pulp and Paper Industry	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
2.H.3 - Other (please specify)	CO_2	0.0	157.9	10.0	5.0	11.2	0.02
3.A - Livestock							
3.A.1.a.i - Dairy Cows	CH_4	733.9	738.0	5.0	30.0	30.4	3.33
3.A.1.a.ii - Other Cattle	CH_4	171.7	166.9	5.0	30.0	30.4	0.17
3.A.1.b - Buffalo	CH_4	0.0	0.1	5.0	30.0	30.4	0.00
3.A.1.c - Sheep	CH_4	185.6	207.1	5.0	30.0	30.4	0.26
3.A.1.d - Goats	CH_4	81.1	98.8	5.0	30.0	30.4	0.06
3.A.1.e - Camels	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.A.1.f - Horses	CH_4	13.2	12.1	5.0	30.0	30.4	0.00
3.A.1.g - Mules and Asses	CH_4	13.4	13.0	5.0	30.0	30.4	0.00
3.A.1.h - Swine	CH_4	3.4	3.8	5.0	30.0	30.4	0.00
3.A.1.j - Other (please specify)	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.A.2.a.i - Dairy cows	CH_4	148.3	149.1	5.0	30.0	30.4	0.14
3.A.2.a.i - Dairy cows	N_2O	62.8	63.2	5.0	50.0	50.2	0.07
3.A.2.a.ii - Other cattle	CH_4	26.6	25.9	5.0	50.0	50.2	0.01
3.A.2.a.ii - Other cattle	N_2O	11.7	11.4	5.0	50.0	50.2	0.00
3.A.2.b - Buffalo	CH_4	0.0	0.0	5.0	0.0	5.0	0.00
3.A.2.b - Buffalo	N_2O	0.0	0.0	5.0	50.0	50.2	0.00
3.A.2.c - Sheep	CH_4	5.6	6.2	5.0	0.0	5.0	0.00
3.A.2.c - Sheep	N_2O	4.0	4.4	5.0	50.0	50.2	0.00
3.A.2.d - Goats	CH_4	2.8	3.4	5.0	0.0	5.0	0.00
3.A.2.d - Goats	N_2O	2.6	3.2	5.0	50.0	50.2	0.00
3.A.2.e - Camels	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.A.2.e - Camels	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
3.A.2.f - Horses	CH_4	1.2	1.1	5.0	0.0	5.0	0.00
3.A.2.f - Horses	N_2O	0.1	0.1	5.0	50.0	50.2	0.00
3.A.2.g - Mules and Asses	CH_4	1.2	1.2	5.0	0.0	5.0	0.00
3.A.2.g - Mules and Asses	N_2O	0.1	0.1	5.0	50.0	50.2	0.00
3.A.2.h - Swine	CH_4	13.4	15.2	5.0	30.0	30.4	0.00
3.A.2.h - Swine	N_2O	2.3	2.6	5.0	50.0	50.2	0.00
3.A.2.i - Poultry	CH_4	3.5	3.5	5.0	0.0	5.0	0.00
3.A.2.i - Poultry	N_2O	0.7	0.7	5.0	50.0	50.2	0.00
3.A.2.j - Other (please specify)	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.A.2.j - Other (please specify)	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
3.B - Land							
3.B.1.a - Forest land Remaining Forest land	CO_2	1425.6	1264.0	30.0	30.0	42.4	18.99
3.B.1.b.i - Cropland converted to Forest Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.1.b.ii - Grassland converted to Forest Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.1.b.iii - Wetlands converted to Forest Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00

3.B.1.b.iv - Settlements converted to Forest Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.1.b.v - Other Land converted to Forest Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.2.a - Cropland Remaining Cropland	CO_2	72.9	72.9	10.0	30.0	31.6	0.04
3.B.2.b.i - Forest Land converted to Cropland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.2.b.ii - Grassland converted to Cropland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.2.b.iii - Wetlands converted to Cropland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.2.b.iv - Settlements converted to Cropland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.2.b.v - Other Land converted to Cropland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.3.a - Grassland Remaining Grassland	CO_2	0.0	0.0	50.0	6.0	50.4	0.00
3.B.3.b.i - Forest Land converted to Grassland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.3.b.ii - Cropland converted to Grassland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.3.b.iii - Wetlands converted to Grassland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.3.b.iv - Settlements converted to Grassland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.3.b.v - Other Land converted to Grassland	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.4.a.i - Peatlands remaining peatlands	CO_2	0.0	0.0	50.0	75.0	90.1	0.00
3.B.4.a.i - Peatlands remaining peatlands	N_2O	0.0	0.0	50.0	0.0	50.0	0.00
3.B.4.b.i - Land converted for peat extraction	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
3.B.4.b.ii - Land converted to flooded land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.5.a - Settlements Remaining Settlements	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.5.b.i - Forest Land converted to Settlements	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.5.b.ii - Cropland converted to Settlements	CO_2	93.5	93.5	0.0	0.0	0.0	0.00
3.B.5.b.iii - Grassland converted to Settlements	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.5.b.iv - Wetlands converted to Settlements	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.5.b.v - Other Land converted to Settlements	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.6.b.i - Forest Land converted to Other Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.6.b.ii - Cropland converted to Other Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.6.b.iii - Grassland converted to Other Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.6.b.iv - Wetlands converted to Other Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.B.6.b.v - Settlements converted to Other Land	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.C - Aggregate sources and non-CO_2 emissions sources on land							
3.C.1.a - Biomass burning in forest lands	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.C.1.a - Biomass burning in forest lands	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
3.C.1.b - Biomass burning in croplands	CH_4	0.1	0.1	0.0	0.0	0.0	0.00

3.C.1.b - Biomass burning in croplands	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
3.C.1.c - Biomass burning in grasslands	CH_4	0.6	0.6	0.0	0.0	0.0	0.00
3.C.1.c - Biomass burning in grasslands	N_2O	0.9	0.8	0.0	0.0	0.0	0.00
3.C.1.d - Biomass burning in all other land	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.C.1.d - Biomass burning in all other land	N_2O	0.0	0.0	0.0	0.0	0.0	0.00
3.C.2 - Liming	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
3.C.3 - Urea application	CO_2	26.1	32.6	0.0	0.0	0.0	0.00
3.C.4 - Direct N_2O Emissions from managed soils	N_2O	510.9	552.4	0.0	0.0	0.0	0.00
3.C.5 - Indirect N_2O Emissions from managed soils	N_2O	170.0	184.9	0.0	0.0	0.0	0.00
3.C.6 - Indirect N_2O Emissions from manure management	N_2O	40.1	40.6	0.0	0.0	0.0	0.00
3.C.7 - Rice cultivation	CH_4	0.0	0.0	0.0	0.0	0.0	0.00
3.D - Other							
3.D.1 - Harvested Wood Products	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
4.A - Solid Waste Disposal							
4.A - Solid Waste Disposal	CH_4	423.0	698.9	5.0	30.0	30.4	2.98
4.B - Biological Treatment of Solid Waste							
4.B - Biological Treatment of Solid Waste	CH_4	4.5	3.4	30.0	5.0	30.4	0.00
4.B - Biological Treatment of Solid Waste	N_2O	3.9	3.0	30.0	5.0	30.4	0.00
4.C - Incineration and Open Burning of Waste							
4.C.1 - Waste Incineration	CO_2	0.0	0.0	5.0	40.0	40.3	0.00
4.C.1 - Waste Incineration	CH_4	0.0	0.0	5.0	10.0	11.2	0.00
4.C.1 - Waste Incineration	N_2O	0.0	0.0	5.0	10.0	11.2	0.00
4.C.2 - Open Burning of Waste	CO_2	3.8	3.0	5.0	40.0	40.3	0.00
4.C.2 - Open Burning of Waste	CH_4	8.8	6.9	5.0	10.0	11.2	0.00
4.C.2 - Open Burning of Waste	N_2O	2.5	2.0	5.0	10.0	11.2	0.00
4.D - Wastewater Treatment and Discharge							
4.D.1 - Domestic Wastewater Treatment and Discharge	CH_4	88.9	78.9	5.0	30.0	30.4	0.04
4.D.1 - Domestic Wastewater Treatment and Discharge	N_2O	76.4	66.9	5.0	30.0	30.4	0.03
4.D.2 - Industrial Wastewater Treatment and Discharge	CH_4	9.1	18.6	5.0	10.0	11.2	0.00
4.E - Other (please specify)							
4.E - Other (please specify)	CO_2	0.0	0.0	0.0	0.0	0.0	0.00
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3							
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	N_2O	74.6	122.3	0.0	0.0	0.0	0.00
5.B - Other (please specify)							
5.B - Other (please specify)	CO_2	0.0	0.0	0.0	0.0	0.0	0
Total							
						Uncertainty in total inventory: 5.393	

Annex III: Key Category Analysis

Table A3.1: Key Category Analysis – Level Assessment (2019)

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.3.b	Road Transportation	CO_2	2596.07	2596.07	0.23	0.23
3.B.1.a	Forest land Remaining Forest land	CO_2	1263.97	1263.97	0.11	0.34
3.A.1	Enteric Fermentation	CH_4	1239.84	1239.84	0.11	0.44
2.A.1	Cement production	CO_2	1003.50	1003.50	0.09	0.53
1.A.4	Other Sectors - Liquid Fuels	CO_2	764.78	764.78	0.07	0.60
4.A	Solid Waste Disposal	CH_4	698.86	698.86	0.06	0.66
3.C.4	Direct N_2O Emissions from managed soils	N_2O	552.40	552.40	0.05	0.71
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	539.89	539.89	0.05	0.75
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO_2	471.34	471.34	0.04	0.79
1.A.5	Non-Specified - Liquid Fuels	CO_2	444.54	444.54	0.04	0.83
1.A.1	Energy Industries - Liquid Fuels	CO_2	235.26	235.26	0.02	0.85
3.A.2	Manure Management	CH_4	205.56	205.56	0.02	0.87
3.C.5	Indirect N_2O Emissions from managed soils	N_2O	184.85	184.85	0.02	0.89
2.H	Other	CO_2	157.91	157.91	0.01	0.90
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	N_2O	122.33	122.33	0.01	0.91
1.B.2.a	Oil	CH_4	101.02	101.02	0.01	0.92
4.D	Wastewater Treatment and Discharge	CH_4	97.45	97.45	0.01	0.93
3.B.5.b	Land Converted to Settlements	CO_2	93.50	93.50	0.01	0.94
2.C.2	Ferroalloys Production	CO_2	86.32	86.32	0.01	0.94
3.A.2	Manure Management	N_2O	85.64	85.64	0.01	0.95
3.B.2.a	Cropland Remaining Cropland	CO_2	72.93	72.93	0.01	0.96

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
4.D	Wastewater Treatment and Discharge	N_2O	66.91	66.91	0.01	0.96
2.C.1	Iron and Steel Production	CO_2	62.37	62.37	0.01	0.97
1.A.3.b	Road Transportation	N_2O	40.82	40.82	0.00	0.97
3.C.6	Indirect N_2O Emissions from manure management	N_2O	40.61	40.61	0.00	0.98
1.A.4	Other Sectors - Biomass	CH_4	40.16	40.16	0.00	0.98
3.C.3	Urea application	CO_2	32.63	32.63	0.00	0.98
1.A.3.a	Civil Aviation	CO_2	28.62	28.62	0.00	0.99
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO_2	21.76	21.76	0.00	0.99
2.A.2	Lime production	CO_2	18.78	18.78	0.00	0.99
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	17.32	17.32	0.00	0.99
1.A.1	Energy Industries - Gaseous Fuels	CO_2	17.26	17.26	0.00	0.99
2.D	Non-Energy Products from Fuels and Solvent Use	CO_2	12.27	12.27	0.00	0.99
1.A.3.b	Road Transportation	CH_4	8.33	8.33	0.00	0.99
1.A.4	Other Sectors - Biomass	N_2O	7.90	7.90	0.00	0.99
4.C	Incineration and Open Burning of Waste	CH_4	6.95	6.95	0.00	1.00
1.A.3.c	Railways	CO_2	6.67	6.67	0.00	1.00
1.A.1	Energy Industries - Solid Fuels	CO_2	6.26	6.26	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	N_2O	3.92	3.92	0.00	1.00
1.B.1	Solid Fuels	CO_2	3.49	3.49	0.00	1.00
4.B	Biological Treatment of Solid Waste	CH_4	3.40	3.40	0.00	1.00
4.C	Incineration and Open Burning of Waste	CO_2	3.01	3.01	0.00	1.00
4.B	Biological Treatment of Solid Waste	N_2O	3.01	3.01	0.00	1.00
1.B.2.a	Oil	N_2O	2.98	2.98	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	CH_4	2.96	2.96	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	N_2O	2.17	2.17	0.00	1.00

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.B.2.b	Natural Gas	CH_4	2.02	2.02	0.00	1.00
4.C	Incineration and Open Burning of Waste	N_2O	1.97	1.97	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	CH_4	1.67	1.67	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	N_2O	1.19	1.19	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	N_2O	1.09	1.09	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CH_4	0.98	0.98	0.00	1.00
3.C.1	Emissions from biomass burning	N_2O	0.83	0.83	0.00	1.00
3.C.1	Emissions from biomass burning	CH_4	0.66	0.66	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	N_2O	0.58	0.58	0.00	1.00
2.C.5	Lead Production	CO_2	0.50	0.50	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	N_2O	0.38	0.38	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CH_4	0.37	0.37	0.00	1.00
1.A.3.a	Civil Aviation	N_2O	0.25	0.25	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	CH_4	0.20	0.20	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	CH_4	0.19	0.19	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	N_2O	0.18	0.18	0.00	1.00
1.A.3.c	Railways	N_2O	0.09	0.09	0.00	1.00
1.B.2.a	Oil	CO_2	0.09	0.09	0.00	1.00
1.A.3.c	Railways	CH_4	0.06	0.06	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	CH_4	0.04	0.04	0.00	1.00
1.A.1	Energy Industries - Solid Fuels	N_2O	0.03	0.03	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.02	0.02	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	N_2O	0.01	0.01	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	N_2O	0.0095	0.0095	0.0000	1.0000
1.A.1	Energy Industries - Gaseous Fuels	CH_4	0.0065	0.0065	0.0000	1.0000

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.3.a	Civil Aviation	CH_4	0.0042	0.0042	0.0000	1.0000
1.B.2.b	Natural Gas	CO_2	0.0034	0.0034	0.0000	1.0000
1.A.1	Energy Industries - Solid Fuels	CH_4	0.0013	0.0013	0.0000	1.0000
1.B.2.b	Natural Gas	N_2O	0.0011	0.0011	0.0000	1.0000
1.B.1	Solid Fuels	CH_4	1.52E-06	1.52E-06	1.33E-10	1.0000
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	0	0	0	1
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	0	0	0	1
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	0	0	0	1
1.A.1	Energy Industries - Peat	CO_2	0	0	0	1
1.A.1	Energy Industries - Peat	CH_4	0	0	0	1
1.A.1	Energy Industries - Peat	N_2O	0	0	0	1
1.A.1	Energy Industries - Biomass	CO_2	0	0	0	1
1.A.1	Energy Industries - Biomass	CH_4	0	0	0	1
1.A.1	Energy Industries - Biomass	N_2O	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	N_2O	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	N_2O	0	0	0	1
1.A.3.e	Other Transportation	CO_2	0	0	0	1
1.A.3.e	Other Transportation	CH_4	0	0	0	1
1.A.3.e	Other Transportation	N_2O	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	CO_2	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	CH_4	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	N_2O	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	CO_2	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	CH_4	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	N_2O	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	CH_4	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	0	0	0	1
1.A.4	Other Sectors - Peat	CO_2	0	0	0	1
1.A.4	Other Sectors - Peat	CH_4	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.4	Other Sectors - Peat	N_2O	0	0	0	1
1.A.4	Other Sectors - Biomass	CO_2	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	CO_2	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	CH_4	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	N_2O	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	CO_2	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	CH_4	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	N_2O	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	CH_4	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	0	0	0	1
1.A.5	Non-Specified - Peat	CO_2	0	0	0	1
1.A.5	Non-Specified - Peat	CH_4	0	0	0	1
1.A.5	Non-Specified - Peat	N_2O	0	0	0	1
1.A.5	Non-Specified - Biomass	CO_2	0	0	0	1
1.A.5	Non-Specified - Biomass	CH_4	0	0	0	1
1.A.5	Non-Specified - Biomass	N_2O	0	0	0	1
1.B.1	Solid Fuels	N_2O	0	0	0	1
1.C	Carbon dioxide Transport and Storage	CO_2	0	0	0	1
2.A.3	Glass Production	CO_2	0	0	0	1
2.A.4	Other Process Uses of Carbonates	CO_2	0	0	0	1
2.B.1	Ammonia Production	CO_2	0	0	0	1
2.B.2	Nitric Acid Production	N_2O	0	0	0	1
2.B.3	Adipic Acid Production	N_2O	0	0	0	1
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
2.B.5	Carbide Production	CO_2	0	0	0	1
2.B.5	Carbide Production	CH_4	0	0	0	1
2.B.6	Titanium Dioxide Production	CO_2	0	0	0	1
2.B.7	Soda Ash Production	CO_2	0	0	0	1
2.B.8	Petrochemical and Carbon Black Production	CO_2	0	0	0	1
2.B.8	Petrochemical and Carbon Black Production	CH_4	0	0	0	1
2.B.9	Fluorochemical Production	SF_6, PFCs, HFCs and other halogenated gases	0	0	0	1
2.C.1	Iron and Steel Production	CH_4	0	0	0	1
2.C.2	Ferroalloys Production	CH_4	0	0	0	1
2.C.3	Aluminium production	CO_2	0	0	0	1
2.C.3	Aluminium production	PFCs (PFCs)	0	0	0	1
2.C.4	Magnesium production	CO_2	0	0	0	1
2.C.4	Magnesium production	Sulphur Hexafluoride (SF_6)	0	0	0	1
2.C.6	Zinc Production	CO_2	0	0	0	1
2.E	Electronics Industry	SF_6, PFCs, HFCs and other halogenated gases	0	0	0	1
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0	0	0	1
2.F.2	Foam Blowing Agents	HFCs (HFCs)	0	0	0	1
2.F.3	Fire Protection	HFCs, PFCs	0	0	0	1
2.F.4	Aerosols	HFCs, PFCs	0	0	0	1
2.F.5	Solvents	HFCs, PFCs	0	0	0	1
2.F.6	Other Applications (please specify)	HFCs, PFCs	0	0	0	1
2.G	Other Product Manufacture and Use	SF_6, PFCs	0	0	0	1
2.G	Other Product Manufacture and Use	N_2O	0	0	0	1
3.B.1.b	Land Converted to Forest land	CO_2	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
3.B.2.b	Land Converted to Cropland	CO_2	0	0	0	1
3.B.3.a	Grassland Remaining Grassland	CO_2	0	0	0	1
3.B.3.b	Land Converted to Grassland	CO_2	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	CO_2	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	N_2O	0	0	0	1
3.B.4.b	Land Converted to Wetlands	N_2O	0	0	0	1
3.B.4.b	Land Converted to Wetlands	CO_2	0	0	0	1
3.B.5.a	Settlements Remaining Settlements	CO_2	0	0	0	1
3.B.6.b	Land Converted to Other land	CO_2	0	0	0	1
3.C.2	Liming	CO_2	0	0	0	1
3.C.7	Rice cultivation	CH_4	0	0	0	1
3.D.1	Harvested Wood Products	CO_2	0	0	0	1
4.E	Other (please specify)	CO_2	0	0	0	1
5.B	Other (please specify)	CO_2	0	0	0	1
				11492		

Table A3.1: Key Category Analysis – Level Assessment (2009)

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.3.b	Road Transportation	CO_2	2259.85	2259.85	0.22	0.22
3.B.1.a	Forest land Remaining Forest land	CO_2	1425.63	1425.63	0.14	0.36
3.A.1	Enteric Fermentation	CH_4	1202.36	1202.36	0.12	0.48
2.C.1	Iron and Steel Production	CO_2	635.10	635.10	0.06	0.54
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	620.20	620.20	0.06	0.60
2.A.1	Cement production	CO_2	585.00	585.00	0.06	0.66
3.C.4	Direct N_2O Emissions from managed soils	N_2O	510.92	510.92	0.05	0.71
1.A.4	Other Sectors - Liquid Fuels	CO_2	499.67	499.67	0.05	0.76
4.A	Solid Waste Disposal	CH_4	423.00	423.00	0.04	0.80
1.A.1	Energy Industries - Liquid Fuels	CO_2	308.44	308.44	0.03	0.83
3.A.2	Manure Management	CH_4	202.58	202.58	0.02	0.85
1.A.5	Non-Specified - Liquid Fuels	CO_2	185.97	185.97	0.02	0.87
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO_2	174.74	174.74	0.02	0.88
3.C.5	Indirect N_2O Emissions from managed soils	N_2O	169.96	169.96	0.02	0.90
1.B.2.a	Oil	CH_4	100.62	100.62	0.01	0.91
4.D	Wastewater Treatment and Discharge	CH_4	98.06	98.06	0.01	0.92
3.B.5.b	Land Converted to Settlements	CO_2	93.50	93.50	0.01	0.93
2.A.2	Lime production	CO_2	86.45	86.45	0.01	0.94
3.A.2	Manure Management	N_2O	84.28	84.28	0.01	0.94
4.D	Wastewater Treatment and Discharge	N_2O	76.35	76.35	0.01	0.95
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	N_2O	74.63	74.63	0.01	0.96
3.B.2.a	Cropland Remaining Cropland	CO_2	72.93	72.93	0.01	0.97
1.A.4	Other Sectors - Biomass	CH_4	50.37	50.37	0.00	0.97

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
3.C.6	Indirect N_2O Emissions from manure management	N_2O	40.14	40.14	0.00	0.98
1.A.3.b	Road Transportation	N_2O	35.63	35.63	0.00	0.98
2.C.2	Ferroalloys Production	CO_2	35.45	35.45	0.00	0.98
3.C.3	Urea application	CO_2	26.08	26.08	0.00	0.99
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO_2	19.54	19.54	0.00	0.99
1.A.1	Energy Industries - Gaseous Fuels	CO_2	17.32	17.32	0.00	0.99
2.D	Non-Energy Products from Fuels and Solvent Use	CO_2	14.84	14.84	0.00	0.99
1.A.3.a	Civil Aviation	CO_2	10.73	10.73	0.00	0.99
1.A.4	Other Sectors - Biomass	N_2O	9.91	9.91	0.00	0.99
1.A.3.c	Railways	CO_2	9.53	9.53	0.00	0.99
4.C	Incineration and Open Burning of Waste	CH_4	8.79	8.79	0.00	0.99
1.A.3.b	Road Transportation	CH_4	7.55	7.55	0.00	0.99
2.C.3	Aluminium production	PFCs	7.04	7.04	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	6.09	6.09	0.00	1.00
1.A.1	Energy Industries - Solid Fuels	CO_2	4.98	4.98	0.00	1.00
4.B	Biological Treatment of Solid Waste	CH_4	4.45	4.45	0.00	1.00
4.B	Biological Treatment of Solid Waste	N_2O	3.94	3.94	0.00	1.00
4.C	Incineration and Open Burning of Waste	CO_2	3.82	3.82	0.00	1.00
1.B.1	Solid Fuels	CO_2	3.49	3.49	0.00	1.00
1.B.2.a	Oil	N_2O	2.97	2.97	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	N_2O	2.66	2.66	0.00	1.00
4.C	Incineration and Open Burning of Waste	N_2O	2.49	2.49	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	CH_4	1.86	1.86	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	N_2O	1.40	1.40	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	CH_4	1.11	1.11	0.00	1.00

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
3.C.1	Emissions from biomass burning	N_2O	0.90	0.90	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	N_2O	0.86	0.86	0.00	1.00
2.C.3	Aluminium production	CO_2	0.80	0.80	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	N_2O	0.76	0.76	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	N_2O	0.74	0.74	0.00	1.00
3.C.1	Emissions from biomass burning	CH_4	0.73	0.73	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CH_4	0.48	0.48	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CH_4	0.39	0.39	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	CH_4	0.26	0.26	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	N_2O	0.18	0.18	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	N_2O	0.16	0.16	0.00	1.00
1.A.3.c	Railways	N_2O	0.13	0.13	0.00	1.00
1.A.3.a	Civil Aviation	N_2O	0.09	0.09	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	CH_4	0.09	0.09	0.00	1.00
1.A.3.c	Railways	CH_4	0.09	0.09	0.00	1.00
1.B.2.a	Oil	CO_2	0.09	0.09	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	CH_4	0.04	0.04	0.00	1.00
1.A.1	Energy Industries - Solid Fuels	N_2O	0.02	0.02	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	N_2O	0.02	0.02	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	N_2O	0.01	0.01	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	CH_4	0.01	0.01	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.0060	0.0060	0.0000	1.0000
1.A.3.a	Civil Aviation	CH_4	0.0016	0.0016	0.0000	1.0000
1.B.2.b	Natural Gas	N_2O	0.0011	0.0011	0.0000	1.0000
1.A.1	Energy Industries - Solid Fuels	CH_4	0.0010	0.0010	0.0000	1.0000

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.B.2.b	Natural Gas	CH_4	0.0002	0.0002	0.0000	1.0000
1.B.1	Solid Fuels	CH_4	0.0000	0.0000	0.0000	1.0000
1.B.2.b	Natural Gas	CO_2	5.68E-07	5.68E-07	5.55E-11	1.0000
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	0	0	0	1
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	0	0	0	1
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	0	0	0	1
1.A.1	Energy Industries - Peat	CO_2	0	0	0	1
1.A.1	Energy Industries - Peat	CH_4	0	0	0	1
1.A.1	Energy Industries - Peat	N_2O	0	0	0	1
1.A.1	Energy Industries - Biomass	CO_2	0	0	0	1
1.A.1	Energy Industries - Biomass	CH_4	0	0	0	1
1.A.1	Energy Industries - Biomass	N_2O	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	N_2O	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	N_2O	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	CO_2	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	CH_4	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	N_2O	0	0	0	1
1.A.3.e	Other Transportation	CO_2	0	0	0	1
1.A.3.e	Other Transportation	CH_4	0	0	0	1
1.A.3.e	Other Transportation	N_2O	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	CO_2	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	CH_4	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	N_2O	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	CO_2	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	CH_4	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	N_2O	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	CH_4	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	0	0	0	1
1.A.4	Other Sectors - Peat	CO_2	0	0	0	1
1.A.4	Other Sectors - Peat	CH_4	0	0	0	1
1.A.4	Other Sectors - Peat	N_2O	0	0	0	1
1.A.4	Other Sectors - Biomass	CO_2	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
1.A.5	Non-Specified - Solid Fuels	CO_2	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	CH_4	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	N_2O	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	CO_2	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	CH_4	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	N_2O	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	CH_4	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	0	0	0	1
1.A.5	Non-Specified - Peat	CO_2	0	0	0	1
1.A.5	Non-Specified - Peat	CH_4	0	0	0	1
1.A.5	Non-Specified - Peat	N_2O	0	0	0	1
1.A.5	Non-Specified - Biomass	CO_2	0	0	0	1
1.A.5	Non-Specified - Biomass	CH_4	0	0	0	1
1.A.5	Non-Specified - Biomass	N_2O	0	0	0	1
1.B.1	Solid Fuels	N_2O	0	0	0	1
1.C	Carbon dioxide Transport and Storage	CO_2	0	0	0	1
2.A.3	Glass Production	CO_2	0	0	0	1
2.A.4	Other Process Uses of Carbonates	CO_2	0	0	0	1
2.B.1	Ammonia Production	CO_2	0	0	0	1
2.B.2	Nitric Acid Production	N_2O	0	0	0	1
2.B.3	Adipic Acid Production	N_2O	0	0	0	1
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0	0	0	1
2.B.5	Carbide Production	CO_2	0	0	0	1
2.B.5	Carbide Production	CH_4	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	IPCC Category	Greenhouse Gas	Latest Year Estimate [kt CO_2-e]	Absolute Value of Latest Year	Level Assessment	Cumulative Total of Column F
2.B.6	Titanium Dioxide Production	CO_2	0	0	0	1
2.B.7	Soda Ash Production	CO_2	0	0	0	1
2.B.8	Petrochemical and Carbon Black Production	CO_2	0	0	0	1
2.B.8	Petrochemical and Carbon Black Production	CH_4	0	0	0	1
2.B.9	Fluorochemical Production	SF_6, PFCs, HFCs	0	0	0	1
2.C.1	Iron and Steel Production	CH_4	0	0	0	1
2.C.2	Ferroalloys Production	CH_4	0	0	0	1
2.C.4	Magnesium production	CO_2	0	0	0	1
2.C.4	Magnesium production	SF_6	0	0	0	1
2.C.5	Lead Production	CO_2	0	0	0	1
2.C.6	Zinc Production	CO_2	0	0	0	1
2.E	Electronics Industry	SF_6, PFCs, HFCs	0	0	0	1
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0	0	0	1
2.F.2	Foam Blowing Agents	HFCs	0	0	0	1
2.F.3	Fire Protection	HFCs, PFCs	0	0	0	1
2.F.4	Aerosols	HFCs, PFCs	0	0	0	1
2.F.5	Solvents	HFCs, PFCs	0	0	0	1
2.F.6	Other Applications (please specify)	HFCs, PFCs	0	0	0	1
2.G	Other Product Manufacture and Use	SF_6, PFCs	0	0	0	1
2.G	Other Product Manufacture and Use	N_2O	0	0	0	1
2.H	Other	CO_2	0	0	0	1
3.B.1.b	Land Converted to Forest land	CO_2	0	0	0	1
3.B.2.b	Land Converted to Cropland	CO_2	0	0	0	1
3.B.3.a	Grassland Remaining Grassland	CO_2	0	0	0	1
3.B.3.b	Land Converted to Grassland	CO_2	0	0	0	1

A	B	C	D	E	F	G
IPCC Code	**IPCC Category**	**Greenhouse Gas**	**Latest Year Estimate [kt CO_2-e]**	**Absolute Value of Latest Year**	**Level Assessment**	**Cumulative Total of Column F**
3.B.4.a.i	Peatlands remaining peatlands	CO_2	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	N_2O	0	0	0	1
3.B.4.b	Land Converted to Wetlands	N_2O	0	0	0	1
3.B.4.b	Land Converted to Wetlands	CO_2	0	0	0	1
3.B.5.a	Settlements Remaining Settlements	CO_2	0	0	0	1
3.B.6.b	Land Converted to Other land	CO_2	0	0	0	1
3.C.2	Liming	CO_2	0	0	0	1
3.C.7	Rice cultivation	CH_4	0	0	0	1
3.D.1	Harvested Wood Products	CO_2	0	0	0	1
4.E	Other (please specify)	CO_2	0	0	0	1
Total			10229	10229	1	

Table A3.1: Key Category Analysis – Trend Assessment (2009-2019)

A	B	C	D	E	F	G	H
IPCC code	**IPCC Category**	**GHG**	**2009 Year Estimate ($Gg\ CO_2\ Eq$)**	**2019 Year Estimate ($Gg\ CO_2\ Eq$)**	**Trend Assessment**	**% Contribution to Trend**	**Cumulative Total of Column G**
2.C.1	Iron and Steel Production	CO_2	635.10	62.37	0.06	0.20	0.20
2.A.1	Cement production	CO_2	585.00	1003.50	0.03	0.11	0.31
3.B.1.a	Forest land Remaining Forest land	CO_2	1425.63	1263.97	0.03	0.10	0.41
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO_2	174.74	471.34	0.03	0.08	0.50
1.A.5	Non-Specified - Liquid Fuels	CO_2	185.97	444.54	0.02	0.07	0.57
4.A	Solid Waste Disposal	CH_4	423.00	698.86	0.02	0.07	0.64
1.A.4	Other Sectors - Liquid Fuels	CO_2	499.67	764.78	0.02	0.06	0.70
2.H	Other	CO_2	0.00	157.91	0.02	0.05	0.75
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	620.20	539.89	0.02	0.05	0.80
1.A.1	Energy Industries - Liquid Fuels	CO_2	308.44	235.26	0.01	0.03	0.83
3.A.1	Enteric Fermentation	CH_4	1202.36	1239.84	0.01	0.03	0.87
2.A.2	Lime production	CO_2	86.45	18.78	0.01	0.02	0.89
1.A.3.b	Road Transportation	CO_2	2259.85	2596.07	0.01	0.02	0.91
2.C.2	Ferroalloys Production	CO_2	35.45	86.32	0.00	0.01	0.92
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_X and NH_3	N_2O	74.63	122.33	0.00	0.01	0.93
3.A.2	Manure Management	CH_4	202.58	205.56	0.00	0.01	0.94
3.C.4	Direct N_2O Emissions from managed soils	N_2O	510.92	552.40	0.00	0.01	0.95
4.D	Wastewater Treatment and Discharge	N_2O	76.35	66.91	0.00	0.01	0.95
1.A.3.a	Civil Aviation	CO_2	10.73	28.62	0.00	0.01	0.96
1.A.4	Other Sectors - Biomass	CH_4	50.37	40.16	0.00	0.01	0.96
4.D	Wastewater Treatment and Discharge	CH_4	98.06	97.45	0.00	3.92E-03	9.67E-01
1.B.2.a	Oil	CH_4	100.62	101.02	0.00	3.70E-03	9.70E-01
3.B.5.b	Land Converted to Settlements	CO_2	93.50	93.50	0.00	3.56E-03	9.74E-01

A	B	C	D	E	F	G	H
IPCC code	IPCC Category	GHG	2009 Year Estimate (Gg CO_2 Eq)	2019 Year Estimate (Gg CO_2 Eq)	Trend Assessment	% Contribution to Trend	Cumulative Total of Column G
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	6.09	17.32	0.00	3.22E-03	9.77E-01
3.A.2	Manure Management	N_2O	84.28	85.64	0.00	2.78E-03	9.80E-01
3.B.2.a	Cropland Remaining Cropland	CO_2	72.93	72.93	0.00	2.77E-03	9.83E-01
2.C.3	Aluminium production	PFCs	7.04	0.00	0.00	2.44E-03	9.85E-01
3.C.5	Indirect N_2O Emissions from managed soils	N_2O	169.96	184.85	0.00	1.87E-03	9.87E-01
3.C.6	Indirect N_2O Emissions from manure management	N_2O	40.14	40.61	0.00	1.38E-03	9.88E-01
2.D	Non-Energy Products from Fuels and Solvent Use	CO_2	14.84	12.27	0.00	1.36E-03	9.90E-01
1.A.3.c	Railways	CO_2	9.53	6.67	0.00	1.24E-03	9.91E-01
3.C.3	Urea application	CO_2	26.08	32.63	0.00	1.03E-03	9.92E-01
1.A.4	Other Sectors - Biomass	N_2O	9.91	7.90	0.00	9.96E-04	9.93E-01
4.C	Incineration and Open Burning of Waste	CH_4	8.79	6.95	0.00	9.01E-04	9.94E-01
1.A.1	Energy Industries - Gaseous Fuels	CO_2	17.32	17.26	0.00	6.76E-04	9.95E-01
1.B.2.b	Natural Gas	CH_4	0.00	2.02	0.00	6.22E-04	9.95E-01
4.B	Biological Treatment of Solid Waste	CH_4	4.45	3.40	0.00	4.94E-04	9.96E-01
4.B	Biological Treatment of Solid Waste	N_2O	3.94	3.01	0.00	4.37E-04	9.96E-01
4.C	Incineration and Open Burning of Waste	CO_2	3.82	3.01	0.00	3.93E-04	9.97E-01
1.A.2	Manufacturing Industries and Construction - Solid Fuels	N_2O	0.86	2.17	0.00	3.72E-04	9.97E-01
1.A.5	Non-Specified - Liquid Fuels	N_2O	2.66	3.92	0.00	2.87E-04	9.97E-01
2.C.3	Aluminium production	CO_2	0.80	0.00	0.00	2.77E-04	9.98E-01
1.A.5	Non-Specified - Liquid Fuels	CH_4	1.86	2.96	0.00	2.69E-04	9.98E-01
4.C	Incineration and Open Burning of Waste	N_2O	2.49	1.97	0.00	2.55E-04	9.98E-01
1.A.3.b	Road Transportation	N_2O	35.63	40.82	0.00	2.46E-04	9.98E-01
1.A.1	Energy Industries - Solid Fuels	CO_2	4.98	6.26	0.00	2.06E-04	9.99E-01
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CH_4	0.39	0.98	0.00	1.68E-04	9.99E-01

A	B	C	D	E	F	G	H
IPCC code	**IPCC Category**	**GHG**	**2009 Year Estimate (Gg CO_2 Eq)**	**2019 Year Estimate (Gg CO_2 Eq)**	**Trend Assessment**	**% Contribution to Trend**	**Cumulative Total of Column G**
2.C.5	Lead Production	CO_2	0.00	0.50	0.00	1.53E-04	9.99E-01
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	N_2O	1.40	1.09	0.00	1.48E-04	9.99E-01
1.A.4	Other Sectors - Liquid Fuels	CH_4	1.11	1.67	0.00	1.33E-04	9.99E-01
1.B.1	Solid Fuels	CO_2	3.49	3.49	0.00	1.31E-04	9.99E-01
1.A.4	Other Sectors - Liquid Fuels	N_2O	0.74	1.19	0.00	1.10E-04	9.99E-01
1.B.2.a	Oil	N_2O	2.97	2.98	0.00	1.10E-04	9.99E-01
1.A.1	Energy Industries - Liquid Fuels	N_2O	0.76	0.58	0.00	8.37E-05	1.00E+00
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO_2	19.54	21.76	0.00	5.80E-05	1.00E+00
3.C.1	Emissions from biomass burning	N_2O	0.90	0.83	0.00	5.41E-05	1.00E+00
1.A.2	Manufacturing Industries and Construction - Biomass	N_2O	0.18	0.38	0.00	5.37E-05	1.00E+00
3.C.1	Emissions from biomass burning	CH_4	0.73	0.66	0.00	5.19E-05	1.00E+00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CH_4	0.48	0.37	0.00	4.99E-05	1.00E+00
1.A.3.b	Road Transportation	CH_4	7.55	8.33	0.00	4.74E-05	1.00E+00
1.A.3.a	Civil Aviation	N_2O	0.09	0.25	0.00	4.42E-05	1.00E+00
1.A.1	Energy Industries - Liquid Fuels	CH_4	0.26	0.20	0.00	2.83E-05	1.00E+00
1.A.2	Manufacturing Industries and Construction - Biomass	CH_4	0.09	0.19	0.00	2.73E-05	1.00E+00
1.A.3.c	Railways	N_2O	0.13	0.09	0.00	1.66E-05	1.00E+00
1.A.3.c	Railways	CH_4	0.09	0.06	0.00	1.16E-05	1.00E+00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.01	0.02	0.00	3.92E-06	1.00E+00
1.B.2.a	Oil	CO_2	0.09	0.09	0.00	3.28E-06	1.00E+00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	N_2O	0.02	0.01	0.00	3.16E-06	1.00E+00
1.B.2.b	Natural Gas	CO_2	0.00	0.00	0.00	1.06E-06	1.00E+00
1.A.1	Energy Industries - Solid Fuels	N_2O	0.02	0.03	0.00	9.47E-07	1.00E+00
1.A.3.a	Civil Aviation	CH_4	0.00	0.00	0.00	7.49E-07	1.00E+00

A	B	C	D	E	F	G	H
IPCC code	IPCC Category	GHG	2009 Year Estimate (Gg CO_2 Eq)	2019 Year Estimate (Gg CO_2 Eq)	Trend Assessment	% Contribution to Trend	Cumulative Total of Column G
1.A.3.d	Water-borne Navigation - Liquid Fuels	N_2O	0.16	0.18	0.00	4.85E-07	1.00E+00
1.A.1	Energy Industries - Gaseous Fuels	N_2O	0.01	0.01	0.00	3.73E-07	1.00E+00
1.A.1	Energy Industries - Gaseous Fuels	CH_4	0.01	0.01	0.00	2.53E-07	1.00E+00
1.A.3.d	Water-borne Navigation - Liquid Fuels	CH_4	0.04	0.04	0.00	1.15E-07	1.00E+00
1.A.1	Energy Industries - Solid Fuels	CH_4	0.00	0.00	0.00	4.28E-08	1.00E+00
1.B.2.b	Natural Gas	N_2O	0.00	0.00	0.00	4.00E-08	1.00E+00
1.B.1	Solid Fuels	CH_4	0.00	0.00	0.00	1.64E-10	1.00E+00
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	0	0	0	0	1
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	0	0	0	0	1
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	0	0	0	0	1
1.A.1	Energy Industries - Peat	CO_2	0	0	0	0	1
1.A.1	Energy Industries - Peat	CH_4	0	0	0	0	1
1.A.1	Energy Industries - Peat	N_2O	0	0	0	0	1
1.A.1	Energy Industries - Biomass	CO_2	0	0	0	0	1
1.A.1	Energy Industries - Biomass	CH_4	0	0	0	0	1
1.A.1	Energy Industries - Biomass	N_2O	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Peat	N_2O	0	0	0	0	1
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	0	0	0	0	1

A	B	C	D	E	F	G	H
IPCC code	IPCC Category	GHG	2009 Year Estimate (Gg CO_2 Eq)	2019 Year Estimate (Gg CO_2 Eq)	Trend Assessment	% Contribution to Trend	Cumulative Total of Column G
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	CO_2	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	CH_4	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Peat	N_2O	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	CO_2	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	CH_4	0	0	0	0	1
1.A.3.d	Water-borne Navigation - Biomass	N_2O	0	0	0	0	1
1.A.3.e	Other Transportation	CO_2	0	0	0	0	1
1.A.3.e	Other Transportation	CH_4	0	0	0	0	1
1.A.3.e	Other Transportation	N_2O	0	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	CO_2	0	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	CH_4	0	0	0	0	1
1.A.4	Other Sectors - Solid Fuels	N_2O	0	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	CO_2	0	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	CH_4	0	0	0	0	1
1.A.4	Other Sectors - Gaseous Fuels	N_2O	0	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	0	0	0	0	1

A	B	C	D	E	F	G	H
IPCC code	IPCC Category	GHG	2009 Year Estimate (Gg CO_2 Eq)	2019 Year Estimate (Gg CO_2 Eq)	Trend Assessment	% Contribution to Trend	Cumulative Total of Column G
1.A.4	Other Sectors - Other Fossil Fuels	CH_4	0	0	0	0	1
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	0	0	0	0	1
1.A.4	Other Sectors - Peat	CO_2	0	0	0	0	1
1.A.4	Other Sectors - Peat	CH_4	0	0	0	0	1
1.A.4	Other Sectors - Peat	N_2O	0	0	0	0	1
1.A.4	Other Sectors - Biomass	CO_2	0	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	CO_2	0	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	CH_4	0	0	0	0	1
1.A.5	Non-Specified - Solid Fuels	N_2O	0	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	CO_2	0	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	CH_4	0	0	0	0	1
1.A.5	Non-Specified - Gaseous Fuels	N_2O	0	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	0	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	CH_4	0	0	0	0	1
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	0	0	0	0	1
1.A.5	Non-Specified - Peat	CO_2	0	0	0	0	1
1.A.5	Non-Specified - Peat	CH_4	0	0	0	0	1
1.A.5	Non-Specified - Peat	N_2O	0	0	0	0	1
1.A.5	Non-Specified - Biomass	CO_2	0	0	0	0	1
1.A.5	Non-Specified - Biomass	CH_4	0	0	0	0	1
1.A.5	Non-Specified - Biomass	N_2O	0	0	0	0	1
1.B.1	Solid Fuels	N_2O	0	0	0	0	1
1.C	Carbon dioxide Transport and Storage	CO_2	0	0	0	0	1
2.A.3	Glass Production	CO_2	0	0	0	0	1
2.A.4	Other Process Uses of Carbonates	CO_2	0	0	0	0	1

A	B	C	D	E	F	G	H
IPCC code	IPCC Category	GHG	2009 Year Estimate (Gg CO_2 Eq)	2019 Year Estimate (Gg CO_2 Eq)	Trend Assessment	% Contribution to Trend	Cumulative Total of Column G
2.B.1	Ammonia Production	CO_2	0	0	0	0	1
2.B.2	Nitric Acid Production	N_2O	0	0	0	0	1
2.B.3	Adipic Acid Production	N_2O	0	0	0	0	1
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0	0	0	0	1
2.B.5	Carbide Production	CO_2	0	0	0	0	1
2.B.5	Carbide Production	CH_4	0	0	0	0	1
2.B.6	Titanium Dioxide Production	CO_2	0	0	0	0	1
2.B.7	Soda Ash Production	CO_2	0	0	0	0	1
2.B.8	Petrochemical and Carbon Black Production	CO_2	0	0	0	0	1
2.B.8	Petrochemical and Carbon Black Production	CH_4	0	0	0	0	1
2.B.9	Fluorochemical Production	SF_6, PFCs, HFCs	0	0	0	0	1
2.C.1	Iron and Steel Production	CH_4	0	0	0	0	1
2.C.2	Ferroalloys Production	CH_4	0	0	0	0	1
2.C.4	Magnesium production	CO_2	0	0	0	0	1
2.C.4	Magnesium production	SF_6	0	0	0	0	1
2.C.6	Zinc Production	CO_2	0	0	0	0	1
2.E	Electronics Industry	SF_6, PFCs, HFCs	0	0	0	0	1
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0	0	0	0	1
2.F.2	Foam Blowing Agents	HFCs	0	0	0	0	1
2.F.3	Fire Protection	HFCs, PFCs	0	0	0	0	1
2.F.4	Aerosols	HFCs, PFCs	0	0	0	0	1
2.F.5	Solvents	HFCs, PFCs	0	0	0	0	1
2.F.6	Other Applications (please specify)	HFCs, PFCs	0	0	0	0	1
2.G	Other Product Manufacture and Use	SF_6, PFCs	0	0	0	0	1

A	B	C	D	E	F	G	H
IPCC code	**IPCC Category**	**GHG**	**2009 Year Estimate (Gg CO_2 Eq)**	**2019 Year Estimate (Gg CO_2 Eq)**	**Trend Assessment**	**% Contribution to Trend**	**Cumulative Total of Column G**
2.G	Other Product Manufacture and Use	N_2O	0	0	0	0	1
3.B.1.b	Land Converted to Forest land	CO_2	0	0	0	0	1
3.B.2.b	Land Converted to Cropland	CO_2	0	0	0	0	1
3.B.3.a	Grassland Remaining Grassland	CO_2	0	0	0	0	1
3.B.3.b	Land Converted to Grassland	CO_2	0	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	CO_2	0	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	N_2O	0	0	0	0	1
3.B.4.b	Land Converted to Wetlands	N_2O	0	0	0	0	1
3.B.4.b	Land Converted to Wetlands	CO_2	0	0	0	0	1
3.B.5.a	Settlements Remaining Settlements	CO_2	0	0	0	0	1
3.B.6.b	Land Converted to Other land	CO_2	0	0	0	0	1
3.C.2	Liming	CO_2	0	0	0	0	1
3.C.7	Rice cultivation	CH_4	0	0	0	0	1
3.D.1	Harvested Wood Products	CO_2	0	0	0	0	1
4.E	Other (please specify)	CO_2	0	0	0	0	1
5.B	Other (please specify)	CO_2	0	0	0	0	1
Total			**10229**	**11492**	**0.32**	**1**	

Annex IV: Methodology to prioritize adaptation measures/actions

This methodology is used for prioritization of adaptation measures/actions in the frame of Revised NDC of Albania. It considers that in tune with the Paris Agreement's adaptation objectives, the adaptation measure/actions will enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2 of the Paris agreement. Based on that the adaptation expert/team had:

a) Firstly, identified the main topics of adaptation measures.

b) Considering that all the actions identified have significant potential to contribute to adaptation, the prioritization exercise is focused on two main aspects, namely:

   - Co-benefit potential of the actions, which refers to the probability and the extent to which said actions can also generate (i) socio-economic development and (ii) mitigation benefits.

   - Ease of implementation, which seeks to identify actions whose implementation is easier to achieve. This aspect considers the complexity of (i) the institutional and (ii) technical requirements and (iii) the magnitude of costs (financial aspects) as inversely proportional to the ease of implementation, i.e., a very expensive measure is less "easy to implement" considering that a large budget needs to be mobilized. Feasibility was not analysed as all the actions are considered both feasible and necessary.

Each sub-category was rated as "low", "medium" or "high", and ratings were weighted and cumulated, leading to an overall priority rating. The weights for co-benefits are 0.8 for development and 0.2 for mitigation. For ease of implementation, weights are 0.3 for institutional, 0.3 for technical, and 0.4 for financial.

For each category, ratings of low, medium or high were associated respectively with **1, 2 or 3** points. The total weights equally consider the co-benefits and the ease of implementation criteria. The final priority level identifies as "Very high" the actions with a rating of >4.5 points, as High those with 4.5>x>4.0, and with medium priorities those with a rating <4.0 (the maximum number of points an action could get is 6).

Annex V: Climate

Expected changes in other climate indicators

Warm and cold days

The projected increase in maximum and minimum temperatures is expected to have as consequence an increase in number of warm days (Tmax>35°C) and decrease the number of cold days (Tmin<0°C). RCP8.5 projects the highest increase in number of warm days and the lowest decrease in number of cold days compared to other scenarios.

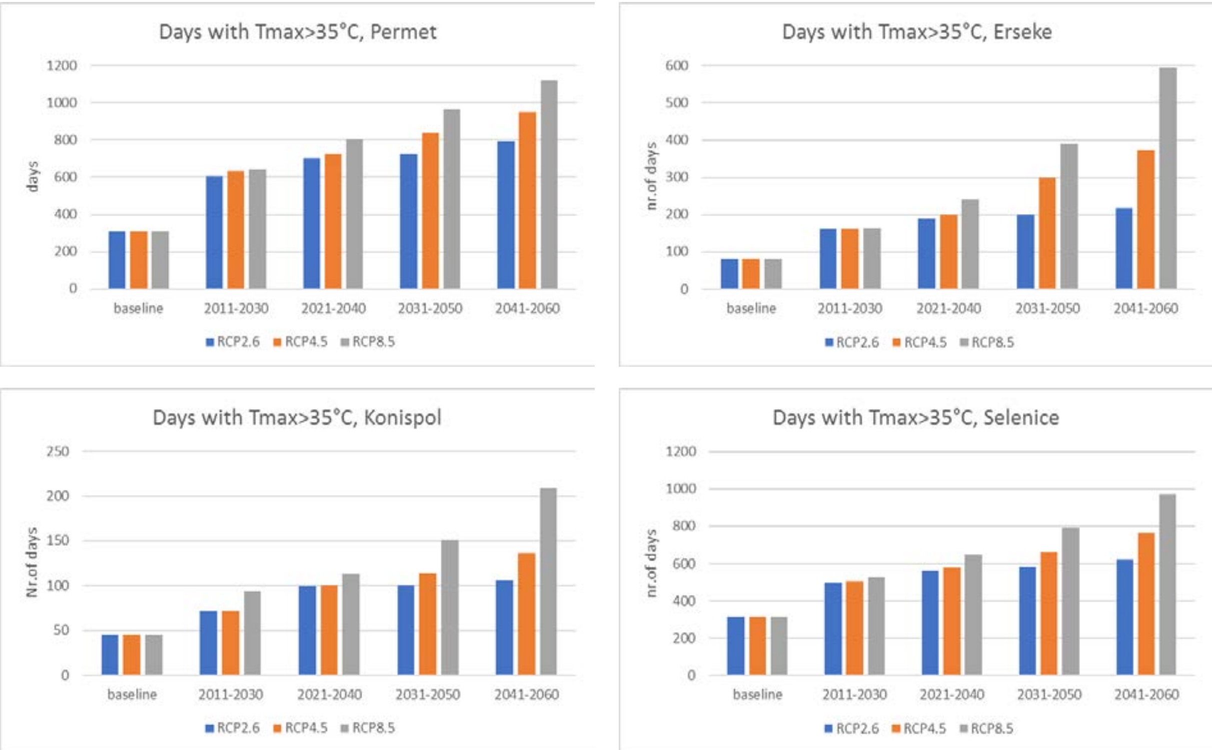
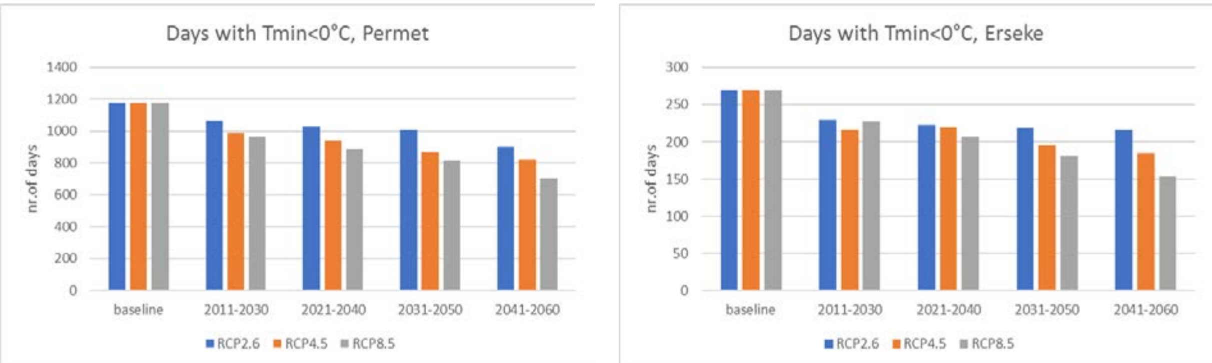


Figure A5-1: Baseline and projected changes in number of days with Tmax≥35°C, different scenarios, VRB area



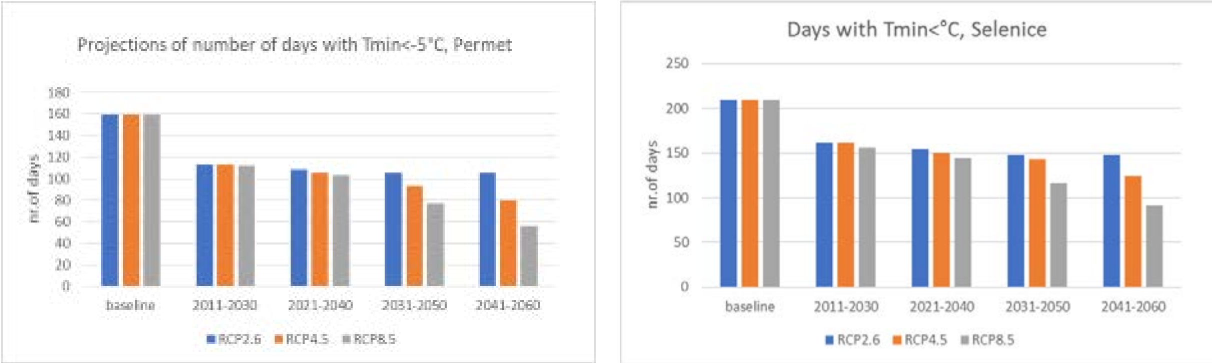


Figure A5-2: Baseline and projected changes in number of days with Tmin≤0°C, different scenarios, VRB area

Heat and cold waves

Cold waves are not registered for the period 1986-2005. This period coincides with the warmest period since the beginning of observations. As the scenarios do project increases in both maximum and minimum temperatures the VRB area will not face with cold waves phenomenon. As per heat waves the number of cases and their duration is expected to increase especially in the western part of VRB area. In the central and upper part of the Vjosa River the heat waves are not expected to happen very often.

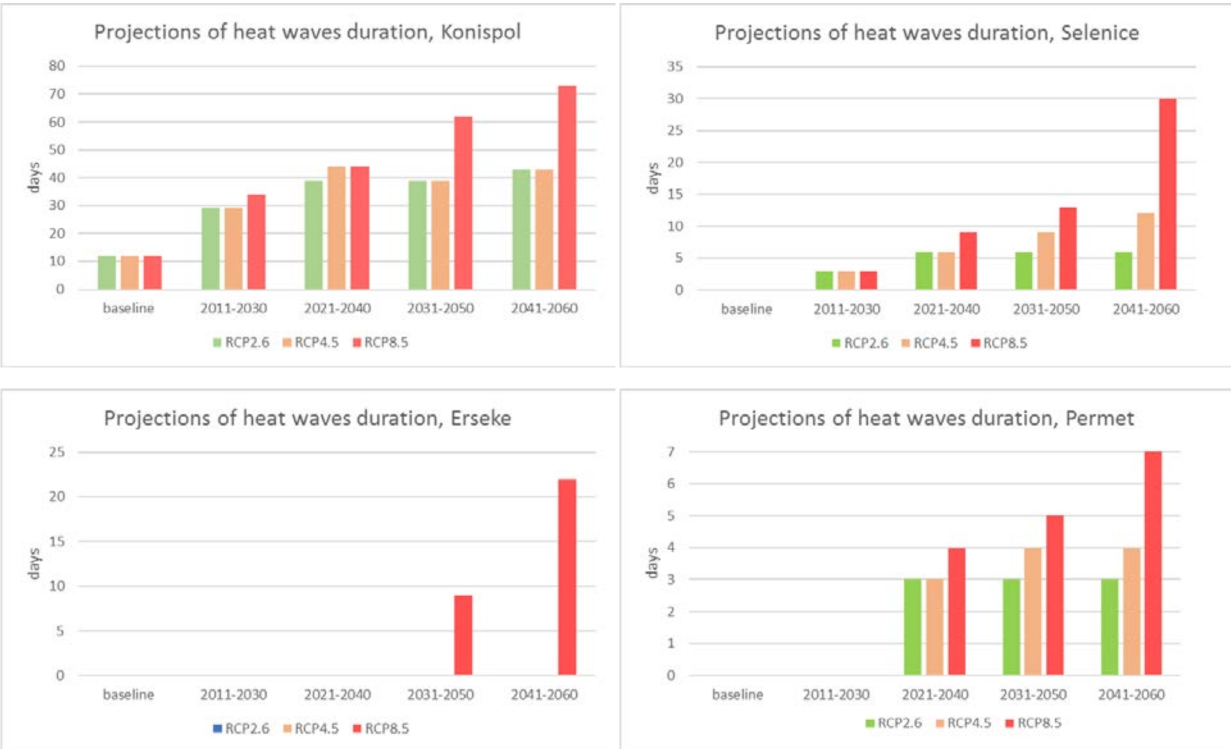


Figure A5-3: projected changes in heat waves duration, VRB area

Heating and cooling degree days

Following the projected changes in both minimum and maximum temperatures the degree days for heating is expected to decrease and degree days for cooling to increase. It indicates the increasing energy demand for cooling especially in the coastal part of VRB.

Konispol

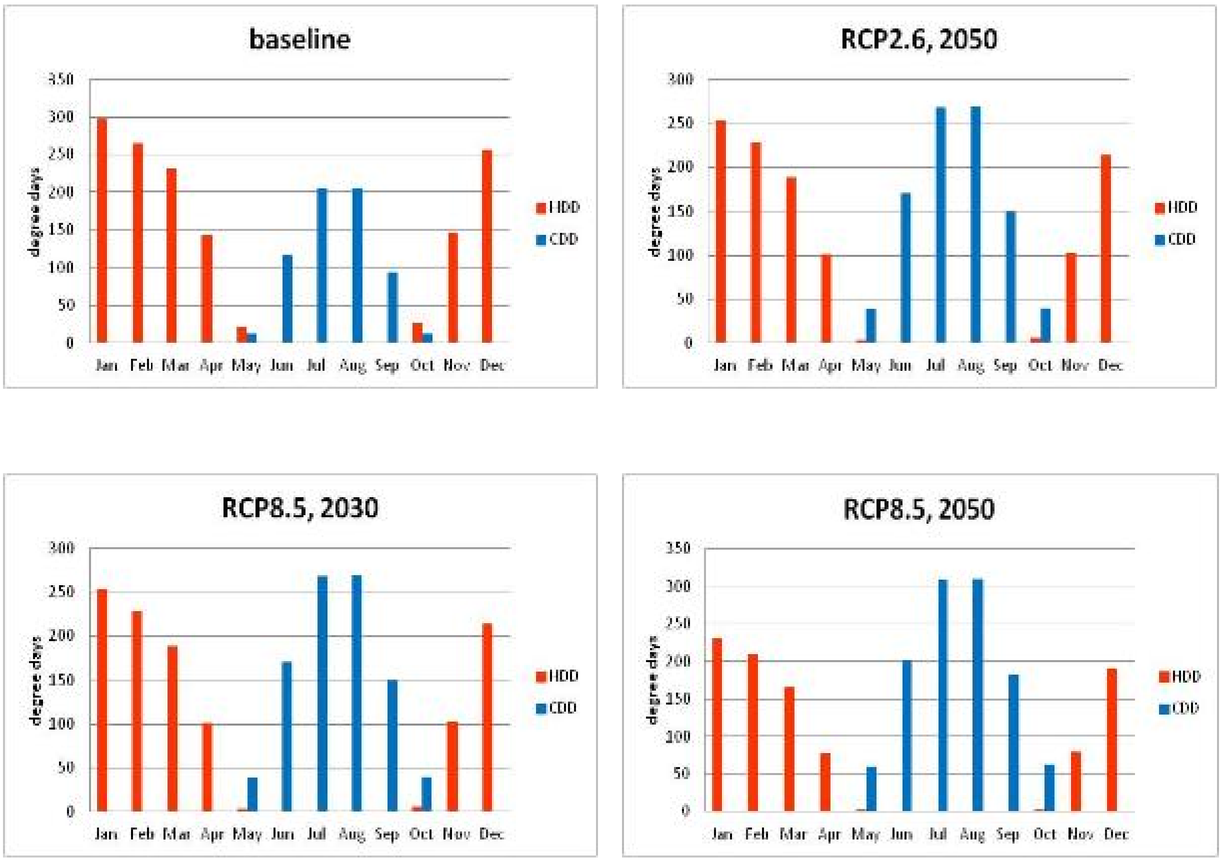
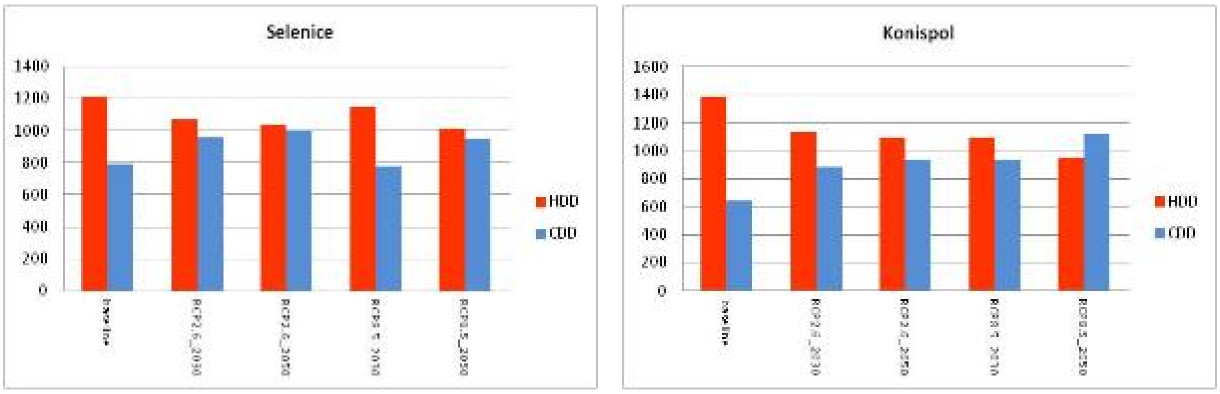


Figure A5-4: Changes in heating and cooling degree days, different RCPs, Konispol (average monthly values)



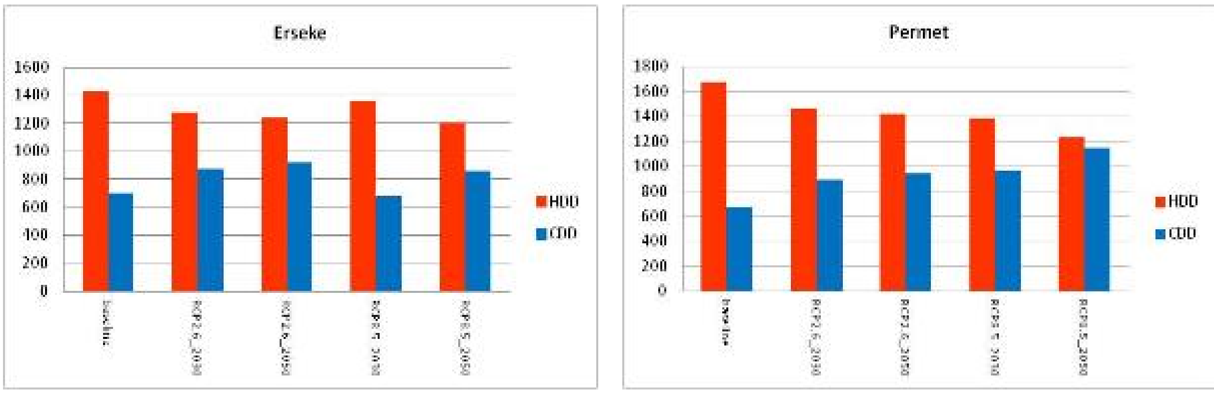


Figure A5-5 Changes in annual heating and cooling degree days in VRB area (annual values)

The Standardized Precipitation Index /Drought

Referring to the increasing trend of both minimum and maximum temperature a potential increase of drought frequency and duration is expected as conclusion. The 10% percentiles in precipitation projected changes indicate indirectly for the increase of drought frequency. The in-depth analysis for VRB area is focused on SPI-1 (accumulation period – 1 month) and SPI-3 (accumulation period – 3 months). The graphs show the interannual distribution of total number of cases registered as moderate dry (-1≤SPI≤-1.49), severe dry (-1.5≤SPI≤-1.99) and extreme dry (SPI≤-2) for the climatological period 1986-2005, in Permet area. In fact, the analysis of SPI1 and SPI3 do not show any clear tendency. The projection of both SPI1 and SPI3 produced very similar results. The reason might be related to the many and continuous gaps in precipitation baseline data and the low reduction trends projected by precipitation scenarios. Given that, no exact conclusion related to frequency or intensity of droughts might be drawn.

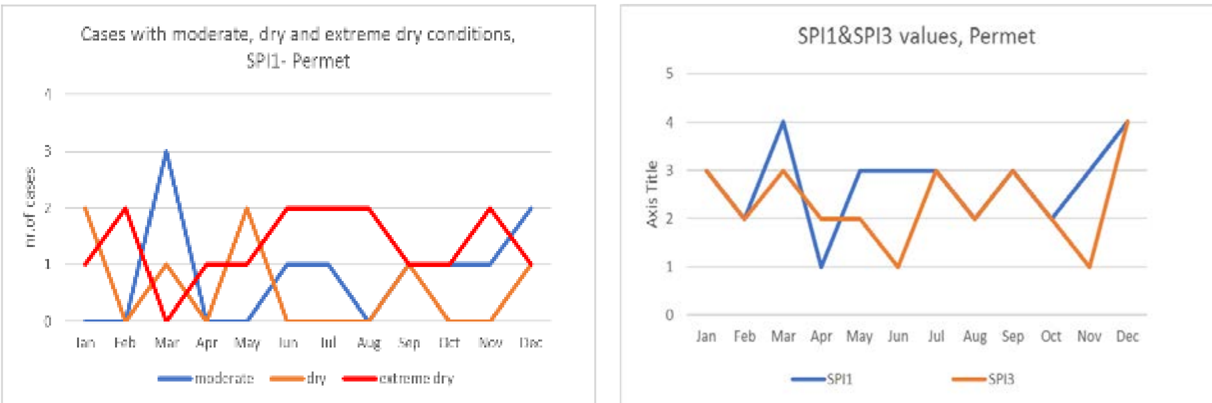


Figure A5-6: Annual course of SPI1

Tourism climate index

Considering the criteria of Mieczkovski as per the tourism climate index (TCI), projections for the coastal area of the VRB result to an extension of the period with:

- good conditions (TCI value 60-70): from mid-March to mid-October and from early March to end early November
- very good conditions (TCI value 70-80): from end March - beginning of October to mid-March – mid-October (for RCP8.5 even longer)
- excellent conditions (TCI value 80-90): from mid-April to end September and from early April to beginning of October (RCP8.5).

Similar projections result from the simulation of the TCI for the inner part of the VRB area. It is expected to have:

- good conditions: from end February mid-October to mid-February to early November (mid-November for RCP8.5)
- very good conditions from mid-March to early October
- excellent conditions from beginning of April to end September.

The annual course of TCI values, baseline and projected from different scenarios up to 2050, is shown for Permet and Vlora areas in Figure A5-7.

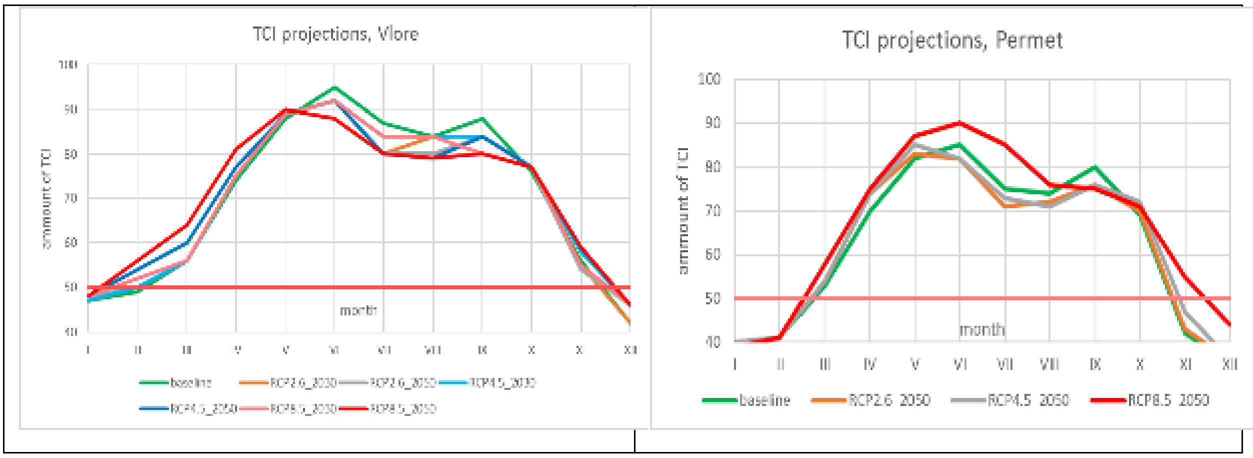


Figure A5-7: TCI values, baseline and projected from different scenarios

Annex VI: Shared Socio-economic Pathways (SSPs)

Table A6-1: SSP narratives for Albania and the Vjosa area

SSP1	**Sustainability – Taking the Green Road (Low challenges to mitigation and adaptation)** Under this SSP, the sustainable path the world is embracing will affect the dynamics of economic development and environmental quality in every country. International support and integration policies will ensure the implementation of green policies in Albania. Albania will face more education investments, more healthcare supply, moderate to high economic growth, shifted toward human well-being, and less inequality. Due to a more educated population, the country will face lower population growth. Population in total will decline throughout the century. Due to a lower level of inequality, more people would be able to travel for leisure, thus affecting tourism sector. Lower resources intensity and lower population will imply lower demand for water. Management of water resources are also expected to improve. Stronger regulation on environment will also impact agriculture sector. Agriculture will experience improvements in productivity due to application of best practices in the sector and the improvements in technology. High sustainability means less food consumption, therefore again affecting agriculture production.
SSP2	**Middle of the Road (Medium challenges to mitigation and adaptation)** As the world follows a path in which trends do not shift markedly from historical patterns, Albania will experience similar social, economic, and technological developments as the ones it experiences today. GDP composition does not change, making the country highly reliant on service sector, and less on agriculture and industry. Albania remains a service economy, with activities mostly concentrated in financial services, hospitality, retail, and less in health, human services, information technology and education. Less efforts in environmental management, will lead to further degradation of environmental systems. Few efforts to achieve sustainability goals will affect management of resources. This path will cause moderate economic growth, higher population growth compared to SSP1, similar inequality levels to the ones experienced today. Population in total will decline throughout the century. The implication in different sectors is expected as follows: Water demand will increase due to the higher population compared to SSP1. Tourism sector might be affected by the higher population, but on the other hand, the persisting inequality among the population will affect tourism demand in Vjosa basin. The combined impact of these two driving forces on tourism is uncertain. Less emphasis and developments in technology will affect agricultural production, lowering agricultural production yield.

SSP3	**Regional Rivalry – A Rocky Road (High challenges to mitigation and adaptation)** Under such scenario, stronger levels of nationalism will lead to strong constrains in international collaboration. For a country like Albania, highly reliant on international support, this will cause a substantial impact on economic development and economic growth. Slow economic development, with low rates of growth, causing even more inequality, are some of the highlights of the future under this scenario. Low investments in education, technology and healthcare and few environmental actions will strongly the wellbeing of the population. A less educated population will lead to a higher rates of population growth, compared to other scenarios. Higher needs for food and water, accompanied with more disregard toward the environment, will cause resources exploitation. Less technological development will impact the production levels in agriculture sector, which on the other hand must comply the needs of a rising population. Low level of economic development on the other hand will affect consumption, by making it lower. Tourism sector in Vjosa river basin will face decline due to the rise of poverty and inequality among regions.
SSP4	**Inequality – A Road Divided (Low challenges to mitigation, high challenges to adaptation)** This scenario see a world with rising inequality. Education and healthcare access are reserved to only one part of the population. This causes high stratification among the country. This will highly affect Albania, a country currently suffering from the increasing stratification of the population. The jeopardized social cohesion might cause high political instability and conflicts. Fragmentation is also observed in the manner of implementation of different policies, for instance in environmental field. Population will decline among the rich and increase among the poor.
SSP5	**Fossil-fuelled Development – Taking the Highway (High challenges to mitigation, low challenges to adaptation)** This scenario will see growth in all sectors in Albania, high investment in education and healthcare, causing less inequality, decline of population, high levels of economic growth, and increase in environmental action. The declining population will cause lower demand for water. High technological development will increase production yield in agriculture. Tourism will be negatively affected by the decline in population, but positively affected by the high economic growth rates and lower inequality levels. The overall effect on tourism in Vjosa will result from the combined effects of population decline and economic growth.

Note for the calculation of the international tourists' baseline scenario for Vjosa River Basin:

Note: The rate of change is derived by combining the rate of change of GDP with the rate of change of population, for example: For deriving the value of change 4.32% (second row) the combined effect of both population change and GDP change for the region WORLD between each 5 years period was considered:

GDP change: [124024.942(GDP 2035)/152193.398(GDP2030)]^(1/5)-1= 0.039

Population change: [8158.529 (population 2035)/ 7975.8 (population 2030)]^(1/5)-1 = 0.005

Combined effect = 0.039+0.005=0.0432

Therefore, the number of tourists increases 3.9% because of the economic rise, and 0.5% from population rise between the years 2030-2035 in SSP1.

Table A6-2: Baseline scenarios for Water sector (water needs) in Vjosa River Basin (according to IIASA-WiC POP and NCAR models)

Scenario	Unit	2010	2020	2035	2060
SSP1	litres/day	38,451,408	38,938,372	38,379,461	34,784,439
SSP2	litres/day	38,451,408	39,248,905	39,530,441	37,140,114
SSP3	litres/day	38,451,408	40,041,149	42,337,658	43,185,224
SSP4	litres/day	38,451,408	38,979,409	38,271,204	33,892,093
SSP5	litres/day	38,451,408	38,595,079	37,219,553	33,354,085

Source: calculated by E. Pojani

Table A6-3: Baseline scenarios for Agricultural Production - Non-Energy Crops (Food/feed) for Reforming economies

Model	Scenario	Variable	Unit	2010	2020	2030	2060
AIM/CGE	SSP3-Baseline	Production|Crops|Non-Energy	million t DM/yr	199.774	206.328	211.335	225.534
		Rate of change	%		0.65%	0.48%	0.49%
GCAM4	SSP4-Baseline	Production|Crops|Non-Energy	million t DM/yr	104.855	100.732	98.172	108.893
		Rate of change	%		-0.80%	-0.51%	0.36%
IMAGE	SSP1-Baseline	Production|Crops|Non-Energy	million t DM/yr	199.049	225.647	254.372	282.814
		Rate of change	%		2.54%	2.43%	-0.44%
MESSAGE-GLOBIOM	SSP2-Baseline	Production|Crops|Non-Energy	million t DM/yr	152.437	174.134	195.848	228.998
		Rate of change	%		2.70%	2.38%	0.69%
REMIND-MAGPIE	SSP5-Baseline	Production|Crops|Non-Energy	million t DM/yr	156.374	168.896	162.795	150.175
		Rate of change	%		1.55%	-0.73%	-0.80%

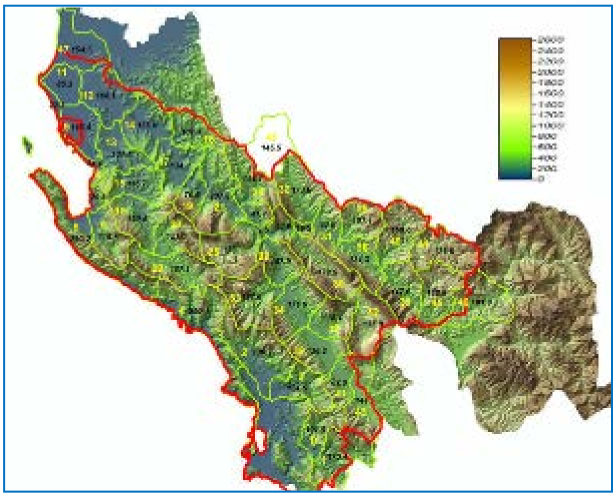
Source: SSP Public Database

Table A6-4: Baseline scenarios for Agricultural Production - Non-Energy Crops (Food/feed) for Vjosa River Basin

Model	Scenario	Variable	Unit	2010	2020	2030	2060
AIM/CGE	SSP3-Baseline	Production|Crops|Non-Energy	kv/ha	40.780	42.118	43.140	46.038
GCAM4	SSP4-Baseline	Production|Crops|Non-Energy	kv/ha	40.780	39.177	38.181	42.351
IMAGE	SSP1-Baseline	Production|Crops|Non-Energy	kv/ha	40.780	46.229	52.114	57.941
MESSAGE-GLOBIOM	SSP2-Baseline	Production|Crops|Non-Energy	kv/ha	40.780	46.584	52.393	61.262
REMIND-MAGPIE	SSP5-Baseline	Production|Crops|Non-Energy	kv/ha	40.780	44.045	42.454	39.163

Source: calculated by E. Pojani Figure 61

Annex VII: Soils



FigureA7-1: Subzones in VRB

TableA7-1 Potential Quantity of Eroded Material m^3/ha/month

Sub-basin	Potential Quantity of Eroded Material m^3/ha/month (2036-2050)												Potential Quantity of Eroded Material m^3/ha/year	Risk of erosion
	Month													
	I	II	III	IV	V	VI	VI	VIII	IX	X	XI	XII		
0	1,03	1,08	0,86	0,69	0,54	0,29	0,12	0,23	0,50	1,13	1,68	1,54	9,7	Moderate (III)
1	2,40	2,51	2,00	1,61	1,27	0,68	0,28	0,53	1,16	2,63	3,91	3,59	22,6	Very high (V)
2	1,87	2,01	1,62	1,21	0,99	0,51	0,24	0,46	1,03	1,89	3,09	2,65	17,6	High (IV)
3	1,18	1,26	1,02	0,76	0,63	0,32	0,15	0,29	0,65	1,19	1,94	1,67	11,0	High (IV)
4	2,33	2,00	1,94	1,72	1,69	0,81	0,66	0,94	1,47	2,73	3,51	2,76	22,6	Very high (V)
5	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,1	Very low (I)
6	0,33	0,29	0,28	0,25	0,24	0,12	0,09	0,14	0,21	0,39	0,50	0,40	3,2	Low (II)
7	0,26	0,22	0,22	0,19	0,19	0,09	0,07	0,11	0,16	0,31	0,39	0,31	2,5	Low (II)
8	0,07	0,06	0,06	0,05	0,05	0,03	0,02	0,03	0,05	0,09	0,11	0,09	0,7	Very low (I)
9	0,13	0,11	0,10	0,09	0,09	0,04	0,04	0,05	0,08	0,15	0,19	0,15	1,2	Very low (I)
10	0,52	0,44	0,43	0,38	0,37	0,18	0,15	0,21	0,33	0,60	0,78	0,61	5,0	Low (II)
11	0,16	0,14	0,13	0,12	0,12	0,06	0,05	0,07	0,10	0,19	0,24	0,19	1,6	Very low (I)
12	0,12	0,10	0,10	0,09	0,08	0,04	0,03	0,05	0,07	0,14	0,17	0,14	1,1	Very low (I)
13	0,09	0,08	0,08	0,07	0,07	0,03	0,03	0,04	0,06	0,11	0,14	0,11	0,9	Very low (I)
14	0,28	0,24	0,23	0,20	0,20	0,10	0,08	0,11	0,18	0,32	0,42	0,33	2,7	Low (II)
15	1,39	1,28	1,11	0,79	0,60	0,35	0,15	0,33	0,62	1,40	2,30	1,90	12,2	High (IV)
16	0,13	0,12	0,12	0,12	0,13	0,09	0,06	0,05	0,08	0,15	0,19	0,15	1,4	Very low (I)

17	0,29	0,25	0,25	0,26	0,28	0,19	0,13	0,12	0,18	0,33	0,42	0,32	3,0	Low (II)
18	0,36	0,33	0,29	0,21	0,16	0,09	0,04	0,09	0,16	0,36	0,60	0,50	3,2	Low (II)
19	0,13	0,12	0,12	0,12	0,13	0,09	0,06	0,06	0,09	0,16	0,20	0,15	1,4	Very low (I)
20	0,45	0,41	0,36	0,25	0,19	0,11	0,05	0,11	0,20	0,45	0,74	0,61	3,9	Low (II)
21	0,24	0,22	0,24	0,23	0,22	0,16	0,10	0,13	0,21	0,35	0,39	0,26	2,8	Low (II)
22	2,76	2,54	2,20	1,57	1,19	0,69	0,31	0,66	1,23	2,78	4,56	3,78	24,3	Very high (V)
23	0,65	0,65	0,57	0,45	0,39	0,22	0,12	0,16	0,35	0,71	1,06	0,89	6,2	Moderate (III)
24	0,13	0,12	0,13	0,13	0,12	0,09	0,06	0,07	0,11	0,19	0,21	0,14	1,5	Very low (I)
25	0,34	0,34	0,30	0,24	0,20	0,12	0,06	0,08	0,19	0,38	0,56	0,47	3,3	Low (II)
26	0,34	0,34	0,30	0,24	0,20	0,11	0,06	0,08	0,18	0,37	0,55	0,46	3,2	Low (II)
27	0,59	0,56	0,45	0,38	0,38	0,25	0,13	0,16	0,32	0,55	0,92	0,75	5,4	Moderate (III)
28	0,28	0,27	0,21	0,18	0,18	0,12	0,06	0,07	0,15	0,26	0,44	0,36	2,6	Low (II)
29	0,27	0,26	0,21	0,18	0,17	0,11	0,06	0,07	0,14	0,25	0,42	0,34	2,5	Low (II)
30	1,57	1,55	1,22	1,08	0,99	0,60	0,49	0,51	0,83	1,66	2,51	2,06	15,1	High (IV)
31	0,11	0,11	0,09	0,08	0,07	0,04	0,04	0,04	0,06	0,12	0,18	0,15	1,1	Very low (I)
32	0,12	0,12	0,09	0,08	0,08	0,05	0,03	0,03	0,07	0,11	0,19	0,16	1,1	Very low (I)
33	0,65	0,70	0,56	0,42	0,35	0,18	0,08	0,16	0,36	0,66	1,08	0,92	6,1	Moderate (III)
34	1,78	1,85	1,81	1,62	1,21	0,60	0,27	0,66	1,24	2,40	3,46	2,84	19,7	High (IV)
35	0,16	0,16	0,12	0,11	0,10	0,06	0,05	0,05	0,08	0,17	0,26	0,21	1,5	Very low (I)
36	0,13	0,13	0,11	0,09	0,09	0,05	0,04	0,04	0,07	0,14	0,22	0,18	1,3	Very low (I)
37	0,94	0,98	0,96	0,86	0,64	0,32	0,14	0,35	0,66	1,27	1,83	1,50	10,4	High (IV)
38	1,57	1,63	1,60	1,44	1,07	0,53	0,24	0,58	1,10	2,12	3,06	2,51	17,4	High (IV)
39	0,30	0,32	0,26	0,24	0,21	0,15	0,09	0,11	0,18	0,39	0,58	0,47	3,3	Low (II)
40	0,05	0,05	0,04	0,04	0,04	0,03	0,02	0,02	0,03	0,06	0,10	0,08	0,5	Very low (I)
41	1,72	1,79	1,43	1,15	0,91	0,48	0,20	0,38	0,83	1,88	2,80	2,57	16,1	High (IV)
42	0,26	0,27	0,26	0,23	0,17	0,09	0,04	0,09	0,18	0,35	0,50	0,41	2,8	Low (II)
43	1,50	1,57	1,25	1,00	0,79	0,42	0,17	0,33	0,72	1,64	2,44	2,24	14,1	High (IV)
44	0,05	0,05	0,04	0,04	0,03	0,02	0,01	0,02	0,03	0,06	0,09	0,07	0,5	Very low (I)
45	0,19	0,21	0,17	0,16	**0,14**	0,10	0,06	0,07	0,12	0,25	0,37	0,30	2,1	Very low (I)
46	0,17	0,18	0,15	0,14	**0,12**	0,09	0,05	0,06	0,10	0,22	0,33	0,27	1,9	Very low (I)
47	0,09	0,08	0,08	0,07	**0,07**	0,03	0,03	0,04	0,06	0,11	0,14	0,11	0,9	Very low (I)
48	0,18	0,17	0,14	0,12	**0,12**	0,08	0,04	0,05	0,10	0,17	0,29	0,23	1,7	Very low (I)
AVERAGE OF POTENTIAL QUANTITY OF ERODED MATERIAL FOR VJOSA RIVER BASIN 6.98 m^3/ha/year														

Annex VIII: Agriculture

Agriculture zones

VRB represents an interesting geographic area regarding agriculture. It lies into three agro-ecological zones[108]:

i. **The lowland zone.** This agro-ecological zone lies in Fieri region and includes municipalities of Fieri and Patos. The area starts from Vjosa mouth (north of it) alongside the Adriatic Sea where plains range from 1 to 200 m above sea level. Alluvial soils dominate here and also there are different spots with saline soils. About 80 % of annual rainfall (about 900-1200 mm/year) is concentrated during the October – March period. These pedoclimatic conditions help for good cultivation of most crops; irrigation is necessary during summer.

ii. **The Intermediate zone.** This zone lies in southern part of Vjosa mouth and include all Vlora region, municipalities of; Vlora, Selenica, Himara, Saranda, Delvina, Konispol and Livadhja. In this area is induced as well the Mallakaster and Roskovec municipalities (Fieri region). This area is between the lowland and mountain zones at altitudes from 100 to 900 m and average rainfall is about 800 mm/year. Here field crops and fruit trees are grown but there is also low forest and shrubs.

iii. **The Southern Highlands Mountain** zone (Southern Highlands and Northern & Central Mountains) where the summer is warm and the winter is cold, with more than 100 days per year with frost. Annual rainfall is from 900-1 500 mm with considerable snow. Cereals especially wheat, barley and rye are grown, and fruits (apples, plums, pears etc.). In this zone forests and pastures dominate. In this zone is included all Gjirokaster region (municipalities; Memaliaj, Tepelene, Permet, Gjirokaster, Kelcyre, Libohove, Dropull) and Kolonja municipality from Korca region.

[108] http://www.fao.org/ag/agp/AGPC/doc/Counprof/Albania/albania.htm

Annex IX: Livestock

Vulnerability assessment is conducted for main livestock categories. The maximum risk level is rated at -5 while the lack of impact is rated at zero.

Table A9-1: assessment of the expected climate impacts for different livestock categories

AEZs	Vulnerability factors	Impact assessment for livestock category				
		Cattle	Sheep	Goats	Pigg	Poultry
North and central mountain zone	Lack of water availability	-3	-3	-3	-1	0
	Forage production decrease	-1	-1	0	0	0
	Spread of diseases	-3	-3	-3	-1	-2
	Heat stress	-3	-3	-3	-1	-2
	Rare breeds	-3	-2	-2	0	0
	Animal production	-3	-3	-3	-2	-1
South highland	Lack of water availability	-3	-3	-4	-2	-2
	Forage production decrease	-2	-2	0	-2	-2
	Spread of diseases	-4	-4	-4	-4	-4
	Heat stress	-3	-4	-3	-2	-3
	Rare breeds	-4	-2	-2	0	0
	Animal production	-3	-3	-3	-2	-1
Intermediate zone	Lack of water availability	-4	-4	-4	-1	-1
	Forage production decrease	-4	-4	-1	-3	-3
	Spread of diseases	-4	-4	-4	-2	-2
	Heat stress	-4	-4	-4	-2	-2
	Rare breeds	-3	-3	-3	-1	-1
	Animal production	-4	-4	-4	-2	-2
Lowland zone	Lack of water availability	-5	-5	-5	-3	-3
	Forage production decrease	-5	-5	-3	-2	-1
	Spread of diseases	-5	-5	-4	-3	-3
	Heat stress	-5	-5	-4	-3	-3
	Rare breeds	-3	-2	-2	-2	-2
	Animal production	-4	-5	-4	-2	-2

Source: World Bank study on "Reducing the Vulnerability of Albania's Agricultural Systems to Climate Change" (2013)

Annex X: Disaster risk

Table A10-1: The direct damages caused by floods in the Vjosa river basin 1946-2018.

Year	Flood Events	Deaths	Missing	Houses Destroyed	Houses Damaged	Directly affected	Evacuated	Losses $Local	Damages in crops Ha.	Lost Cattle	Damages in roads Mts
1946	10	2	1	19	74		146	9.91E+06	10602.7	1016	
1956	2						26	3.50E+06			
1960	3	1		108	100	557		5.10E+06			
1962	11					827 6623		1.19E+07	540	72	
1963	1							1.63E+08			
1865	1	14									
1970	7								7500	15	
1971	1			3					4000	10	
1976	9				390				1898		
1978	1								150		
1979	13				150				1367	18	
1980	2								163		
1981	3	1		72	447			3.70E+07	1374	285	
1985	1										
1998	1							3.55E+05			2000
1999	1							4.34E+05			
2000	3				124						
2001	1										
2002	1										
2004	2				5	100	20		690		
2003	1										
2005	20			1	1207	204	144	1.84E+08	2100	25	300
2006	1								150		
2010	6				25	270	90	8.78E+06	320		50
2013	6					132	132		290		150
2014	5										
2015	7	1	1		20	397316	770				
2017	7					350000					
2018	2										
TOTAL	123	19	2	203	2542	748579	1328	4.24E+08	31144.7	1441	300

(Source: DesInventar Albania)

Annex XI: Tourism

Some potential impacts are detailed as follows:

The expected temperature increases in the upper section of the basin (the hilly and mountainous regions and but also in Llogara National Park, the mountain of Gramoz) is expected to have negative effects for winter tourism and the environment in general.

Trekking and sports tourism could suffer in the summer considerable modification due to the reduction of the natural wood cover. In the central-southern section, climate change could cause a contraction in tourist demand due to the high level of humidity for greater rainfall, causing many problems.

In the tourism of the villages, the accessibility of places would be limited as there would not be the right and necessary safety tools - let us think about driving by car in the rain or worse with the storm - especially considering the only way to reach the centre and the centers historical is precisely the way. This type of tourism will suffer a sharp decline due to heavy losses: according to the available knowledge, most of the architectural and cultural assets in general are made up of materials that will degrade strongly due to rainfall and extreme events.

In agritourism and rural tourism the heavy rains, especially in the intermediate seasons, will alter the holiday and the contact with nature will be increasingly altered due to the impossibility of having a direct relationship with it and limiting sharing with the farmer's work. Added to this is that humid climates increase insects of various kinds towards which tourists are generally fearful and therefore the attractiveness of this type of tourism is certainly reduced.

Inland tourism and therefore cultural and food and wine tourism will suffer from the relative scarcity of water and especially in Vlora (city and villages) where the persistence of water shortages could cause conflicts of use with residents, as well as the deterioration of monuments and archaeological sites in stone material.

Seaside tourism in central-southern Albania will undergo huge transformations, especially if we are not careful right now both to innovate the system of swimming pools in the hotels with sea water, and to maintain high water quality. In fact, the sea waters could undergo changes mainly due to the increase in surface water temperatures, such as to no longer be attractive to tourists, especially due to the variability and instability of the ecosystem's marine. The anthropogenic pressure deriving from the influx of tourists increases the vulnerability to the impacts of climate change of the Albanian coasts, in terms of sea level rise and the incidence of extreme events, reducing the natural resilience capacity of coastal environments.

Another type of tourism practiced in many coastal regions and foreseeable changes is that of the visit of the historical cities and archaeological sites (Gjirokastra, Apollonia, Vlora, Orikum, Amantia, Butrint etc.). The emotion transferred to tourists from the monuments during walks or visits to the landscape would be of lesser impact due to the difficult climatic conditions both due to severe storms and excessive humid heat. Such reduced experientially does not allows tourists to enjoy the beauties and the local heritage, on the contrary reachable only the slow mode of use allows. If the humid heat will rage, tourists will not be able to walk due to the too high temperatures and the tourists who have as their primary attraction that of enjoying the landscape or that of discovering natural beauties on foot will certainly be the first to be affected by this climate.

Annex XII: Strategies for mitigation and adaptation

	Description of strategy and/or measure Actions that affect the climate change adaptation and mitigation
Strategies, strategic documents, legislation, plans (high priority)	
National Strategy for Development and Integration 2015-2020, NSDI-II	Ensure the sustainable management of natural resources and undertake climate action through better management of forests and water, and the application of agricultural production methods in environmental protection and mitigation of climate changes; a targeted increase in the number of certified organic farms by 2020; an increase in the number of farmers benefitting from irrigation infrastructure to 300,000 by 2020. Enhance and strengthen the protection of nature through a targeted 17% increase in the surface of Protected Areas of the territory through the enhancement and integrated management of protected areas; the establishment of the ecological network "Natura 2000"; the assurance of conservation status for 5% of threatened species and habitats. Strengthen the management and preservation of forestry and pasture resources through a targeted 40% reduction in illegal logging by 2020; achieving 100% coverage with breeding plans for all forest economies countrywide; the rehabilitation of 25% of degraded areas. Develop sustainable tourism in Albania, which indirectly affect positively on climate change as this will preserve natural ecosystems Strengthen the management of water use, in order to reduce floods and phenomena of erosion and soil loss, through: The rehabilitation and modernization of existing infrastructure related to irrigation, drainage and flood protection; the development and implementation of mechanisms for the sustainable management of irrigation, drainage and flood protection systems (qualitatively improve the functionality of the drainage system); the preparation and implementation of the river basin management plans; the coordination and management of water use in the context of climate change mitigation related issues; the rehabilitation of damaged river beds.
National Strategy for Integrated Water Resources Management[109]	Effective management of natural disasters; provision of flood protection (preliminary flood risk assessment, maps of flood risk areas, flood risk map, flood risk management plans), and preparing for drought and water constraints. The actions proposed to fulfil this specific objective are: - Rehabilitation of buildings damaged by natural causes. - Strengthening cooperation and fulfilling institutional obligations - Mitigating the consequences by providing financial support to families whose homes have been damaged by natural or other disasters. - Develop a National Disaster Management Plan including Initial flood risk assessment for each watershed, water scarcity risk analysis (also related to forest fires) for each watershed; reducing the risk of waterborne diseases; establishment of early warning systems
Draft Environmental Cross-cutting Strategy (ECCS) 2015-2020	The proposed measures/actions: **water resources:** the inclusion of climate change issues in all strategic papers of water management, better management of water resources to reduce the effects of flooding and drought and consequent soil loss. **protected areas:** increasing the surface and improving management of the existing ones, identification and establishment of "Natura 2000" network of Special Areas of Conservation of importance to the European Union, to ensure a favourable conservation status and increasing the carbon sequestration potential of natural ecosystem. **forests and pastures:** forest improvement with sustainable and multifunctional management plans and afforestation, prevention of illegal cutting through the control of Forest Police, Prevention of fires, reforestation of coastal and internal forests to avoid soil erosion with consequent carbon loss, preventing further degradation and protection of biodiversity, ensuring the maximum potential to fulfil the ecological functions and increase carbon sequestration.
Strategic Document on Climate Change (SDCC)	An Adaptation Plan with 15 priority actions is developed, consisting of in: Overarching Actions / implementation framework (like Steering of the adaptation process in Albania; Overarching mainstreaming initiative; Climate finance readiness; etc.) and Sector-wise and cross-sector strategic actions (like Implementation monitoring system; Initiative for capacity building on climate change adaptation; Climate Resilient Irrigation, Drainage and Flood protection; etc.)

[109] Mott MacDonald | Përgatitja dhe Zbatimi i një Strategjie MIBU, Strategjia Kombëtare për Menaxhimin e Integruar të Burimeve Ujore, available at http://ambu.gov.al/public/STRATEGJIA%20KOMB%C3%8BTARE%20P%C3%8BR%20MENAXHIMIN%20E%20INTEGRUAR%20T%C3%8B%20BURIMEVE%20UJORE.pdf

Crosscutting Strategy for Rural and Agricultural Development 2014-2020 (CSRAD) • approved with DCM no. 709, dated 29.10.2014	Among the measures that may help address the climate change impacts are: • Investments in physical assets for processing and marketing of agricultural and fishing products, with objective to support the development of human resources and physical assets, increase the ability of the agri-food sector to cope with competition pressure and market forces, and help the sector to progressively meet EU standards. The measure will also help address the challenge of climate change, boosting energy resource utilization efficiency and renewable energy. • Forestry and forest protection with objective to support actions for the regeneration, conservation and improvement of ecosystems that depend on agriculture and forestry, thus addressing the challenge of climate change. More specifically, expanding and improving forest resources through afforestation to prevent erosion, protect water resources, increase biodiversity and help adapt to the challenges of climate change. • Transfer of knowledge and improvement of agriculture extension services to help farmers, forest owners and SMEs in rural areas to improve sustainable management and overall performance of their farms or businesses.
The General National Plan, Albania 2030 Approved by DCM No. 881, dated 14.12.2016	The GNP includes many measures that positively affect climate change adaptation: - Water sector: rehabilitation, expansion and creation of infrastructure for water supply including climate change scenarios in this sector. Water demand management through reuse, securing new water reserves, rainwater, desalination, etc. - Agriculture sector: improving water efficiency, irrigation infrastructure, plant varieties, drainage system, fertilization and soil moisture conservation considering the impacts of temperature increase due to climate change. - Coast: monitoring coastline dynamics and sea level; monitoring of water quality in wetlands and groundwater; management of coastal erosion as well as adaptation measures to cope with expected sea level rise.
Integrated Cross-sectorial Plan for the Coast	The plan aims to create a macro- and local scale management framework for reduction of the impacts and risks related to climate change, through adaptation and mitigation actions. Among others, the plan highlights the need for the central and local governments to cope with and mitigate the risks of climate change through initiatives such as: afforestation; planting trees in endangered areas; construction of dams for preventing floods using ecological materials; limiting urban sprawl; use of the renewable energy, etc.
The Document of Strategic Policies for Protection of Biodiversity for the period 2016–2020 Approved by DCM no.31, date 20.1.2016	under Objective III, Review and monitoring of threatening effects and activities, recognizes the CC impact on our environment. Changes in vegetation patterns, loss of biological resources, sudden increase in alien species, and changes in fish resources are some of the biggest challenges the globe is facing and proposes the followings: • Conducting studies on the selection and management of climate change indicators • Assessment of forest health and vitality • Selection and monitoring of forest insects, indicative of climate change • Long-term monitoring of changes in forest ecosystems • Predicting future changes, in the distribution and diversity of species, sensitive to climate change • Improve systematic management of climate change sensitive species. Development of new varieties, suitable for climate change.
The Law Nr. 155/2020 "On climate change"	The purpose of this law is to: contribute to GHG reduction; accelerate adaptation to climate change with a view to mitigating the harmful effects of climate change; contribute to global efforts on climate change by fulfilling the obligations of the Republic of Albania to the Convention; establish a comprehensive legal and inter-institutional framework for taking climate action at national level, in line with EU climate change legislation. Article 6 of the Law, Integrating climate change into sector strategies, requests from all line ministries that have state responsibilities/ competencies in sectors that have an impact or get impacted by climate change, particularly in the sectors of transport, energy, water, agriculture and rural development, urban development and disaster management, to: a) integrate climate change mitigation and adaptation issues into their legislation, development strategies, plans, programs and projects; b) cooperate in the implementation of legislation, strategies, plans, programs and projects addressing climate change; c) cooperate in monitoring, evaluating and reporting on the implementation of strategies, plans, programs and projects addressing climate change. The Law has articles on institutional setup and coordination in climate change issues; education and

	training, information and public awareness; public participation; inclusion of the private sector, promotion of climate friendly investments, etc.
Draft DCM "On monitoring and reporting GHG emissions and other information relevant to climate change at the national level"	This Decision is partially aligned with REGULATION (EU) No 525/2013 on a mechanism for monitoring and reporting GHG emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC. It establishes a mechanism for monitoring and reporting on GHGs and other climate change information at the national level that is appropriate for the non-annex 1 party status of the RoA to the Convention. This mechanism includes the set of institutional, legal and procedural arrangements made for estimating GHGs anthropogenic emissions by sources and removals by sinks, and for reporting and archiving inventory information. It aims to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of reporting by the RoA to the UNFCCC; monitor and report GHG anthropogenic emissions by sources and removals by sinks; monitor and report the actions taken by Republic of Albania to adapt to the inevitable consequences of climate change in a cost-effective manner; establish and make operational nationally appropriate procedures for collecting, processing, reporting, verifying and archiving the requested data for such reporting in a sustainable manner and on a continuous basis based on its national circumstances, capabilities and capacities; ensure effective and sustainable involvement of all the relevant stakeholders and coordination among them.
Ongoing and/or finalized projects with climate change adaptation component	
EU Flood Protection Infrastructure Project – FPIP, 2nd and 3rd Actions *(2017-2020)* (finalized)	The specific objective of the 2nd Action of FPIP, implemented by PRONEWS Programme[110] was to further increase the capacity of the Albanian Civil Protection to prevent and respond to disaster management. For the main results, among others, are: • Improvement of the Legal and Institutional framework on Early Warning, Flood Management and Civil Protection (Assessment, unification and updating of prefectural civil protection emergency plans; New law on Civil protection[111]) • Development of Flood Hazard Maps according to the provisions of EU Floods Directive (***The identification of Areas with potential Significant Flood risk*** for five river basins, exclude Drini and Buna basin: Mati, Ishem-Erzen, Shkumbin, Seman and ***Vjosa.) The development of hazard maps*** for five river basins: Mati, Ishem-Erzen, Shkumbin, Seman and ***Vjosa***. *3rd Action* **Overall** Objective of this action, implemented by UNDP and finalized in 2017, was to strengthen resilience and disaster risk preparedness and prevention in southeast Albania in line with the post-disaster needs assessment following the February 2015 floods. In the frame of the FPIP project are constructed around 10 flood protection infrastructures along the Vjosa River flow, such as: (i) in stream Otima in Armen - Bishti i Malit area and Selenice-Armen area (Vlore); (ii) Shushica River in Ceprat - Dheu i Bardhe, by fixing the damaged levee and river erosion works; (iii) in certain areas in the village of Bishan, Mifol, Fitore, Novosele area; (iv) fixing the damages on Martina Branch Irrigation Canal, whose left embankment serves as a levee against flooding from Vjosa River on right side of flow (Fier); (v) on Osum River at Veterrik and Bilçe area (Berat); (vi) on Drinos River in the area of Mashkullore, Palokaster and Shtepez village (Gjirokaster);etc.
Adaptation to Climate Change through Transboundary Flood Risk Management in the Western Balkans'[112]	This project, funded by German Federal Ministry for Economic Cooperation and Development, aimed at strengthening of trans-boundary flood risk management regarding climate change, in the Western Balkans, in the Drin catchment and other catchment areas of the region (Albania, Kosovo, North Macedonia and Montenegro) which are increasing due to climate change.

[110] PRO NEWS - http://www.pronewsprogramme.eu/about-the-project/

[111] Law no. 45/2019 "On civil protection" approved on 18/07/2019.

[112] https://www.giz.de/en/worldwide/29000.html

(2012 –2021)	
Building the resilience of Kune – Vaini Lagoon through ecosystem-based adaptation (EbA) (2016 – 2020)	The main objective was to increase the capacity of government and local communities living near the Kune – Vaini Lagoon System (KVLS) to adapt to climate change using an integrated suite of adaptation interventions, including Ecosystem-based Adaptation (EbA) approaches.
Establishing Albania's Environmental Information Management and Monitoring System'	Aimed at strengthening of capacity for environmental monitoring and information management in Albania, by establishing an operational environmental information management and monitoring system (EIMS). The project addresses the need for an environmental monitoring system that is integrated throughout relevant government institutions and that uses international monitoring standards for indicator development, data collection, analysis, and policymaking.
Integrated climate-resilient transboundary flood risk management in the Drin River basin in the Western Balkans	The objective of the project, funded by the Adaptation Fund, was to assist the riparian countries, Albania, North Macedonia and Montenegro, to implement an integrated climate-resilient river basin flood risk management approach in order to improve their existing capacity to manage flood risk at regional, national and local levels and to enhance resilience of vulnerable communities in the DRB to climate-induced floods.
Advancing Albania's planning for medium and long-term adaptation through the development of a National Adaptation Planning (NAP) process.	The project, recently started, funded by the Green Climate Fund – GCF as part of the Readiness Programme, will enable Albania to plan and attract larger scale finance for more resilient future by strengthening the adaptation planning processes through: • the strengthening of a national mandate, strategy and steering mechanism that focuses on assessing and addressing capacity gaps (particularly in the priority sectors of tourism, urban development, agriculture, transport, and energy), • the development of a NAP Strategy action plan document and its implementation plan, and • the development of financing, monitoring and evaluation strategies to ensure that capacities and funding options are institutionalized for the long-term sustainability of adaptation planning beyond the life of the project.
River Basin Management Plans	• The Preparation of River Basin Management Plans (RBMP) for the Drini-Buna and Semani River Basins is part of the institutional support for Integrated Water Resources Management (IWRM) component of the Albania Water Resources and Irrigation Project (WRIP). The WRIP, financed by the World Bank, the Swedish International Development Cooperation Agency (Sida) and the Government of Albania, is designed to lay the foundations for more rational and accountable water resources management. RBMP Reports consider climate change impacts on water resources for irrigation, floods, etc. • Shkumbini River Basin Management & Climate Change Adaptation Plan, prepared by Prepared EU funded IBECA project (2018), considers the climate change pressures on water environment, including abstraction and artificial flow pressures, flooding, soil erosion. The RBMP also includes climate change mitigation and adaptation plan.
At local level	• Civil Emergency Plan for Vlora Region (2018) that considers climate related hazards such as floods, fires and damages to various types of infrastructure changes. • Management plan for Vjosa basin 2018-2020 (in publication process) that considers management of floods, infrastructural adaptation measures, etc.

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