UNEP

FIRST BIENNIAL UPDATE REPORT OF THE REPUBLIC OF UZBEKISTAN

UNDER THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

Tashkent 2021

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The first biennial update report of the Republic of Uzbekistan was developed in accordance with decision 2/CP.17 of the United Nations Framework Convention on Climate Change (UNFCCC) based on the Guidelines for the submission of biennial reports by non-Annex I Parties with financial assistance of the Global Environment Facility (GEF) and technical and methodological support of the United Nations Environment Programme (UNEP).

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Uzhydromet expresses its sincere gratitude to ministries and organizations, representatives of scientific and public organizations, the experts who contributed to the preparation of the First Biennial Update Report of the Republic of Uzbekistan on the UN Framework Convention on Climate Change.

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ABBREVIATIONS

AASL	Aydar-Arnasay system of lakes
ADB	Asian Development Bank
AEMCS	Automatic electricity metering and control system
AFD	French Development Agency
AFOLU	Agriculture, forestry and other types of land use
APG	Associated petroleum gas
BAU	Business as usual
BCS	Booster compressor stations
CAREC	Central Asia Regional Economic Cooperation
CCGT/GTU	Combined cycle gas turbine, gas-turbine unit
CDB	China Development Bank
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CHPP	Cogeneration of heating and power plant
CHS	Centralized heating system
CIS	Commonwealth of Independent States
DMP	Department for monitoring air, surface water and soil pollution
EBRD	European Bank for Reconstruction and Development
EC IFAS	Executive Committee of the International Fund for Saving the Aral Sea
EE	Energy efficiency
EIB	European Investment Bank
ESTs	Environmentally sound technologies
FAO	Food and Agriculture Organization of the United Nations
FBUR	First Biennial Updated Report
FEC	Fuel and energy complex
FER	Fuel and energy resources
FNC	First National Communication on Climate Change
FNC	Fourth National Communication on Climate Change
FOLUT	Forestry and other land use types
FRDRU	Fund for Reconstruction and Development of the Republic of Uzbekistan
GACMO	Greenhouse Gas Abatement Cost Model
GCF	Green Climate Fund
GCOS	Global Climate Observing System
GDP	Gross domestic product
GDP (PPP)	Gross domestic product based on purchasing power parity
GEF	Global Environment Facility
GHGs	Greenhouse gases
GIZ	German Corporation for International Cooperation
Goskomecology	State Committee on Ecology and Environmental Protection
Goskomstat	State Committee on Statistics
Goskomzemgeodezkadastr	State Committee on Land Resources, Geodesy, Cartography and State Cadastre
GTE	Gas turbine engines
GWP	Global warming potential
HFCs	Hydrofluorocarbons
HPP	Hydro power plant
IAEA	International Atomic Energy Agency
IBMS	Integrated background monitoring stations
IBRD	International Bank for Reconstruction and Development
ICC	Interagency Coordinating Council

ICT	Information and communication technologies
IDA	International Development Association
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IFAS	International Fund for saving the Aral Sea
IIEC	International Institute for Energy Conservation
INDCs	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
IPS	Interconnected power system
IRENA	International Renewable Energy Agency
IsDB	Islamic Development Bank
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
JSC	Joint-Stock Company
KP	Kyoto Protocol
LDN	land degradation neutrality
M&E	Monitoring and evaluation system
MGPP	Mubarek gas processing plant
MinInvest	Ministry of Investment and Foreign Trade
MoA	Ministry of Agriculture
MoES	Ministry of Emergency Situations
MoHCS	Ministry of Housing and Communal Services
MRV	Monitoring, Reporting and Verification
NACAG	Nitric Acid Climate Action Group
NAMA	Nationally Appropriate Mitigation Action
NAP	National Action Programme
NBSAP	National Biodiversity Strategy and Action Plan
NDC	Nationally Determined Contribution
NEAP	National Environmental Action Plan
NGOs	Non-governmental non-commercial organizations
NGV	Natural gas vehicles
NHC	National Holding Company
NHS	National Hydrometeorological Service
NIGMI	Scientific Research Hydrometeorological Institute
NIR	National Inventory Report
NMVOC	Non-methane volatile organic compounds
NPP	Nuclear power plant
OPP	Oil processing plant
PA	Paris Agreement
PAs	Protected areas
PFCs	Perfluorocarbons
PKM	Resolution of the Cabinet of Ministers of the Republic of Uzbekistan
PP	Resolution of the President of the Republic of Uzbekistan
PPP	Public–private partnership
PTL	Power transmission line
PVPP	Photovoltaic power plants
QA/QC	Quality Assurance / Quality Control
RES	Renewable energy sources
RSD	Remote sensing data
SCADA	Supervisory Control And Data Acquisition

SDG	Sustainable Development Goals
SFD	Saudi Fund for Development
SFF	State Forest Fund
SGP	Small Grants Program
SNC	Second National Communication on Climate Change
SPA	Scientific and production association
SSPRES	State System for Prevention and Response to Emergency Situations
SW	Solid waste
SWM	Solid waste management
TNC	Third National Communication on Climate Change
TPP	Thermal power plant
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UP	Decree of the President of the Republic of Uzbekistan
Uzhydromer	Center for Hydrometeorological Service
WB	World Bank
WBG	World Bank Group
WHO	World Health Organization
WMO	World Meteorological Organization
WPP	Wind power plant
ZRU	Law of the Republic of Uzbekistan
COP	Conference of Parties
CC	climate change

Measurement units

t.o.e.	ton of oil equivalent
GW	gigawatt
MW	megawatt
kW	kilowatt
kWh	kilowatt/hour
Gg	gigagram (1000 tons)
Gcal	gigacalorie
Gj	gigajoule (10^9 j)
ppm	parts per million (measuring unit of the relative value equal to $1 \cdot 10^{-6}$ from the base index)

Chemical formula

CO_2	carbon dioxide
CH_4	methane
N_2O	nitrous oxide
CH_2F2; C_2HF_5; $C_2H_2F_4$; $C_2H_3F_3$	hydrofluorocarbons (HFCs)
CO	carbon monoxide
NO_x	nitrogen oxides
SO_2	sulphur dioxide
SF_6	sulphur hexafluoride

INTRODUCTION

Climate change is posing a serious threat to Uzbekistan. The country is one of the most vulnerable to climate change states in Eurasia. The average rate of warming in Uzbekistan exceeds the average rate on a global scale, there is an intense melting of glaciers, a decrease in water resources, an increase in the number of extreme meteorological events - mudflows, avalanches, droughts. These processes cause significant damage to the country's economy and the life of the population.

Uzbekistan joined the United Nations Framework Convention on Climate Change (UNFCCC) on June 20, 1993, as a country not included in Annex I. The Kyoto Protocol was ratified in August, 1999.

Uzbekistan signed the Paris Agreement (PA), by providing Intended Nationally Determined Contributions (INDC),[1] to the UNFCCC Secretariat on 19 April 2017 and ratified it on 2 October 2018.[2] The country has undertaken to reduce by 2030 the specific greenhouse gas emissions per unit of GDP by 10% of the 2010 level. Measures and actions to achieve the objective of curbing the growth of greenhouse gas emissions are laid down in sectoral development programs aimed at structural transformation, modernization and diversification of production, reduction of the energy intensity of GDP, the introduction of energy-saving technologies in the sectors of the economy and the social sphere.

The INDC also reflects measures to adapt to climate change in agriculture and water management, the social sector, ecosystems, strategic infrastructure, production systems and actions to mitigate the consequences of the Aral Sea disaster.

In support of the implementation of the obligations under the PA, the "Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019-2030" was approved[3]. The main goal of the Strategy is to integrate the principles of a "green" economy into the ongoing structural reforms to achieve sustainable economic progress, contributing to social development, reducing greenhouse gas emissions, climate and environmental sustainability.

Uzbekistan prepared and submitted, in accordance with the requirements and guidelines of the UNFCCC: the First National Communication[4] (1999); the Second National Communication[5] (2008); the Third National Communication[6] (2016) and reports on inventory of greenhouse gas (GHG) emissions for the period 1990-2012.

In accordance with the decision of the Government, the Center for Hydrometeorological Service (Uzhydromet) is the organization responsible for the overall coordination of activities to fulfill the obligations of the UNFCCC and PA in the country, as well as the preparation of National Communications and Biennial Reports. Uzhydromet, together with ministries and agencies, conducts an inventory of greenhouse gas emissions of the Republic of Uzbekistan [7,8].

The First Biennial Update Report (FBUR) of the Republic of Uzbekistan was developed in accordance with the decision to the 17th Conference of the Parties (2/CP.17) to the UNFCCC based on the “Guidelines for the submission of biennial update reports by non-Annex-I Parties”.

[1] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Uzbekistan%20First/INDC%20Uzbekistan%2018-04-2017_Eng.pdf
[2] ZRU No.491 of 02.10.2018 «On the Ratification of the Paris Agreement (Paris, December 12, 2015)»
[3] PP No. 4477 of 4.10.2019 «On adoption of the Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019-2030».
[4] https://unfccc.int/sites/default/files/resource/Uzbekistan%20INC.pdf
[5] https://unfccc.int/sites/default/files/resource/6_Glava_ENG.zip
[6] https://unfccc.int/sites/default/files/resource/TNC%20of%20Uzbekistan%20under%20UNFCCC_english_n.pdf
[7] https://unfccc.int/sites/default/files/resource/uzbnc2nir.pdf
[8] https://unfccc.int/sites/default/files/resource/National%20GHI%20Report_Uzbekistan_eng_0.pdf

This document was prepared by Uzhydromet with financial support from the Global Environment Facility (GEF), technical and methodological support from the United Nations Environment Programme (UNEP), with the participation of stakeholders, experts from key ministries, agencies, industrial companies, scientific units, NGOs (Annex 1).

The First Biennial Update Report supplements the information of the Third National Communication of the Republic of Uzbekistan, and contains the following sections:

- National circumstances;
- GHG inventory for 1990-2017;
- Measures to mitigate GHG emissions;
- Internal monitoring, reporting and verification system;
- Support received and needs.

SUMMARY

National circumstances

State structure. The Republic of Uzbekistan - as a sovereign democratic republic was formed on September 1, 1991. The system of state power is based on the principle of separation of powers into legislative, executive and judicial. The head of state is the President. The highest legislative body is the bicameral parliament, the Oliy Majlis, which consists of the Legislative Chamber (lower chamber) and the Senate (upper chamber).

Location. The Republic of Uzbekistan is located in Central Asia in the interfluve of the Amu Darya and the Syr Darya, covers an area of 448.9 thousand km^2. The country's territory in the north and north-east borders with Kazakhstan, in the east and southeast - with Kyrgyzstan and Tajikistan, in the west - with Turkmenistan, and in the south - with Afghanistan.

Climate. The climate of Uzbekistan is dry, sharply continental, with large seasonal and daily air temperature ranges, with hot and long summers, relatively humid springs and unstable winters. The distribution of atmospheric precipitation over the territory is extremely uneven, closely related to the location of mountain systems, the height of the terrain and the exposure of slopes. The minimum amount of precipitation falls in the desert part of the country (100 mm/year), the maximum - 900 mm/year in the mountains. The average temperature in winter (January) ranges from -8°C to + 3°C, in mountainous regions it can drop up to -16°C. In summer (July), the average temperature in the northern regions of the country is + 26-32°C, while in the south it reaches + 41-42°C.

Population. The total population of the country for 2020 was 34.383 mln people. The urban population accounts for 50.5% of the total population, while the rural population accounts for 49.5%.

Economic indicators. By 2019, the country's GDP is estimated at 511.8 trillion UZS or $58 billion against $46.7 billion in 2010. In the structure of GDP, the share of industry and construction is 36.4%, the service sector accounts for 35.5 % and agriculture, forestry, fisheries - 28.1%.

Fuel and energy resources. Uzbekistan mainly meets its needs at the expense of its own energy resources and is an exporter of natural gas. The fuel and energy complex includes electric power, heat power, oil and gas and coal industries, on which the economy is based. At present, thermal power plants are the main producer and supplier of electricity in the republic (about 85%). In accordance with the long-term development plans of the country, it is planned to increase the share of electricity production using renewable energy sources to a level of at least 25% by 2030.

Greenhouse gas inventory

The section provides information on GHG emissions / removals for the period 1990-2017, including new data for 2013-2017. The inventory was carried out in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use, and Waste sectors. Emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons and carbon dioxide absorption are reviewed. The analysis of changes in the time series for GHG emissions for the period 1990-2017 is carried out.

Methane, nitrous oxide and hydrofluorocarbon emissions are converted to CO_2-equivalent units using the global warming potentials (GWPs) presented in the IPCC Fourth Assessment Report (2007).

For Uzbekistan, the total GHG emissions in 2017 amounted to:

- 189.2 mln t CO_2-eq. excluding CO_2 removals in the Forestry and Other Land Use-Sector (FOLU);
- 177.4 mln t CO_2-eq. including the absorption of CO_2 in the FOLU Sector.

Trends in total GHG emissions:

- for the period 1990-2017 - an increase of 6.7%.
- for the period 2013-2017 - a slight decrease by 0.6%.

In 2017, total GHG emissions per capita amounted to 5.8 t CO_2-eq./person, and per GDP - 2.55 kg/USD.

Information on mitigation measures and their effects

In recent years, the country has adopted a number of documents defining national policies and measures to mitigate climate change.

In order to ensure the fulfillment of the PA obligations in the country, the "Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019-2030" has been developed and approved, the main tasks of which are:

- increasing the energy efficiency of the economy and rational consumption of natural resources through technological modernization and the development of financial mechanisms;
- diversification of energy sources, inclusion of “green” criteria based on advanced international standards in priority areas of public investment and spending;
- assistance in the implementation of pilot projects in the areas of transition to a "green" economy through the development of mechanisms of state incentives.

The implementation of the Strategy envisages to 2030:

- reduction of specific greenhouse gas emissions per unit of gross domestic product by 10% from the level of 2010;
- a twofold increase in the energy efficiency indicator and a decrease in the carbon intensity of GDP;
- development of renewable energy sources (RES) with bringing their share to 25% or more of the total volume of electricity generation.

The National Sustainable Development Goals (NSDGs) were approved, which include targets and indicators aimed at reducing greenhouse gas emissions.

The adopted laws “On the ratification of the Charter of the International Renewable Energy Agency (IRENA)”, “On the use of renewable energy sources”, “On public-private partnership” provided a legal and regulatory framework for the development and implementation of RES.

As part of the ongoing institutional reform, a number of new specialized ministries and agencies have been created, which are responsible for implementing measures to improve energy efficiency and reduce GHG emissions. Measures and actions aimed at combating climate change are integrated into sectoral development strategies: the Strategy for Innovative Development of the Republic of Uzbekistan for 2019-2021, the Strategy for the Management of Solid Waste in the Republic of Uzbekistan for the period 2019-2028, Agricultural development strategy of the Republic of Uzbekistan for 2020-2030, the Concept of environmental protection of the Republic of Uzbekistan until 2030, the Concept of providing the Republic of Uzbekistan with electric energy for 2020-2030.

Medium-term development priorities are defined in the State Development Programs.

The complex of measures to mitigate the impact on climate change being implemented in the country includes technical measures to reduce direct greenhouse gas emissions, improve energy efficiency in various sectors of the economy, diversify energy sources, and carbon sequestration in agriculture and forestry.

Analysis of technical projects showed that as a result of programs implemented for the period of 2010-2017, the main reduction in emissions was achieved in the Energy sector. The most effective measures turned out to be in the oil and gas industry, where a number of investment projects have been implemented aimed at utilizing associated petroleum gases, the introduction of the latest mini-power plants for generating electricity, and automated gas metering systems. The reconstruction of gas networks was carried out within the framework of seven CDM projects.

On the energy generation side, the reduction of GHG emissions was achieved as a result of improving the energy efficiency of CHPPs and boiler units by upgrading existing condensing power plants, and replacing outdated power units with modern CCGT and GTU (increasing the efficiency of units up to 50-57%). In industry, one of the instruments for reducing energy intensity was the mechanism of lending to subprojects aimed at improving the energy efficiency of industrial enterprises in the country, introduced within the framework of the World Bank's project "Improving the Energy Efficiency of Industrial Enterprises".

Three possible scenarios have been developed to assess the forecast indicators of greenhouse gas emissions in Uzbekistan for the future until 2030.

The business-as-usual scenario (BAU) was calculated based on the existing growth trends in the sectors of the economy.

The realistic scenario took into account the containment of the growth of emissions in the sectors of the economy (energy, oil and gas industry, forestry, etc.) as a result of the implementation of energy saving and energy efficiency measures reflected in the adopted state and sectoral programs and current investment projects.

The ambitious scenario assumed the intensive development of sectors (industry, transport, energy), the development of a "green economy", the realization of the maximum capacity to reduce greenhouse gas emissions.

The calculations were carried out using the GACMO (Greenhouse Gas Abatement Cost Model) model, which was developed through more than 20 years of research in the framework of the UNEP/DTU (Danish Technical University) [9] Partnership, and is used by a number of countries to calculate emission projections in preparing their commitments to PA.

The starting point for making projections of emissions was the results of the national GHG inventory, 2017. All three considered scenarios for forecasting GHG emissions until 2025 and 2030 demonstrate an increase in total emissions, respectively: by 15-258% - in 2025 and by 18-42% - in 2030 relative to 2017.

The predicted positive trends in GHG emissions are due to (1) an increase in the population of the country, the level of its well-being; (2) development of energy-intensive sectors of the economy (industry, construction, transport); (3) an increase in the production and processing of fossil fuels; (4) increased production in the agricultural sector.

Financial resources, technology transfer, capacity building, technical support received and needs

Financial support for activities related to climate change directly depends on the investment conditions of the country. Since 2017, the Uzbek government has been implementing reforms aimed at removing barriers and improving the investment environment.

[9] UNEP DTU Partnership is actively involved in the implementation of the UN Climate Change Strategy and Energy Program. https://unepdtu.org/publications-database/?fwp_content_type=web-based-tools

As a result, there is a significant increase in the inflow of financing, which indicates an improvement in the characteristics of the investment climate, as well as an increase in investor confidence in the economy of Uzbekistan. International development organizations seek to restore or expand their presence in Uzbekistan.

International financial institutions and foundations provide Uzbekistan with financial and technical support for the implementation of climate programs in the form of grants, loans, soft loans, etc. Grants received from international organizations are intended primarily for capacity building, technical support, technology transfer. The total budget of projects on a grant basis is estimated at $ 69.4 mln USD. The main funding sources are the Global Environment Facility (GEF), IDA funds, the World Bank Group's IBRD, the Climate Change Fund, and the Asian Development Bank's Clean Energy Funding Partnership. They account for over 80% of the aid received. The main funds were used to promote energy efficiency, clean energy development, sustainable forest management, cross-sectoral synergy of mitigation measures with other development goals, for example, the development of a sustainable rural housing market, etc.

In connection with the commitments arising from the decisions of the COP and the Paris Agreement related to the regular submission of National Communications and Biennial Reports, further support is needed to develop and strengthen existing technical and institutional capacity, including in the following areas: (i) improving the quality of estimates of greenhouse gas emissions; (ii) assessment of technology needs and climate technology transfer mechanisms (iii) methods and approaches to mobilize human and financial and technological resources; (iv) design and further development of an MRV system for monitoring GHG emissions, and evaluating the implementation of mitigation measures and financial support received.

In the future, in order to fulfill the country's obligations under the Paris Agreement and prepare reporting under the UNFCCC, the development of the national MRV system will require support from international organizations and financial institutions and access to climate finance resources.

Information about the internal MRV system

In Uzbekistan, one of the priority areas of the Strategy for the transition to a "green" economy is "... the creation of a monitoring, reporting and verification (MRV) system on greenhouse gas emissions, taking into account national circumstances, to continuously track the implementation of the country's quantitative obligations under the Paris Agreement and ensure reporting on greenhouse gas emissions".

The development and implementation of an effective national MRV system will help build capacity and create an enabling environment in the country, and will also allow:

- to stimulate *decision-making* in the design and implementation of policies and measures for low-carbon development and, if necessary, adjust the policy;
- to improve *coordination and information exchange* between different sectors of the economy;
- to track progress towards the declared Nationally Determined Contributions (NDC);
- to meet the requirements of the Enhanced Transparency Framework.

The republic has accumulated valuable experience in the implementation of MRV for CDM projects in the oil and gas and chemical industries. Practical steps have been taken to monitor progress towards achieving the national Sustainable Development Goals.

Currently in Uzbekistan, on the basis of the Center for Hydrometeorological Service under the Republic of Uzbekistan, there is a stable institutional system that makes it possible to carry out an inventory of GHG emissions on an ongoing basis.

During the preparation of the FBUR, the following elements of the system were implemented - carried out assessments of: financial assistance from donor countries, investments in low-emission technologies, received support for capacity building (technical assistance, participation in seminars and training workshops).

From the lessons learned from the preparation of National Inventories and the implementation of CDM projects, it follows that an effective MRV system involves:

- the required level of political support;
- well-organized information flows between participating institutions.

Implementing a national MRV system is a complex process that requires time and resources. In addition to creating working institutional mechanisms, an appropriate legal framework is needed that defines the functions and tasks of the parties involved in the implementation of the national MRV system that ensure the stability of the functioning of the internal MRV system.

Currently, Uzhydromet, together with FAO, within the framework of the Transparency Initiative (CBIT), prepared and submitted to the GEF-7 a project proposal (PIF) to support the implementation of the project "Strengthening the capacity of national institutions to move from existing MRV mechanisms to an expanded transparency framework in accordance with with the Paris Agreement ", which aims to develop and support existing reporting tools and institutional arrangements, and build capacity for transparency-related activities in line with country priorities.

1 NATIONAL CIRCUMSTANCES

1.1 GEOGRAPHIC LOCATION AND CLIMATE

The Republic of Uzbekistan is located in the central part of Eurasian continent, within the Amu Darya and Syr Darya river basins. The country borders on Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Afghanistan. The total border length is 6,221 km. The total area of the Republic is 448.9 thousand km^2. Uzbekistan is a landlocked country (Fig. 1.1).

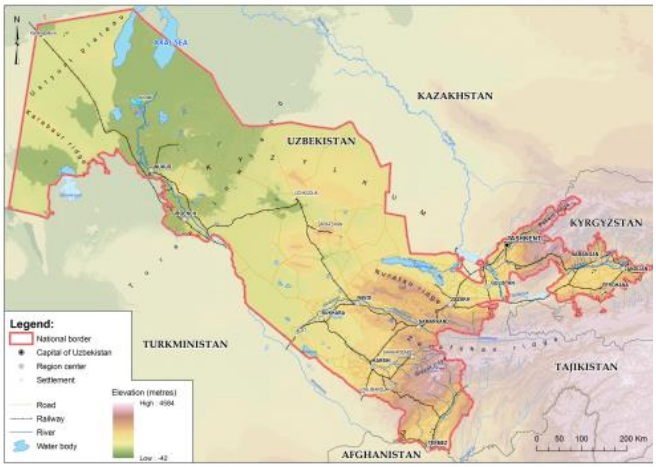

Figure 1.1 *Physical Map of the Republic of Uzbekistan*

Relief. The Republic occupies a huge territory with a complex variety of surface and relief forms. The desert accounts for 78.8% of the total area of the country, including the Kyzylkum and the Aralkum, a new desert formed as a result of the Aral Sea degradation. In the east and south-east, the plains pass into the spurs of the Tien - Shan and Gissar-Alay mountain systems, which have strongly dissected relief and present 21.2% of the country's territory. The highest point is 4,643 m (in the Gissar mountain ridge). The lowest point of 16.5 m below sea level is located in the Mingbulak depression.

Climate. Uzbekistan's climate is sharply continental, with large seasonal and daily variations in air temperature, with hot and extended summer, relatively humid spring and unstable winter.

The territory of Uzbekistan to the north and west is open for different air masses to penetrate, and is located in the area of movement of the planetary high-altitude frontal zone. Cyclone activity intensifies in winter and spring. Cyclones cross the country and cold intrusions are accompanied by winds and heavy precipitation, so that precipitation falls mainly from November to May (about 90% of the annual average precipitation amount for Uzbekistan), and peaks in March.

Distribution of precipitation across the territory is extremely uneven and closely associated with disposition of mountain systems, terrain elevation, and direction of mountain slopes (Fig. 1.2). An increase in the amount of precipitation is observed in the piedmont and mountain areas, especially along the windward slopes. However, generally, the territory of Uzbekistan is attributed to the arid zone. In some years, cold air masses freely penetrate into the southernmost regions of the country. The absolute minimum winter air temperature recorded by the Termez meteorological station after 1990 was –19.7°C (2008).

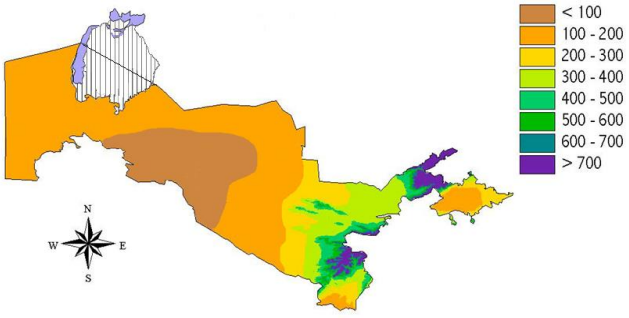

Figure 1.2 *Distribution of Long-term Average Annual Precipitation for Period 1990-2019*

The absolute minimum winter air temperature in the northern part of Uzbekistan (Ustyurt Plateau) recorded after 1990 was –34.2°C (2006).

In warm year season, high levels of solar radiation inflow in the Central Asia create conditions for the formation of vast heat centers, especially over the burning deserts (Karakum and Kyzylkum).

The absolute maximum summer air temperature in the desert regions of Uzbekistan reaches 45-49°C and more (Fig. 1.3).

The highly warmed air above the plains of Uzbekistan is characterized by a high humidity deficit, so that during the summer season conditions are often created for the formation of droughts (Fig.1.4).

The average annual air temperature in the plains is currently (1990-2018) 14.9°C - the warmest month is July (28.8°C), and the coldest month is January (0.9°C).

However, the average monthly air temperature across the territory of Uzbekistan varies widely (Table 1.1).

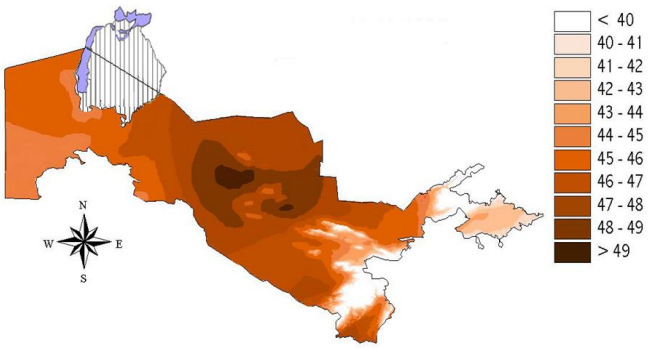

Figure 1.3 *Distribution of registered absolute maximum air temperature over the entire observation period*

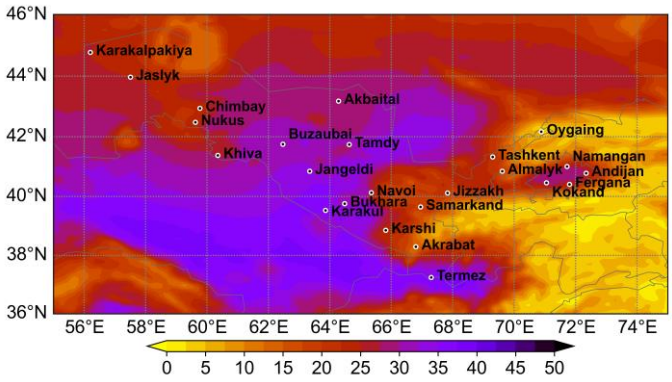

Figure 1.4 *Distribution of the Average Long-term Air Humidity*

Table 1.1 *Average monthly air temperatures and monthly precipitation (1990-2019)*

Months	1	2	3	4	5	6	7	8	9	10	11	12
Northern zone (Aral Sea region, Muynak meteorological station)												
Average, °C	-5.3	-3.4	5.4	14.0	21.8	27.1	29.1	27.3	19.9	11.0	2.6	-3.5
Maximum, °C	-1.1	1.8	11.7	20.6	28.4	34.0	35.7	34.5	27.1	17.9	7.9	0.6
Minimum, °C	-8.6	-7.4	0.6	8.6	15.5	20.1	22.2	20.3	13.3	5.2	-1.0	-6.8
Precipitation, mm	8.2	10.9	17.8	16.9	14.9	5.3	5.1	2.3	1.8	7.1	12.8	7.7
Southern zone (Valley Surkhandarya river, Denau meteorological station)												
Average, °C	5.1	6.9	13.2	18.7	24.4	28.8	29.9	27.9	23.5	17.5	10.8	6.4
Maximum, °C	10.2	12.4	19.6	25.3	31.3	35.9	37.2	35.5	31.6	25.5	17.4	11.8
Minimum, °C	1.4	2.8	8.0	13.2	18.6	22.9	23.8	21.8	17.3	11.7	6.2	2.5
Precipitation, mm	42.5	58.9	58.5	47.3	23.4	4.5	0.4	0	0.4	12.3	34	48.3

The ongoing global climate change is causing an increase in air temperatures throughout Uzbekistan. This is occurring due to high natural variability, which is causing significant interannual fluctuations[10]. Statistically significant trends are being noted in the long-term series of observations of the mean annual air temperature (Fig. 1.5).

[10] Chub V.E., Spektorman T.Yu. Climate trends across the territory of Uzbekistan//Climate change, causes, consequences and response measures. Bulletin No. 10, Tashkent 2016.

The ratio of the trend increment to the standard deviation was used as a criterion for the significance of trends ($\Delta Tr/\sigma$)[11]. The trend increment relative to the 30s of the last century at Tashkent and Andijan meteorological stations was 2.4°C and 1.8°C, respectively.

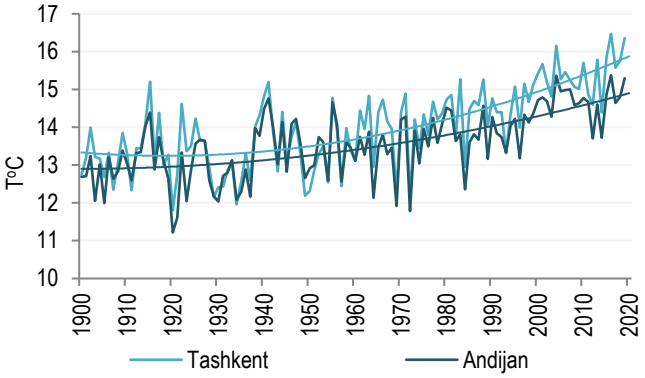

Figure 1.5 *Change in average annual air temperatures by stations of Uzbekistan*

The highest spatial density of meteorological observations in Uzbekistan has been observed since the 1950s, which makes it possible to assess the rate and significance of the ongoing warming throughout the country, based on data from 50 stations. The assessments carried out in the framework of the preparation of the Fourth National Communication (FNC) to the UNFCCC showed that at the overwhelming majority of stations in Uzbekistan, the increase in average annual air temperatures from 1950 to 2019 is statistically significant, the trend increment 1.5-2 times and more exceeds the natural variability. The highest rates of warming are noted in Karakalpakstan (Ustyurt and the Aral Sea region: 0.41-0.43°C over 10 years), followed by the flat territories of Tashkent region and Zeravshan valley (0.36 and 0.32°C over 10 years). In the southern part of Uzbekistan (Surkhandarya region), the warming rates are lower (0.21°C over 10 years), the lowest were recorded in the mountainous zone (0.12-0.18°C over 10 years) (Table 1.2).

Table 1.2. *Characteristics of trends in mean annual air temperatures, averaged over geographic areas and regions of Uzbekistan for the period 1950-2019*

Geographic areas and regions of Uzbekistan	Trend increment (ΔTr)	Standard deviation (σ)	$\Delta Tr/\sigma$	Warming rate °C/10year
Ustyurt (northern part of Karakalpakstan)	2.6	1.20	2.13	0.43
Aral region (central and southern parts of Karakalpakstan)	2.4	1.15	2.12	0.41
Khorezm region	1.7	0.91	1.85	0.28
Desert zone (Kyzylkum and Bukhara region)	1.8	0.94	1.86	0.29
Valley of the river Zeravshan (Samarkand, part of Bukhara and the south of Navoi region	1.9	0.92	2.05	0.32
Valley of Kashkadarya river (Kashkadarya region)	1.5	0.85	1.74	0.25
Valley of Surkhandarya river (Surkhandarya region)	1.3	0.82	1.56	0.21
Spurs of the Gissar ridge (Kashkadarya region)	0.7	0.66	1.11	0.12
Low mountains of the Turkestan ridge (Jizzakh region)	1.3	0.90	1.44	0.22
Plain part of Jizzakh region and Syrdarya region	1.6	0.94	1.66	0.26
Foothills of the Western Tien Shan (Tashkent region)	2.1	1.02	2.09	0.36
Spurs of the Western Tien Shan (Tashkent region)	1.1	0.69	1.52	0.18
Fergana Valley (Namangan, Andijan and Fergana regions)	1.5	0.86	1.76	0.25

[11] Progress report to CCl on statistical methods. WMO-TD N834, 1997

When considering individual stations, the rates of warming may differ, since in Uzbekistan it is almost impossible to completely exclude local anthropogenic influences on the climate (intensive development of irrigated agriculture for many decades, construction of reservoirs, the emergence of irrigation-waste lakes, reduction of the Aral Sea water area, urban growth).

Global climate change and various local factors affect the air humidity regime. Mesoscale influences are manifested mainly in the warm half of the year:

- in the Aral Sea and Khorezm regions, since 1980, there has been a decrease in the absolute moisture content;
- in the entire irrigated zone (foothills and Fergana Valley), there are tendencies for an increase[10].

The largest increase in the deficit of air humidity (28%) was recorded in the Aral Sea and the Khorezm regions, in the rest of the territory its increase is 8-13%. In general, an increase in the deficit of air humidity occurs due to an increase in air temperatures in all seasons of the year. The shrinkage of the Aral Sea led to additional strong aridization of the climate in the Aral Sea region.

Throughout Uzbekistan, the number of days with high air temperatures is growing, for example, in 2019, the number of days with air temperatures above 38°C at the Tashkent meteorological station exceeded the norm (long-term average value) by twice. Accordingly, the number of days with negative air temperatures, despite several cold winters in recent years, is decreasing by an average of 4-5 days per decade. There is a significant increase in the duration of the hot and dry period. In all seasons of the year, the frequency of positive temperature anomalies is increasing, which in summer becomes dangerous for the health of the population by heatwaves. The ongoing climate change is causing an increase in the frequency of droughts and is increasing the likelihood of water scarcity, which is negatively affecting food security.

Analysis of changes in annual precipitation amounts averaged over various geographic regions of Uzbekistan for the period 1950-2019 confirms the conclusions of the work[12] on insignificant and very weak trends in precipitation decrease, with the exception of the territory of Karakalpakstan, where on average about 100 mm falls per year - weak tendencies of increase were revealed. With insignificant changes in precipitation, at most stations, there is an increase in the frequency of days with heavy precipitation, in this regard, the likelihood of mudflows and floods in the mountainous zone increases.

Forecast calculations of the change rate in air temperatures were carried out as part of the preparation of the Fourth National Communication on Climate Change of the Republic of Uzbekistan in accordance with the scenarios of GHG emissions (RCP - Representative Concentration Pathways) that were developed by the scientific community for the Fifth Assessment Report[13].

Calculations under the extreme scenario by the end of this century on average in Uzbekistan show: (i) an increase in average annual air temperatures may reach 5°C; (ii) changes in annual precipitation amounts will not exceed 5%, however, territorial and intra-annual fluctuations can be significantly higher.

1.2 STATE STRUCTURE

Uzbekistan is the sovereign democratic republic, headed by the President. It is full entity of the international law. On 2 March 1992, Uzbekistan became the member of the United Nations Organization (UN).The state language is Uzbek. The national currency is sum.

[12] Chub V.E., Spektorman T.Yu. Climate trends across the territory of Uzbekistan//Climate change, causes, consequences and response measures. Bulletin No. 10, Tashkent 2016.

[13] IPCC Fifth Assessment Report: Climate Change, 2013. https://www.ipcc.ch/languages-2/russian/publications-russian/

The President is the highest official and the Supreme Commander-in-Chief of the Armed Forces of the Republic of Uzbekistan. President stands as a guarantor of citizen's rights and liberties, Constitution and laws of the Republic of Uzbekistan, sovereignty, security and territorial integrity of the state.

The system of state authority of the Republic of Uzbekistan is based on principle of separation of powers into the legislative, executive and judicial. The Oliy Majlis of the Republic of Uzbekistan is the supreme state representative body, which consists of two chambers – the Legislative Chamber (the lower chamber) and the Senate (the upper chamber).

The executive power is exercised by the Cabinet of Ministers of the Republic of Uzbekistan. It is composed of the Prime Minister, his deputies, ministers, chairmen of state committees, and the head of the government of the Republic of Karakalpakstan. The system of state administration is based on functional – sectoral and territorial principles, including sectoral ministries, state committees, agencies and bodies, as well as local bodies of state authority – khokimiyats (local municipalities) in provinces, cities, towns and districts. Self-governing bodies in settlements, kishlaks and auls, as well as in districts of cities (makhallas) are assemblies of citizens electing Chairman (aksakal) and his advisers for the term of 2.5 years.

The administrative-territorial structure of the Republic of Uzbekistan includes 14 administrative divisions: 12 provinces (viloyats), 1 autonomous republic and 1 city of central subordination (Fig. 1.6).

According to statistical data there are 120 cities, 1,067 urban settlements, 10,996 rural settlements and 262 assemblies of citizens on the territory of the country.

The capital of Uzbekistan is Tashkent city with population of 2.57 mln. Tashkent is a cultural, educational, political and transport center, and the largest city in Uzbekistan and Central Asia as a whole. Other major cities of Uzbekistan* are Namangan - 626.2 thousand people; Samarkand - 519.7 thousand people; Andijan - 441.7 thousand people; Nukus (capital of the autonomous Republic of Karakalpakstan) - 319.8 thousand people.

Figure 1.6 *Administrative Division of Uzbekistan*

1.3 DEMOGRAPHY

Uzbekistan is the most populous country in Central Asia. The total population is 34.383 mln people. The urban population accounts for 50.5% of the total population, while the rural population accounts for 49.5%. In the republic, 30.3% of the total resident population are persons under the working age, 59.5% are of the working age and 10.2% are over the working age.

The population of the Republic of Uzbekistan is growing steadily. Annual population growth, on average, is about 1.7% (Fig. 1.7). According to experts' forecasts, the population in 2030 will reach 39-40 mln people. The average population density in the country is 75.5 people/km^2.

The highest population density is typical for the Fergana Valley (Andijan region - 727.4 people/km^2), the lowest - in Navoi region 9 people/km^2 and in Karakalpakstan 11.4 people/km^2) (Fig. 1.8).

The literacy rate of the adult population of the Republic is 99.99%, and that of the youth - 100%[14].

Distinctive features of the education system in the country are free and universal access for both genders and a high degree of enrollment in education in the system of general secondary and secondary specialized, vocational education.

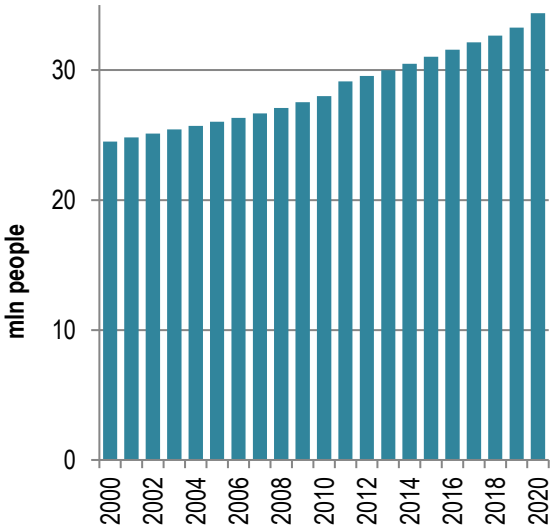

Figure 1.7 *Dynamics of population*

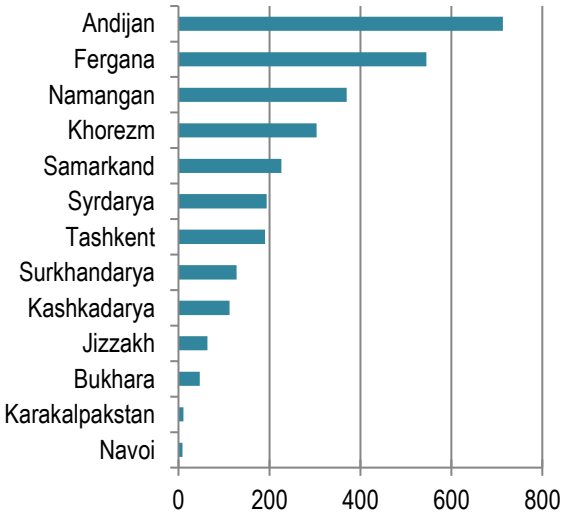

Figure 1.8 *Population density*

1.4 LAND RESOURCES

The total land resources of the country are 44,892.4 thousand hectares. Land, like other natural resources of Uzbekistan, is state property, is a national wealth, is subject to rational use and is protected by the state.

The division of land resources by economic purpose is due to differences in the functions that the land performs for certain purposes. The main categories of land use are presented in Fig. 1.9.

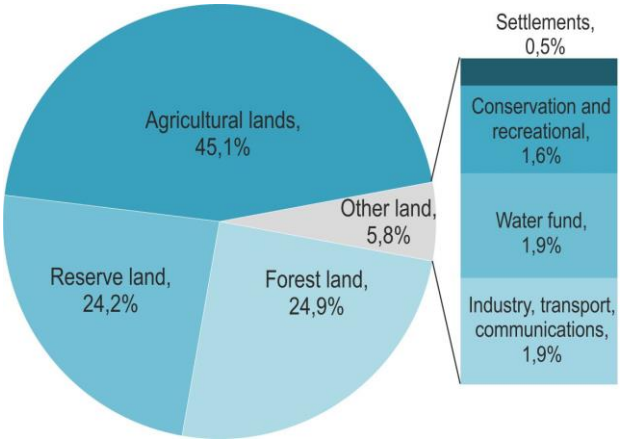

Figure 1.9 *Land fund categories in Uzbekistan, 2018*[1]

Agricultural lands, which are the most valuable and multifunctional category, make up about 45% of the total area of the country. There are also two other major categories of land resources, namely: forest land - 25% and reserve land about 24% of the total area of the country.

The main uses of agricultural land are irrigated and rainfed agriculture, and grazing livestock.

Irrigated agriculture is of key importance for life in Uzbekistan. In an arid climate, irrigation is the basis of the agro-industrial complex, a prerequisite for increasing land productivity, food security and the well-being of the rural

* According to statistics as of January 1, 2020. – stat.uz

[14] United Nations Development Assistance Framework for the Republic of Uzbekistan (UNDAF) 2016-2020/UNDP, 2015

population. Irrigated agriculture occupies about 10% of the country's territory. The total effect of irrigated agriculture and all related sectors of the economy exceeds the direct effect of growing crops and creates up to 50% of the total contribution to the country's GDP.[15]

Pastoralism is based in regions with low natural resource capacity, its technological cycle is extensive and completely dependent on natural forage conditions. Pastures are multicultural in structure and are concentrated mainly in desert and semi-desert areas (81%), piedmont semi-arid regions - 12%, and mountain and alpine pastures account for (7%). Pasture lands are characterized by low productivity of 2-3 c/ha; the yield is unstable, depending on the amount and mode of precipitation. Desert pastures form the basis of the fodder base for sheep breeding, providing year-round maintenance[16], they are most susceptible to the influence of drought. Foothill and mountain pastures - less affected by drought, but more prone to erosion and natural disasters, including landslides and mudflows. Recently, there has been a decrease in the species composition of plants and the value of biomass due to grazing of pastures[17].

The lands of the state forest fund occupy 11.2 mln hectares as of 01.01.2018, which is 25.2% of the total area, of which about 3.26 mln hectares are covered with forests. The largest areas of the forest fund are located in the Republic of Karakalpakstan, Bukhara, Navoi and Kashkadarya regions, the smallest areas are in Samarkand, Syr Darya regions and in the Fergana Valley. According to the data of the State Forest Fund of the Republic of Uzbekistan, forest cover in 2010 was 6.5% of the country's land area, in 2015 - 6.9%, in 2018 - 7.1%.[18]

In order to increase the areas under forest in 2019, the Forestry Development Program for 2020-2024 was approved, in which it is planned to create forests on the territory of 2.78 mln hectares [19].

1.5 WATER RESOURCES

The country is one of the most vulnerable in Central Asia, as more than 80% of Uzbekistan's water resources are formed on the territory of neighboring states.

Water resources of Uzbekistan belong to the Aral Sea basin, their main sources are the surface runoff of the Amu Darya and Syr Darya rivers and their tributaries. The total average annual flow of all rivers is about 116.2 km^3/year, of which 67.4% is formed in the Amu Darya river basin (78.3 km^3/year) and 32.6% in the Syr Darya river basin (37.9 km^3/year). The total groundwater reserve is 1.17 billion m^3, of which 14.7 billion m^3 is located in the Amu Darya river basin and 16.4 billion m^3 - in the Syr Darya river basin.

In recent years, the annual volume of water resources used by Uzbekistan averages 51-53 km^3/year. The estimated natural resources of fresh and slightly saline groundwater are potentially 27.6 km^3/year (75.6 mln m^3/day); however, they are extremely unevenly distributed throughout the country. The needs of water consumers are covered through the combined use of surface water (50.9 km^3/year), exploitable groundwater reserves (0.5 km^3/year), as well as the reuse of collector and drainage wastewater (1.6 km^3/year).

The natural regime of river flow is significantly distorted by water intake for irrigation, discharge of drainage water, as well as by the operation of reservoirs. The river runoff is characterized by significant intra-annual and long-term irregularities and in a dry year (90% of supply) it is 23 km^3 less than in a year of average water availability. Groups of high-water years come periodically after 6-10 years and have a duration of 2-3 years, but more often there are single,

[15] Dukhovny V.A., Sokolov V.I., Khamraev Sh Irrigated agriculture in Uzbekistan: are there reserves of water availability for sustainable development? SIC ICWC, Tashkent, 2017.

[16] Environmental Performance Reviews. Uzbekistan. Third Review. UNECE, Geneva, 2019r.–539 p.

[17] National Program for Increasing Productivity, Conserving Soil Fertility (2004); ADB/GEF CACILM. NFP of Uzbekistan (2006).

[18] Voluntary national review 2020. On the implementation of the 2030 agenda in the field of sustainable development, Ministry of Economic Development and Poverty Reduction of Uzbekistan, Institute for Forecasting and Macroeconomic Research (IFMR), 2020.

[19] PP No. 4424 of 23.08. 2019 "On additional measures to improve the efficiency of forest management in the Republic of Uzbekistan".

low-water periods, observed after 4-7 years, and having a protracted nature - up to 6 years. The cyclical nature of river flow fluctuations and long periods of low water complicate the economic use of water sources.

River water quality is generally considered good due to the implementation of specific measures to prevent the discharge of pollutants and waste into rivers, streams, and other water bodies. In particular, in accordance with government decrees, in recent years, 9 water treatment facilities have been reconstructed in the communal sector, the construction of new and modernization of existing ones continues.

Agriculture is the largest consumer of water resources, accounting for an average of 90-91% of the water used. The total irrigated area in Uzbekistan is 4.3 mln hectares. With the development of irrigated agriculture and diversion of collector-drainage runoff outside the irrigated massifs, along the periphery of irrigation zones in natural lower relief, as well as in places of previously existing natural lakes, irrigation-waste lakes began to form, the volume of which already exceeds the volume of all reservoirs in the Aral Sea basin.

The second largest water consumption sector is public utilities (4.5% of the water used). Due to the proven reserves of groundwater, 69 cities (58%), 335 urban-type settlements (31%) and 2,902 rural settlements (26%) are provided with drinking water. The remaining settlements are provided from other sources of water supply (surface water, unapproved reserves, wells, water conduits, etc.).

Industry accounts for 1.4% of water consumption, fisheries - 1.2%, heat power - 0.5%, other sectors of the economy - about 1.0%. At the same time, industries and energy sectors have been actively developing in recent years and their water consumption is constantly growing.

1.6 BIOLOGICAL RESOURCES AND ECOSYSTEMS

The territory of Uzbekistan is characterized by a wide variety of natural ecosystems. Desert ecosystems are widely represented in the lowland regions. Desert-type steppes occupy almost 80% of the country's territory. In the mountains, where the altitudinal zonality is well expressed, several zonal-climatic zones are clearly defined, corresponding to the main types of mountain ecosystems, including forest ecosystems. Wetland ecosystems are mainly represented in the flat areas of the country.

Forest ecosystems. Forests contribute to reducing the risk of floods, soil degradation, climate change mitigation and biodiversity conservation. In the whole country, about 3.0 mln hectares of the territory are covered with forest vegetation. The productivity of the forests of Uzbekistan is low, which is associated with the general aridity of the territory. The low level of forest cover (6.5-7.1%) is determined by unsustainable forest exploitation. Excessive and unregulated cattle grazing, which leads to a high percentage of forest plant deaths, as well as cutting down trees and shrubs for fuel, causes a particularly tangible damage to the forest fund.[20]

Forests can be divided into three geographical categories: plain-desert, mountain, floodplain.

The largest massifs of plain-desert forests are located in Karakalpakstan, Bukhara and Navoi regions. The main forest-forming species of plantations in the desert zone are black and white saxaul (Holoxilon persicum Bge. and Holoxilon aphillum Hjin.), Large areas are also occupied by Circassians (Salsola Richterii Kar., Salsola paletzkiana Litv.), Kandyms (Calligonum), tamarisk (Tamarix).

Small massifs of mountain forests are found in the spurs of the Western Tien Shan, on the slopes of the western spurs of the Turkestan and Gissar ridges. With a relatively small area, the mountain forests of Uzbekistan are diverse in

[20] Environmental Performance Reviews. Uzbekistan. Third review. UNECE, Geneva, 2019 - 539 p.

species composition. More than 100 tree and shrub species are found in there. By composition, mountain forests can be divided into juniper, pistachio, almond, walnut, apple, hawthorn, mixed forests, as well as bushes.

Tugai forests stretch in narrow bands along the main waterways of - Amu Darya and Syr Darya. In the floodplains and river valleys, tree-shrub and herbaceous communities are developing - tugai, located on the islands and in the coastal strip. The main forest-forming species of tugai are turanga (Populus diversifolia, P. pruinosa), narrow-leaved oak (Elaeagnus angustifolia L.), willow tree (Salix songarica Anderss.) and tamarisk.

Wetland ecosystems. There are more than 500 lakes on the territory of Uzbekistan, mostly small water bodies with an area of less than 1 km^2. Only 32 lakes have an area of more than 10 km^2. Natural floodplain and deltaic lakes are located in the valleys of local rivers, most of which owe their origin to the erosion-accumulative activity of rivers. Mountain lakes, usually of dammed or glacial-moraine origin, are located at an altitude of 1,700-4,000 m above sea level and are a potential reserve of clean, freshwater, the volume of which is estimated at 60 km^3. On the plains, the dominant type of lakes has become irrigation-discharge lakes, which have been formed in recent decades in landscape depressions as a result of the diversion of flood or collector-drainage waters into them. They are mainly confined to the periphery of the irrigated massifs in the middle and lower reaches of Amu Darya and Syr Darya rivers and their deltas.

Arnasay system of lakes is located, the largest in Uzbekistan, in the middle reaches of Syr Darya river, which unites Aydarkul, Tuzkan and Upper Arnasay lakes. The volume of water in lakes of anthropogenic origin is estimated at 40 km^3; the water in the lakes is mineralized, however, it is suitable for fish farming and maintaining biodiversity.

Almost all lowland lakes are "very open" ecosystems, which, in combination with high evaporation (up to 2,000 mm and more), determines their strong dependence on climatic factors. This dependence is especially evident in the example of closed lakes, which are characterized by a high content of mineral salts, when, a certain salinity threshold is reached, progressive waterlogging is observed, and the range of ecosystem services provided is narrowed.

Priaralie zone. The drying up of the Aral Sea and the Amu Darya delta led to significant disruption of natural ecosystems in this region. The negative consequences of the disappearance of the lakes turned out to be so significant that since the 80s, work began to be carried out aimed at maintaining the irrigation-discharge lakes and creating new reservoirs in the delta and on the drained bed of the Aral Sea, fed by river and collector-drainage waters. The country is implementing major programs to improve the environmental and socio-economic situation in the Aral Sea region[21]. Per suggestion of the President of Uzbekistan Sh.Mirziyoyev, in order to improve the ecological situation in the Aral Sea region, this region was declared a "Zone of Environmental Innovations and Technologies" to promote innovative approaches to sustainable development and social stability in the Aral Sea basin. For this purpose, it is envisaged to create the International Innovation Center of the Aral Sea region in Karakalpakstan under the President of Uzbekistan.

1.7 MINERALS

Uzbekistan possesses a large production and mineral resources capacity, unique agricultural raw materials, rich natural resources, and a developed infrastructure. The current level of mineral exploration is associated with the development of deposits of noble, non-ferrous and rare metals, all types of organic fuel - oil, natural gas and gas condensate, brown and semi-coking coal, oil shale, uranium, many types of raw materials for building materials. The list of minerals includes about 100 types of mineral raw materials, of which 60 are already used in the national economy. In terms of proven reserves of such minerals such as gold, uranium, copper, natural gas, tungsten, potassium salts, phosphorites, kaolins, Uzbekistan occupies leading positions not only in the CIS, but also throughout

[21] Report of the President of the Republic of Uzbekistan Sh. Mirziyoyev at the 72nd session of the UN General Assembly.

the world. Thus, the country ranks fourth in the world in terms of gold reserves, and seventh in terms of gold production, tenth or eleventh in terms of copper reserves; uranium - the seventh-eighth, and in its production - eleventh-twelfth place. The available reserves of mineral raw materials for the most part not only feed the operating mining complexes for the long term, but also allow increasing existing capacities, re-organizing the production of a number of important minerals - gold, uranium, copper, lead, silver, lithium, phosphorites, potassium salts, fluorspar, agrochemical ores.[22]

1.8 ECONOMIC DEVELOPMENT

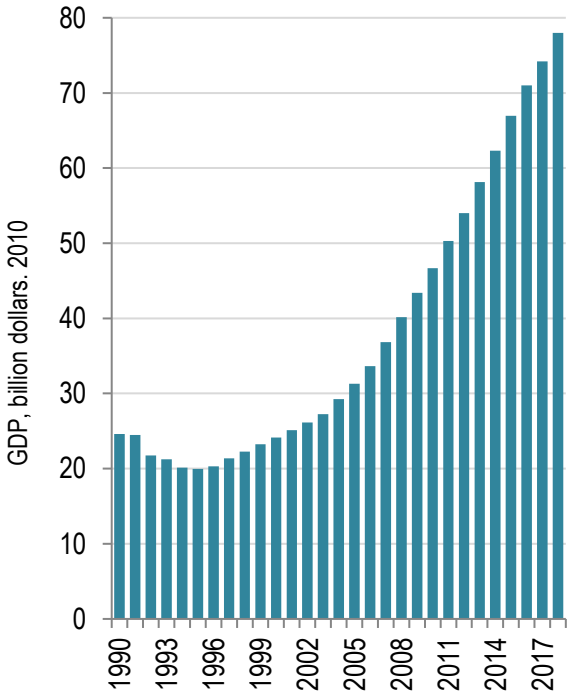

Figure 1.10 *Dynamics of GDP growth in the Republic of Uzbekistan* [1]

Uzbekistan belongs to the developing countries with rapidly growing economies.

Average annual GDP growth for the period of 2010-2019 is 6.5%. By the end of 2019, the country's GDP is estimated at 511.8 trillion UZS or $58 billion against $46.7 billion in 2010 (Fig. 1.10).

During this period, the average annual growth in industry was 7.6%, while the growth in agriculture, forestry and fisheries was only 4.6%.

The service sector developed at an average rate of 13.4% per year. The volume of investments in fixed assets increased by an average of 14.1% every year, and construction work - by 13.4%. The growth of imports (11.4% per year) associated with the needs of the economy, is much faster than the growth of exports (3.3%).

As a result of economic growth, the poverty rate decreased from 17.7% (2010) to 11% (2019). In the sectoral structure of GDP, the "Services" sectors prevail. For the period 2015-2019, there is a gradual increase in the contribution of the Industry sector. Growth in the industrial sector is mainly due to an increase in the added value of the mining and manufacturing industries (Tables 1.2, 1.3).

Table 1.2 *Changes in the structure of GDP for the period of 2015-2019, %*

Sectors of the economy	2015	2016	2017	2018	2019
Gross value added of industries	100	100	100	100	100
Agriculture	34.1	34.0	34.0	31.5	28.0
Industry	20.2	20.6	22.2	26.5	29.3
Construction	6.0	6.0	5.7	6.1	6.6
Services	39.7	39.4	38.1	35.9	36.1

[22] https://kommersant.uz/nedropolzovanie-v-uzbekistane-rasshirenie-vozmozhnostej-dlya-investirovaniya/

Table 1.3 *Dynamics of macroeconomic indicators for the period of 2015-2019.*

Indicators	Measurement unit	Years				
		2015	2016	2017	2018	2019
Gross Domestic Product	Billion UZS	210 183.1	242 495.5	302 536.8	406 648.5	511 838.1
	Growth rate, in %	107.4	106.1	104.5	105.4	105.6
	GDP deflator index, %	110.4	108.7	119.4	127.5	119.2
Inflation rate (growth): to December of the previous year	%	5.6	5.7	14.4	14.3	15.2
Industrial products	Billion UZS	97 598.2	111 869.4	148 816.0	235 340.7	322 535.8
	Growth rate, in %	105.3	105.4	105.2	110.8	105.0
Consumer goods	Billion UZS	42 085.5	48 253.8	59 690.4	83 512.6	110 321.0
	Growth rate, in %	109.7	106.0	106.7	114.7	110.3
Agriculture, forest and fishery	Billion UZS	103 302.0	119 726.7	154 369.4	195 095.6	224 265.9
	Growth rate, in %	106.1	106.1	101.2	100.3	103.1
Investments	Billion UZS	44 810.4	51 232.0	72 155.2	124 231.3	195 927.3
	Growth rate, in %	109.4	104.1	119.4	129.9	138.1
Construction works	Billion UZS	25 423.1	29 413.9	34 698.0	51 129.3	68 854.4
	Growth rate, in %	118.8	107.2	106.0	114.3	122.9
Retail turnover	Billion UZS	71 184.1	88 071.6	105 229.9	133 195.2	164 184.2
	Growth rate, in %	115.3	114.4	101.9	106.5	107.9
Services	Billion UZS	78 530.4	97 050.0	118 811.0	150 889.8	190 356.0
	Growth rate, in %	113.4	114.7	110.7	108.9	113.2
Foreign trade turnover	Billion UZS	24 924.2	24 232.2	26 566.1	33 429.9	41 751.0
	Growth rate, in %	90.5	97.2	109.6	125.8	124.9
Export	Billion UZS	12 507.6	12 094.6	12 553.7	13 990.7	17 458.7
	Growth rate, in %	92.3	96.7	103.8	111.4	124.8
Import	Billion UZS	12 416.6	12 137.6	14 012.4	19 439.2	24 292.3
	Growth rate, in %	88.8	97.8	115.4	138.7	125.0
Balance	Billion UZS	91.0	-43.0	-1 458.7	-5 448.5	-6 833.6
	Growth rate, in %	x	x	x	x	x

Source: data of the State Statistics Committee of the Republic of Uzbekistan as of 01.10.2020.

In general, economic growth until 2017 was the result of the influence of extensive factors associated with the implementation of targeted programs aimed at new construction, technical and technological renewal in sectors of strategic importance. At the same time, a rigid distribution of material, technical, financial resources and foreign exchange resources in the economy remained.

In 2017, a new stage of reforms began in Uzbekistan in all spheres of life and activities of the state. There is a transition from the previous economic model to an open economy and healthy competition, which ensures the achievement of high rates of economic growth due to the diversification of production and an increase in labor productivity. The government reform program is based on the implementation of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan in 2017-2021. The strategy was the most important program document that determined the priority directions of state policy in the medium term for all sectors of the economy and is aimed at: (i) improvement of state and social construction; (ii) ensuring the rule of law and further reforming the judicial and legal system; (iii) development and liberalization of the economy; (iv) development of the social sphere (v) ensuring security, interethnic harmony and religious tolerance, implementation of a balanced, mutually beneficial and constructive foreign policy. The strategy is designed to ensure economic, social and political openness and build a competitive market economy, which will allow for the transition to the group of countries with upper middle income[23].

According to the World Bank's annual review, over the past two years, Uzbekistan has made significant progress in implementing economic reforms to build a market economy. Reforms were conducted that could be implemented through administrative measures, including the abolition of foreign exchange regulation.[24]

A number of institutional and structural transformations are being carried out aimed at improving and increasing the quality of public administration, increasing credit and microcredit resources provided to the public and private sectors of the economy, improving the quality of human capital, developing the financial market through the introduction of new instruments to attract financial resources to the country's economy.

The national SDGs adopted in 2017 are closely linked and harmonized with the Action Strategy in five priority areas and integrated into the Programs for the Development of Sectors and Regions.[25]

Currently, the main priority of the government is the implementation of large-scale reforms while maintaining social stability and sustainable economic growth.

In January 2019, the Roadmap was approved for the main directions of structural reforms in Uzbekistan for 2019–2021, developed with the participation of the World Bank. It contains a comprehensive reform agenda covering five main areas:

- maintaining macroeconomic stability;
- accelerating the transition to a market economy;
- strengthening social protection and provision of public services to the population;
- strengthening the role of the state in a market economy;
- improving the efficiency of using the environment.

Uzbekistan is pursuing an active investment policy. In particular, the portfolio of the World Bank in Uzbekistan as of April 1, 2019 includes 20 projects totaling $ 3.52 billion. Of this, $ 1.34 billion was allocated within the framework of loans from the International Bank for Reconstruction and Development (IBRD), and $ 2.18 billion was provided to the country in the form of loans from the International Development Association (IDA). Bank-financed projects are aimed at developing water supply, agriculture, transport, energy, education, healthcare and urban services.[26]

[23] World Bank Uzbekistan Survey, 2019.
[24] World Bank Uzbekistan Survey, 2019.
[25] PKM No.841 of October 20, 2018 "On measures to implement the National goals and objectives in the field of sustainable development for the period up to 2030"
[26] World Bank Uzbekistan Survey, 2019.

The Asian Development Bank has been operating in Uzbekistan since 1995 and is one of Uzbekistan's key development partners. ADB is supporting the construction of combined cycle plants at the Talimarjan and Takhiatash power plants and the improvement of power transmission lines, and is helping the national electricity company increase its financial sustainability by installing automated metering systems. ADB is financing road and rail projects along the Central Asia Regional Economic Cooperation (CAREC) corridors.

Reforms, which began in 2017, expanded the Asian Development Bank's cooperation with Uzbekistan. ADB supports reforms in energy, transport, water supply and sanitation, municipal solid waste management, water management and agricultural diversification, public finance, capital market development, and mortgage lending.

1.9 ENERGY AND INDUSTRY

The fuel and energy complex of Uzbekistan includes electric power, heat power and oil and gas industry.

The main consumption of energy resources in the country falls on the energy sector - 33.6%, energy consumption by the population - 20.6%, then industry and construction - 22.3%, transport - 16.9%, agriculture - 0.1%.

The economy of Uzbekistan is characterized by high energy intensity; therefore, the modernization and diversification of the fuel and energy industry is one of the main priorities for the country's development. The Ministry of Energy was created in the course of the implementation of reforms to strengthen the energy policy in the country.[27] The Ministry of Energy and the organizations included in its structure carry out state regulation of the processes of production, transmission, distribution and consumption of electric and thermal energy, coal, as well as the extraction, processing, transportation, distribution, sale and use of oil, gas and processed products.

Oil and gas industry. Natural gas reserves became the basis for the creation and development of the oil and gas industry. In terms of natural gas production, Uzbekistan ranks 13th in the world, and in terms of reserves it is in the 24th place[28]. However, resources are rapidly depleting and, at the current production rate, reserves may significantly decrease by 2030. In recent years, the annual volume of gas production has stabilized at the level of 53-57 billion m^3, consumption - at the level of 45-50 billion m^3. Oil production in the country is limited, in connection with which Uzbekistan became an importer of oil, its consumption stabilized at the level of 3.3-3.5 mln t.[29]

Prospective and forecast resources are: gas - about 6 trillion m^3, oil - 850 mln t, gas condensate - 380 mln t. Gas occupies about 80% in the structure of primary energy sources, oil - about 16%, the rest is coal and hydroelectric power plants.[30]

The activities of the oil and gas industry cover the entire chain of oil and gas operations, from geological exploration, development and exploitation of oil and gas fields, drilling, production to processing hydrocarbons, production of oil products, oil and gas and chemical equipment and supplying consumers with oil products.

In the oil and gas industry, about 30 industrial enterprises operate, which produce gasoline, diesel fuel, jet fuel, various types of oils, fuel oil, bitumen, polyethylene of various grades, commercial natural and liquefied gas, oil chemical equipment, gas equipment and others.

[27] UP No.5646 of February 1, 2019 "On measures to radically improve the management system of the fuel and energy industry of the Republic of Uzbekistan

[28] http://nsdg.stat.uz/goal/10

[29] Towards Sustainable Energy: A Low Carbon Development Strategy for the Republic of Uzbekistan. Summary,2015.

[30] https://neftegaz.ru/analisis/oil_gas/328620-neft-gaz-i-energetika-uzbekistana/ , https://tab.voshod.org/lenta/neft-gaz-i-jenergetika-uzbekistana/

Gas transportation is carried out by the departments of main gas pipelines in the northern, southern and eastern directions, which also ensure the export and transit of gas. The gas distribution system of Uztransgaz JSC consists of more than 13,298 thousand km of gas pipelines and 420 gas distribution stations.

The supply of natural gas to consumers of the Republic of Uzbekistan is carried out by Khududgaztaminot JSC. Gas distribution system of JSC "Khududgaztaminot" consists of more than 127.7 thousand km of gas distribution networks of high, medium and low pressure and 96.3 thousand units. gas distribution points.

Guaranteed gas supply to the population and the industrial complex of the republic, regardless of the season, temperature fluctuations, force majeure circumstances, is provided by three underground gas storage stations: the Khojaabad UGS facility, the Sokh UGS facility and the Gazli UGS facility.

In order to fully meet the needs of the economy and the population of the republic in energy resources, a large-scale restructuring of the oil and gas system was carried out in the country in order to reduce unnecessary intermediate chains in the management system.[31]

The investment policy of the oil and gas industry is primarily aimed at attracting foreign investments with high technologies in order to diversify the industry and ensure in-depth processing of oil and gas resources.

Over the past 5 years, such strategic facilities have been commissioned as the Ustyurt Gas Chemical Complex, the Kandym Gas Processing Complex and a number of other industrial facilities.

The implementation of large strategic projects for the deep processing of hydrocarbon raw materials is continuing. In particular, the implementation of an investment project to expand the capacity of JSC "Shurtan Gas Chemical Complex" will increase the production of polymers from the current 125 thousand tons to 500 thousand tons, that is, 4 times.

The oil and gas industry of Uzbekistan is a major source of GHG. The largest volumes of greenhouse gases are generated during the transportation and distribution of gas.

Coal mining industry. Uzbekistan has proven reserves of coal in the amount of 1,900 mln t, including: brown - 1,853 mln t, hard coal - 47 mln t. Forecast resources amount to over 5.7 billion tons of coal. Brown coal in Uzbekistan is mined by open-pit mining at the Angren deposit (Tashkent region), bituminous coal is mined by the mine method at the Shargun and Baysun deposits (Surkhandarya region). In recent years, an increase in coal production has been observed and its further growth is planned (up to 6.4 mln/year)[32].

Electric power industry. Uzbekistan is one of those countries that mainly meet their needs at the expense of their own energy resources. Currently, the available generating capacity of the republic is 14.19 GW (Fig. 1.11), of which:

- TPP - 11 thousand MW or 84.7%
- HPP - 1.85 thousand MW or 14.3%
- block stations and isolated stations - more than 133 MW or 1%.[33]

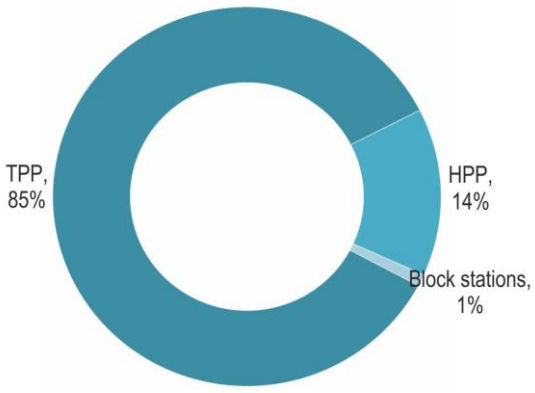

Figure 1.11 *Electricity generation structure in 2019*

[31] PP No.4388 of 09.07.2019. "On measures for the stable provision of the economy and the population with energy resources, financial recovery and improvement of the oil and gas industry management system".
[32] State Committee of the Republic of Uzbekistan on Statistics.
[33] The concept of providing the Republic of Uzbekistan with electric energy for 2020-2030 http://minenergy.uz/ru/lists/view/77

Energy management is vested in the Ministry of Energy. In 2019, there was a reorganization in the management of the energy sector.

The purpose of the reorganization is the transition to modern methods of organizing the production, transportation, distribution and sale of electricity. On the basis of Uzbekenergo JSC, three joint-stock companies "Thermal Power Plants", "National Power Grids of Uzbekistan" and "Regional Power Grids" were organized.[34]

The Joint Stock Company "Uzbekhydroenergo" was established in order to effectively utilize the hydropower potential of the republic, and to form a unified system for managing water and energy resources. The JSC includes all hydroelectric power plants, hydrotechnical and other units related to hydropower.[35]

At present, JSC "Thermal Power Plants" is the main producer and supplier of electricity in the republic (about 85%). Dynamics of electricity production in 2012-2019 is shown in Fig. 1.12[36].

The share of gas fuel accounts for 93.9%, fuel oil - 1.1%, coal - 5.0% in the structure of primary energy resources used at TPPs for the production of electricity and heat.

The main source of greenhouse gas emissions in the electric power industry is the process of fuel combustion in order to obtain heat and electricity [37].

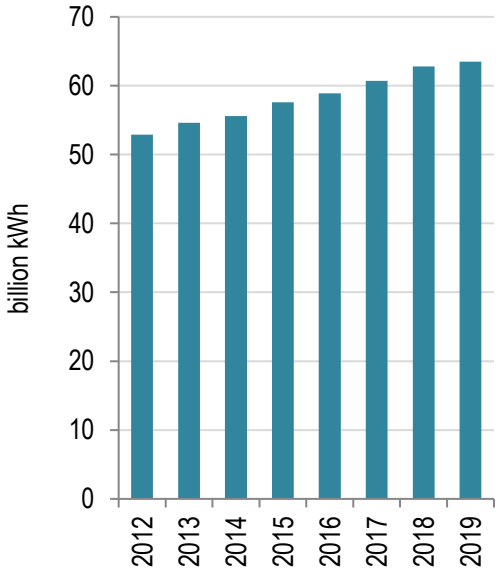

Figure 1.12 *Dynamics of electricity production in 2012-2019*

Hydropower includes 42 HPPs, including 12 large ones, with a total capacity of 1.68 GW, 28 SHPPs with a total capacity of 0.25 GW and 2 micro HPPs with a total capacity of 0.5 GW.

According to the "Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period of 2019-2030", by 2030, it is planned to double the energy efficiency indicator and reduce the carbon intensity of the gross domestic product, provide access to modern and reliable electricity supply for 100% of the population and industries of the economy.

In accordance with the resolution of the President of the Republic of Uzbekistan on the strategy for further development and reform of the electric power industry of the Republic of Uzbekistan, a "Program for the development of generating capacities for the period up to 2030" has been developed, which provides for the implementation of large investment projects aimed at the modernization and reconstruction of existing and construction of new power plants using energy efficient technologies; improvement of electricity metering systems; development of renewable energy sources, especially solar energy; legal reforms to improve tariff policy and ensure the transition to the wholesale market.

It is planned that the implementation of this Program will allow by 2030:

- to increase capacity from 12.9 GW to 29.3 GW, and electricity production from 63.6 billion kWh to 120.8 kWh;
- to reduce the consumption of natural gas from 16.5 bcm to 12.1 bcm;

[34] PP No.4249 of 27.03.2019 "On the strategy for further development and reform of the electric power industry of the Republic of Uzbekistan".
[35] UP No.5044 of 18 May 2017 "On the formation of the joint-stock company "Uzbekgidroenergo".
[36] http://minenergy.uz/ru
[37] http:/minenergy.uz - website of the Ministry of Energy of the Republic of Uzbekistan

– to reduce losses during transmission of electricity to 2.35% and losses during distribution - to 6.5% (1.85 times less than in 2019).

The use of renewable energy sources. Due to the natural and geographical conditions, Uzbekistan has a significant potential for renewable energy. The gross potential of hydro resources, solar energy, wind energy, biomass is 117,984 mln toe, the level of modern technologies allows the use of 179 ml toe, which is three times higher than the current annual consumption of fossil fuels.

The main share of the gross potential is solar energy (total potential - 51 billion toe, technical potential – 177 mln toe). The total potential of hydropower is 9.2 mln toe, technical potential - 1.8 mln toe. The technical potential of wind energy is 520 GW of installed capacity. Despite the presence of a significant potential for renewable energy, there are no large solar PVPPs and wind farms on an industrial scale in the republic[38].

Today, the share of energy received from RES is small. The total installed capacity of renewable energy facilities amounted to 1,746 MW in 2010 and 1,858 MW in 2018 (Fig. 1.13).[39]

Since 2019, the country has produced 15.6 mln kWh of electric energy through solar and wind power plants, and its amount is gradually increasing. [40]

The law "On the use of renewable energy sources" and the law "On public-private partnership", adopted in May 2019 in Uzbekistan, create a legal and regulatory framework to accelerate the implementation of renewable energy projects.

The main directions of state policy in the field of RES use are:

– development and implementation of programs;
– diversification of the fuel and energy balance in terms of the production of electricity, heat and biogas based on renewable energy sources;
– stimulation of the introduction of innovative technologies, scientific and technical developments;
– state support and incentives for renewable energy producers, as well as producers of renewable energy installations;
– development of international cooperation, etc.

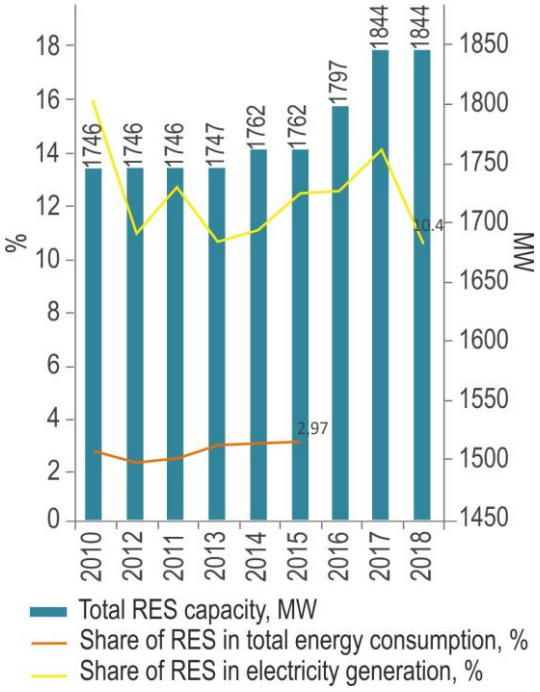

Figure 1.13 *Share of RES in total energy consumption and electricity generation* [1]

In accordance with the country's long-term development plans, it is planned to increase the share of electricity production using renewable energy sources to a level of at least 25% by 2030. To achieve the target indicators, it is planned to build about 10 GW of new renewable energy facilities, including 5 GW solar, 3 GW wind and 1,9 GW hydroelectric power plants.[41],[42] The development of hydropower in the republic follows the path of realizing the potential of small rivers, irrigation canals, reservoirs, watercourses.

[38] https://pubdocs.worldbank.org/en/615901492520591351/Uzbekistan-Wind-Power-ru.pdf
[39] http://renewnews.ru/uzbekistan/
[40] http://stat.uz
[41] PP No.4422 of 22.08.2019 «On accelerated measures to improve the energy efficiency of economic and social sectors, the introduction of energy-saving technologies and the development of renewable energy sources».
[42] PP No.4477 of 4.10.2019 «On approval of the strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019 - 2030».

The industry includes a large machine-building complex, metallurgical plants for the production of ferrous and non-ferrous metals, factories for the production of cars and buses, large chemical enterprises for the production of mineral fertilizers, cement plants, a diversified industrial complex of light industry (ginning, cotton and silk industries), medium and small enterprises for processing of fruits and vegetables and the production of food products. Nowadays, 70.6 thousand industrial enterprises operate in the republic.

The country's economic priorities are: technical and technological renewal of the production of industries; introduction of energy-saving technologies for production and processing; development of the chemical and light industries, the construction materials industry.

The main sources of GHG emissions from the industrial sector are cement production, ammonia and nitric acid production.

Construction materials industry. As of 2018, there are five large and several small cement plants in the country with a total capacity of 8.5 mln t. The largest of them are OJSC "Kyzylkumcement" with a capacity of 3.1 mln t and OJSC "Akhangarancement" with a capacity of 1.7 mln t.

According to the Association "Uzpromstroymaterialy", cement occupies a significant share (76%) in the total production of construction materials in Uzbekistan. During 2014-2017, the volume of cement production increased by 19%. In the next five years, Uzbekistan plans to increase the volume of cement production to 17 mln t/year, for which several new large cement plants will be built[43].

Cement clinker is produced at six enterprises from local mineral raw materials - limestone, loess, kaolin clay, iron-containing additives.

The production of lime and the use of carbonate in the industry is also a source of carbon dioxide emissions, although not as significant. Lime is produced at four enterprises of the republic by decarbonization of limestone.

The chemical industry enterprises of Uzbekistan are united into the "Uzkimyosanoat" Joint Stock Company. Enterprises in this industry produce mineral fertilizers, organic and inorganic substances, artificial fibers, polymeric materials, chemical reagents for the energy, gold mining, chemical industries, and chemical products for plant protection. The raw materials of this industry are natural gas, oil, coal, sulfur, ozokerite, table salt, various non-ferrous metallurgy wastes, raw cotton processing products, etc. Ammonia and weak nitric acid are produced at three large enterprises of "Uzkimyosanoat" JSC: JSC "Maxam Chirchik", JSC "Navoiazot" and JSC "Ferganaazot".

1.10 TRANSPORT

Uzbekistan has a developed transport complex, which includes road, rail, air and pipeline modes of transport. As of January 1, 2020, 15,360 enterprises and organizations are involved in the transport sector. The Republic of Uzbekistan has the highest density of road networks in Central Asia - 41 km per 100 km^2. The total length of the republic's road network is 184 thousand km, including 42.7 thousand km of public highways.

The length of public railways is 4,641.9 km. The total length of electrified sections is 3,728.6 km, the operational length of electrified sections is 1,646.0 km, including high-speed sections - 718.6 km.[44]

The total length of main pipelines is 13,895.7 km, of which 13,779.2 km are gas pipelines, 116.5 km are oil pipelines (as of 2018).

The national airline JSC "Uzbekistan Airways" carries out international air transportation to dozens of countries around the world, and also operates domestic airlines.

[43] Environmental Performance Review. Uzbekistan. Third review. UNECE, Geneva, 2019 - 539 p.
[44] Economic Review No. 10, 2020.

The largest volumes of GHG emissions are produced by road and pipeline transport means. The main measures taken by the government to reduce GHG emissions include: renewal of the fleet of cars, railway locomotives, aircraft; improving the quality of motor fuel; use of alternative fuels (liquefied petroleum and compressed natural gas); transfer of individual sections of the railway to electric traction.[45]

In the country as a whole, more than 1.6 mln vehicles or 62% of their total number are operated on gas fuel, including more than 970 thousand units of vehicles using compressed natural gas. In 2017 alone, over 35 thousand vehicles were converted to gas fuel.

To reduce emissions of pollutants, a phased production of motor fuel of ecological classes Euro-3 Euro-5 for the period until 2023 for all categories of vehicles is envisaged. In the free economic zone "Kokand", together with the "Silk Road Company" (China), a plant for the assembly of electric vehicles is being built. The total cost of the project is $ 30 mln. Currently, 500 electric vehicles have been purchased for the development of a taxi service in Tashkent. The government has set a zero import customs duty rate for electric vehicles.[46]

The programs for the construction and reconstruction of public highways of international and national importance carried out in the republic also make a certain contribution to the reduction of GHG emissions[47].

1.11 AGRICULTURE

The agricultural sector remains one of the leading sectors of the economy of Uzbekistan. In 2019, the contribution of agriculture, forestry and fishery to the GDP of Uzbekistan amounted to 28.0%. Agriculture is one of the largest sources of income for the rural population, accounting for about 60% of the total population. From 2010 to 2017, the share of agriculture (including forestry and fishery) in employment was about 27% each year, which indicates the critical role of this industry in the labor market.

In recent years, there has been an increase in the annual volume of agricultural production: in 2014 by 7%, in 2015 and 2016 by 6.8%, and in 2017 by 2%.[48] This was mainly due to increased productivity, even with a reduction in sown areas.

Agriculture in Uzbekistan is an example of progressive sector modernization (including crop diversification, a move-away from cotton monoculture, rehabilitation of saline irrigated land and agricultural mechanization). The country is gradually moving from the production of raw agricultural products to the processes of adding value as a result of its processing. Small (dehkan) farms occupy less than 10% of the land, but produce about 70% of the total production through horticulture and animal husbandry.

Agriculture is the second largest source of GHG emissions in Uzbekistan after the Energy sector. So, according to the inventory of greenhouse gases for the period 2010-2016, the bulk of GHG emissions in the agriculture sector (50.6%) falls on the share of intestinal fermentation - and the use of synthetic fertilizers (16%), since irrigated agriculture requires intensive use of mineral fertilizers.

1.12 SOLID WASTE MANAGEMENT

Solid waste management activities in the country are coordinated by the State Committee for Ecology and Environmental Protection. Currently, the population's access to services for the collection and removal of solid waste

[45] PKM No.142 of 27.05.2013 "On approval of the program of action for environmental protection".
[46] PP No.3818 of 29.06.2018 "On measures to further streamline foreign economic activity and improve the system of customs and tariff regulation of the Republic of Uzbekistan".
[47] PKM No.142 of 27.05.2013 "On approval of the Action Program for Environmental Protection for 2013-2017".
[48] Environmental Performance Review. Uzbekistan. Third review. UNECE, Geneva, 2019. – 539 p.

(SW) is provided mainly in large cities of the country. According to statistics, the annual volume of waste in the republic is 114.7 mln t.

The country has 296 landfills for burial and waste disposal, including for solid waste (221), industrial waste (16), construction waste (4), sludge collectors (21), tailing dumps (15), special landfills (19), and also 23 landfills for the disposal of hazardous waste, there is a mechanism for the collection and removal of mixed solid waste.

The procurement of recyclable materials is carried out by private enterprises and is unregulated. The procurement process covers only highly liquid types of recyclable materials (paper, plastic, scrap metal). In recent years, clusters for collection, removal, transportation, sorting, utilization, processing and disposal of solid waste have been created in 9 cities of the country. Work is underway to close, recultivate old and build new landfills that meet modern technical and sanitary requirements, equipped with systems for capturing and utilizing landfill gas.

Adopted in 2019, Solid Waste Management Strategy 2019-2028[49] is focused on the development of a nationwide system for the collection and disposal of household waste and the allocation of funds necessary for its implementation. The Strategy defines a number of target indicators, incl. to bring by 2028 the coverage of the population with services for the collection and removal of waste to 100%, and the level of processing of solid waste to 60%.

1.13 INSTITUTIONAL CIRCUMSTANCES RELATED TO THE PREPARATION OF NATIONAL COMMUNICATIONS ON A CONTINUOUS BASIS

The Republic of Uzbekistan signed the UNFCCC in 1993, ratified the Kyoto Protocol in 1999.

In 2015, the Paris Climate Agreement was adopted (entered into force on October 4, 2016), according to which the participating countries form their Nationally Determined Contributions (NDC) to achieve the global goal - "to keep the growth of the global average temperatures well below 2°C above pre-industrial levels and make efforts to limit temperature rise to 1.5°C".[50] The NDC should be updated once every 5 years, the Agreement does not provide for a mechanism of coercion of countries either in relation to the declaration of the NDC, or in the obligation to achieve them.

Uzbekistan signed the Paris Agreement on 19.04.2017, ratified it on 02.10.2018.[51] The NDC of Uzbekistan implies a reduction in the negative impact on the climate in the form of a 10% reduction in specific emissions per unit of GDP by 2030 compared to the 2010 level.[51]

In order to implement the NDC, a number of legal acts were adopted:

- National goals and objectives in the field of sustainable development until 2030.[52] The indicator "CO_2 emissions per unit of value added" is the indicator 9.4.1 of the implementation of the National SDGs until 2030 and is included in the Voluntary National Survey of Uzbekistan on Progress in the SDGs.
- The strategy for the transition to a "green" economy for 2019-2030[53] involves: a) reduction of specific emissions per unit of GDP by 10% from the level of 2010; b) a twofold increase in the energy efficiency indicator and a decrease in the carbon intensity of GDP; c) development of renewable energy sources with bringing their share to 25% or more of the total volume of electricity generation;

[49] PP No.4291 of 17.04.2019 "On approval of the strategy for the management of solid waste in the Republic of Uzbekistan for the period 2019-2028".
[50] https://unfccc.int/ru/peregovornyy-process-i-vstrechi/parizhskoe-soglashenie/chto-takoe-parizhskoe-soglashenie
[51] ZRU No.491 of 02.10.2018 "On the Ratification of the Paris Agreement (Paris, December 12, 2015)"
[52] PKM No.841 of 20.10.2018 "On measures to implement national goals and objectives in the field of sustainable development for the period up to 2030".
[53] PKM No.4477 of 04.10.2019 "On approval of the Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period of 2019-2030".

- Strategy for the development of agriculture for 2020-2030[54] involves: a) reduction of water use per 1 ha of irrigated area by 20% until 2030; b) reduction of greenhouse gas emissions of agricultural origin by 50%.
- The concept of environmental protection until 2030[55] contains measures to: a) transfer 80% of public transport to gas fuel and electric traction; b) increase the territory of the forest fund to 4.5 mln hectares; c) increase the coverage of the population with services for the collection and removal of solid waste (SW) up to 100%; e) increase in the volume of solid waste processing up to 65%.

Biennial Updates and National Communications are the basis for transparency and support for climate change mitigation and adaptation.

Issues related to the preparation of National Communications and GHG Emission Inventories (Articles 4, 12 of the UNFCCC) are regulated by the current legislation of the Republic of Uzbekistan:

- Law "On the Ratification of the Paris Agreement (Paris, December 12, 2015)" No. 491 of 02.10.2018.
- Resolution of the President of the Republic of Uzbekistan No. PP-4896 of 11.17.2020 "On measures to further improve the activities of the Center for the Hydrometeorological Service of the Republic of Uzbekistan."
- Resolution of the President of the Republic of Uzbekistan No. PP-4796 of 03.08.2020 "On measures to further improve and develop the national system of statistics of the Republic of Uzbekistan".

The institutional framework for addressing climate change issues includes a wide range of ministries and agencies (Annex 1).

By the decision of the Government, the Center for the Hydrometeorological Service of the Republic of Uzbekistan (Uzhydromet) was appointed as the responsible organization for coordinating and ensuring the fulfillment of obligations under the UNFCCC[56]. The National Secretariat of the UNFCCC operates in Uzhydromet. The National Coordinator of the UNFCCC in Uzbekistan is the Deputy Director General of Uzhydromet. There is an Information Center on Climate Change under Uzhydromet, which is regularly updated with materials from the Conference of the Parties, IPCC Assessment Reports, methodological and technical guidelines, scientific publications.

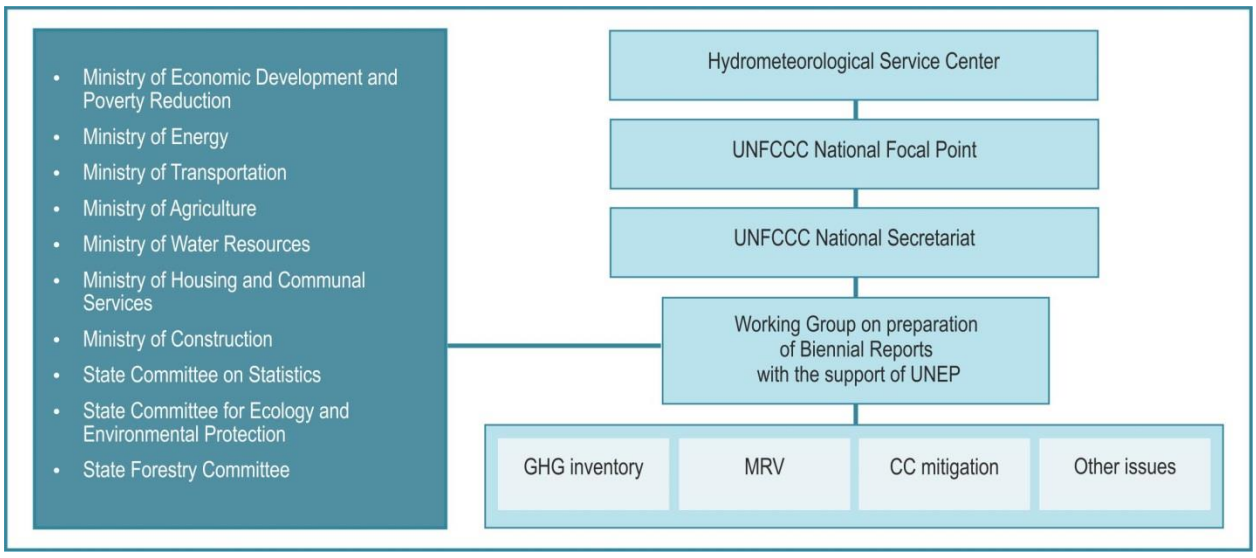

Figure 1.14 *Scheme of the institutional structure for the preparation of FNC and FBUR*

[54] UP No.5853 of 23.10.2019 "On approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030".
[55] UP No.5863 of 30.10.2019 "On approval of the Concept of environmental protection of the Republic of Uzbekistan until 2030".
[56] PP No.4477 of 4.10.2019 «On approval of the strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019 - 2030».

The functions of Uzhydromet include the preparation of National Communications of the Republic of Uzbekistan under the UNFCCC, Reports on the Inventory of Sources of Anthropogenic GHG Emissions and Sinks, and Biennial Reports on updated data. For this, technical expert groups have been formed in all areas of activity related to climate change. It should be noted that in the process of preparing previous National Communications, positive experience has been accumulated, demonstrating the work of stable groups of experts and established interagency ties. Fig. 1.14 shows a diagram of the current institutional structure for the preparation of FNC and FBUR.

Cooperation with international organizations, such as the United Nations Environment Program (UNEP), the Representative Office United Nations in Uzbekistan (UNDP), Global Environment Facility (GEF), Green Climate Fund (GCF), Food and Agriculture Organization (FAO), German Society for International Cooperation (GIZ), French Development Agency (AFD), World Bank, Asian Development Bank, etc., makes a great contribution to increasing expert potential, providing financial, advisory and technical support for the implementation of obligations under the UNFCCC, implementation of projects in the field of climate change and environmental protection.

2 INVENTORY OF GREENHOUSE GASES

2.1 GENERAL GREENHOUSE GAS INVENTORY INFORMATION

The First Biennial Update Report of the Republic of Uzbekistan provides information on greenhouse gas emissions for 2013-2017, as well as updated estimates of emissions for the period of 1990-2012.

Inventory for the period 1990-2017 was prepared in accordance with the requirements of the 2006 IPCC Guidelines for National Inventories. The inventory includes emissions and removals of four greenhouse gases - carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and hydrofluorocarbons (HFCs).

In accordance with the 2006 IPCC Guidelines, the inventory was carried out for the following sectors:

- "Energy";
- "Industrial processes and product use" (IPPU);
- "Agriculture, forestry and other land use" (AFOLU);
- "Waste".

In comparison with the inventory of greenhouse gases submitted under the Third National Communication, the following improvements were made during the preparation of the current report:

- A transition was conducted from the methodologies of the "Revised Guidelines for the Preparation of National Greenhouse Gas Inventories of the IPCC, 1996" to the methodologies of the "Guidelines for National Greenhouse Gas Inventories of the IPCC, 2006" (hereinafter - the IPCC Guidelines, 2006) for all sectors;
- Calculations of greenhouse gas emissions were mainly carried out using the IPCC 2006 Software. For certain categories, calculations were carried out using supplementary Excel tables based on tables in the Appendices to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories;
- Values of national emission factors in key categories of the inventory have been updated.

Estimates of CH_4, N_2O, HFCs emissions were converted to CO_2-equivalent units using their global warming potentials (GWP), the values of which are presented in the IPCC Fourth Assessment Report on Climate Change (Table 2.1).

Table 2.1 *Global Warming Potentials Used in Preparing GHG Inventories*

Greenhouse gas	GWP	Greenhouse gas	GWP
CO_2	1	HFC-125	3500
CH_4	25	HFC-134a	1430
N_2O	298	HFC-152a	124
HFC-32	675	HFC-143a	4470

This GHG inventory has been prepared in accordance with the following principles:

- using the methodologies and structure of the IPCC Guidelines, 2006;
- prioritizing the use of national data and emission factors;
- use in the work of all existing sources of information, including international databases.

When preparing the inventory, the highest priority was given to the assessment of emissions of gases - CO_2, CH_4 and N_2O in key categories, as well as hydrofluorocarbons (HFCs).

Estimates of GHG emissions were carried out mainly using Tier 1 methodologies and, in some categories, - Tier 2. National emission factors were applied, as far as possible, in key categories to obtain more accurate estimates of emissions.

Tier 2 methodologies (taking into account national plant-level emission factors) have been applied to estimate emissions in the following key categories:

- in the "Energy" sector, the "Fugitive emissions from fuels" subsector in the "Natural gas" category;
- in the sector "Industrial processes and product use" in the categories "Ammonia production", "Nitric acid production" and "Cement production";
- in the "Waste" sector, in the category "Disposal of solid waste in landfills";
- in the "Agriculture, forestry and other land use" (AFOLU) sector, in the category "Forest land remaining forest land".

Other inventory categories were estimated using Tier 1 methodologies of the 2006 IPCC Guidelines, default emission factors and national activity data.

2.1.1 Institutional structure for preparation a GHG inventory

For the preparation of the GHG inventory in the country, a stable institutional structure has been created with the coordination role of the Center of the Hydrometeorological Service of the Republic of Uzbekistan. The activity data necessary for preparation of the inventory was provided by the State Statistics Committee, as well as key ministries and agencies of Uzbekistan (Fig. 2.1).

Experts from key ministries and agencies were involved in the preparation of the inventory, including the development of national emission factors.

In some categories, expert judgments were used, as well as information from international statistical databases: International Energy Agency (IEA), Food and Agriculture Organization of the United Nations (FAO).

Issues related to the implementation of the provisions of Articles 4 and 12 of the UNFCCC regarding GHG emission inventories are regulated by the current legislation of the Republic of Uzbekistan:

- Law of the Republic of Uzbekistan No. ZRU-491 of 2.10.2018 "On the ratification of the Paris Agreement";
- Decree of the President of the Republic of Uzbekistan No. PP-4896 of 11/17/2020 "On measures to further improve the activities of the Center of the Hydrometeorological Service of the Republic of Uzbekistan";
- Decree of the President of the Republic of Uzbekistan No. PP-4796 of 03.08.2020 "On measures to further improve and develop the national system of statistics of the Republic of Uzbekistan."

The formation of a stable team of experts with the coordination role of Uzhydromet allows to preserve the "institutional memory" and ensure the continuity and quality of the preparation of the GHG inventory. Uzhydromet has created and maintains databases and archives of GHG inventory, both on paper and in electronic format.

In accordance with the recommendations of the 2006 IPCC Guidelines, quality control is carried out at all stages of the GHG inventory preparation. GHG emission reports are subject to quality assessment and approval by all involved ministries and agencies. Then, according to the approved regulations, an international expert assessment is carried out by the UNFCCC bodies.

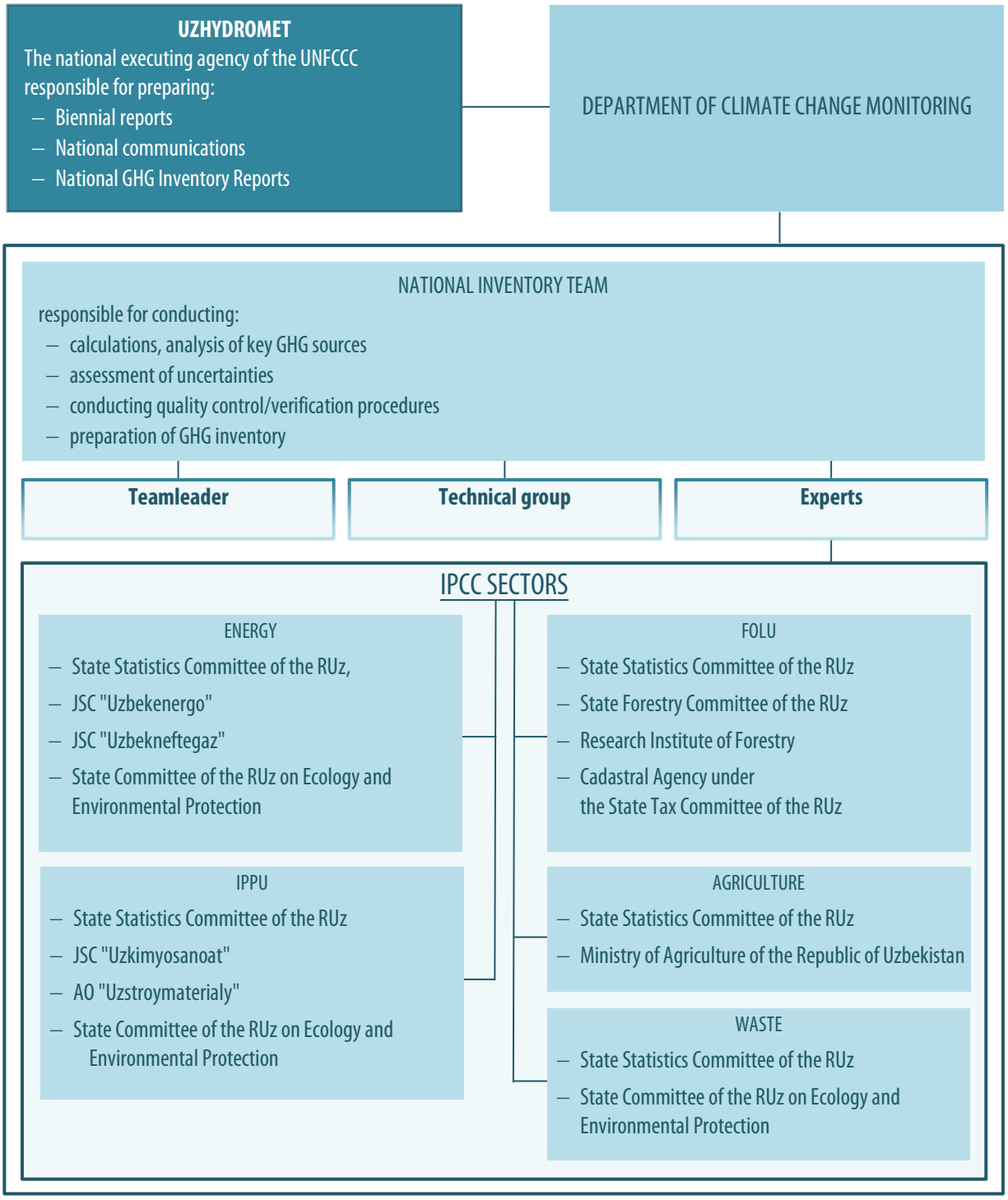

Figure 2.1 Organizational structure of the National Inventory System

2.1.2 Emission estimation methodologies

The methodologies of the IPCC Guidelines 2006 were used to estimate greenhouse gas emissions in the current inventory. In most cases, default emission factors were used in the calculations. National factors were used to estimate emissions in key categories where possible.

Sources of activity data, the types of emission factors used and the level of methodologies used to estimate emissions in the current greenhouse gas inventory are presented in Annex 2.

2.2 TOTAL GREENHOUSE GAS EMISSIONS INFORMATION

2.2.1 Total GHG emissions for selected gases

The total greenhouse gas emissions of the Republic of Uzbekistan in 2017 amounted to 189.2 mln t CO_2-eq (excluding CO_2 removals in the Forestry and Other Land Use (FOLU)) and 180.6 mln t CO_2-eq, taking into account CO_2 removals.

Over the period 1990–2017, GHG emissions increased by 6.7%, and in 2013–2017 they slightly decreased - by 0.6% (Table 2.2, Fig. 2.2).

The largest share of emissions in the country falls on carbon dioxide, its contribution to the total emissions amounted to 53.6% in 2017. Methane accounted for 38.6%, nitrous oxide - 7.6% and hydrofluorocarbons - 0.2%.

Over the period 1990-2017, noticeable changes took place in the structure of GHG emissions, which led to:

- reducing the share of carbon dioxide in emissions by 9.4% (from 63.0% to 53.6%);
- increasing the share of nitrous oxide by 2.3% (from 5.3% to 7.6%);
- increasing the share of methane by 6.9% (from 31.7% to 38.6%).

The decrease in CO_2 emissions was mainly due to the implementation of mitigation measures in the energy sector.

The share of methane in total GHG emissions increased relative to 1990 due to the growth of emissions from the oil and gas industry and the development of livestock breeding.

The growth in N_2O emissions is facilitated by the growing number of livestock and the intensive use of synthetic nitrogen fertilizers.

The most significant change was observed in the emissions of hydrofluorocarbons (since 2000 they have increased by 243 times). If in 2000 their contribution was about 0.01% of total emissions, then in 2017 it reached 0.17%. This is due to the high growth rates of refrigerant consumption in the country for the needs of air conditioning and refrigeration.

The distribution of GHG emissions by inventory

Table 2.2. *Greenhouse gas emissions for selected gases, mln t CO_2-eq*

Year	CO_2	CH_4	N_2O	HFCs	Total
1990	111.7	56.3	9.4	-	177.4
2000	111.0	89.7	7.7	0.001	208.5
2010	103.4	84.5	12.0	0.02	199.9
2011	106.6	83.0	12.4	0.03	202.0
2012	106.8	83.2	12.6	0.04	202.7
2013	96.7	80.6	12.9	0.05	190.3
2014	99.7	79.6	13.6	0.06	192.9
2015	95.9	74.9	14.5	0.09	185.3
2016	95.4	72.9	14.4	0.17	182.8
2017	101.4	73.1	14.4	0.27	189.2
Trend					
$\Delta_{(1990\text{-}2017)}$	-9.2%	29.9%	52.3%	-	6.7%
$\Delta_{(2013\text{-}2017)}$	4.9%	-9.3%	11.2%	464.1%	-0.6%
Contribution					
1990	63.0	31.7%	5.3%	-	100.0%
2013	50.8%	42.4%	6.8%	0.0%	100.0%
2017	53.6%	38.6%	7.6%	0.2%	100.0%

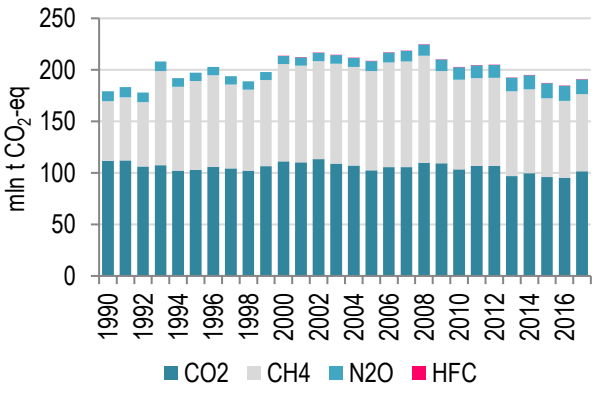

Figure 2.2 *Total GHG emissions in Uzbekistan*

sectors is presented (excluding the FOLU sector) in Fig. 2.3. Sources of **carbon dioxide** emissions are concentrated in the Energy sector (93%) and the Industrial Processes and Product Use (IPPU) sector (7%). **Methane** emissions are distributed across the Energy (69%), Agriculture (28%) and Waste (3%) sectors. The majority of **nitrous oxide** emissions are from the Agriculture sector (87%), 10% from the IPPU sector, 2% from the Energy sector and 1% from the Waste sector.

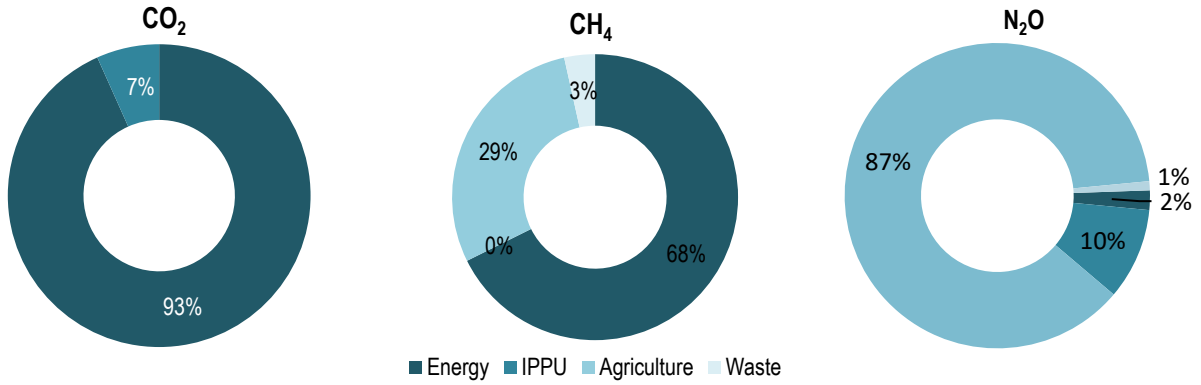

Figure 2.3 *Distribution of GHG emissions by types of gases and sectors of the inventory (excluding the FOLU sector)*

The trends observed in recent years to reduce GHG emissions are associated with the implementation of measures and actions taken within the framework of the following government strategies and programs aimed at improving energy efficiency, energy and fuel saving in the energy sector, industry, residential sector, in transport, as well as the introduction of new energy saving technologies:

- "Action strategies for five priority areas of development of the Republic of Uzbekistan in 2017-2021" and annual programs of measures for its implementation, UP No4947 of 02.07.2017;
- The program of measures to ensure structural changes, modernization and diversification of production for 2015-2019 (PP No4707 of 03.04.2015);
- The Program of Measures to Reduce Energy Intensity, Implementation of Energy-Saving Technologies in the Sectors of the Economy and Social Sphere for 2015-2019 (PP No2343 dated 05.05.2015);
- The Program of Measures for Accelerated Development and Ensuring Financial Sustainability of the Electricity Industry in 2018-2020 (PP No3981 of 23.10.2018);
- The Program of Measures for the Cardinal Improvement and Development of the Waste Management System for 2017 - 2021 (PP No2916 of 21.04.2017);
- Comprehensive program of measures to mitigate the consequences of the Aral Sea disaster, recovery and socio-economic development of the Aral Sea region for 2015-2018 (PKM No255 of 08.29.2015).

GHG emissions per capita

GHG emissions per capita for the period from **1990 to 2017 decreased** (Fig. 2.4) including:

- total emission from 8.6 to 5.8 t CO_2-eq./person;
- CO_2 emission from 5.4 to 3.1 t/person;

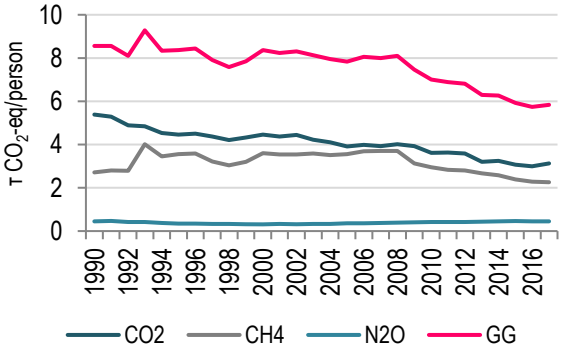

Figure 2.4 *Dynamics of GHG emissions per capita*

– CH_4 emission from 2.7 to 2.3 t CO_2-eq./person;

– N_2O emission from 0.46 to 0.44 t CO_2eq./person.

The decrease in GHG emissions per capita is due to both the absolute decrease in GHG emissions over the past five years, and the stable growth rates of the population in the country (on average 1.6% per year).

2.3 ESTIMATION OF GHG EMISSIONS BY SECTORS

Distribution of GHG emissions by inventory sectors from 1990 to 2017 presented in Table 2.3 and Fig. 2.5.

The largest contribution to GHG emissions is made by the Energy sector (76.3%). The Industrial Processes and Product Use (IPPU) sector accounts for 4.5%, the Agriculture sector - 17.8%, Waste - 1.4%.

Since 1990, there has been a tendency towards a decrease in the contribution to the total emission of the Energy sector (from 85.5% to 76.3%) and an increase in the share of the Agriculture sector (from 8.5% to 17.8%).

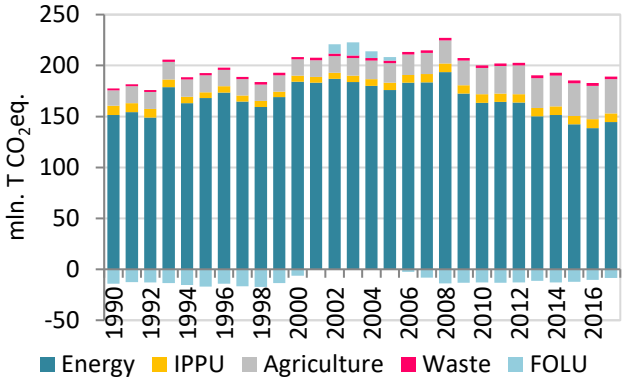

Figure 2.5 *Trends in GHG emissions by sector, mln t CO_2-eq*

Table 2.3. *GHG emissions by inventory sector, mln t CO_2-eq*

Year	Energy	IPPU	Agriculture	Waste	Total emissions	FOLU	Net emission
1990	151.6	8.8	15.1	1.9	177.4	-14.1	163.3
2000	184.2	5.9	16.0	2.4	208.5	-6.4	202.1
2010	163.4	8.4	25.7	2.6	200.1	-12.9	187.1
2011	164.3	8.2	26.9	2.6	202.0	-13.3	188.6
2012	163.8	8.2	28.1	2.6	202.7	-12.9	189.8
2013	150.2	8.2	29.2	2.7	190.3	-11.3	179.0
2014	151.3	8.6	30.3	2.7	192.9	-13.0	179.8
2015	142.2	8.4	32.0	2.7	185.3	-12.2	173.1
2016	138.7	8.6	32.9	2.7	182.8	-10.5	172.3
2017	144.4	8.5	33.7	2.7	189.2	-8.6	180.6
Trend							
$\Delta_{(1990\text{-}2017)}$	-4.7%	-3.8%	122.3%	43.3%	6.7%	38.6%	10.6%
$\Delta_{(2013\text{-}2017)}$	-3.9%	3.5%	15.2%	0.3%	-0.6%	23.8%	0.9%
Contribution							
1990	85.5%	5.0%	8.5%	1.1%	100.0%		
2013	78.9%	4.3%	15.3%	1.4%	100.0%		
2017	76.3%	4.5%	17.8%	1.4%	100.0%		

The growing role of the Agriculture sector in total emissions is associated with an increase in livestock numbers and an increase in the use of nitrogen fertilizers.

The contribution to the total emissions of the IPPU and Waste sectors has slightly changed since 1990.

In the sector "FOLU" for 1990-2017, there were changes in the absorption and emissions of carbon dioxide. CO_2 removals were observed during the periods 1990-2000 and 2006-2017. In 2002-2005, absorptions were replaced by emissions. The transition from CO_2 absorption to emissions is associated with a reduction in the areas of pastures and areas under rice crops. The transition from CO_2 emissions to absorptions in the period 2006-2017 is associated with activities to expand forest plantations on the drained bottom of the Aral Sea, in the Bukhara and Navoi regions, which is carried out within the framework of international projects and state programs on overcoming the Aral Sea disaster.

2.3.1 Energy Sector

The Energy Sector is the largest source of GHG emissions in Uzbekistan. Its contribution to the total emissions is **76.3%** (2017). Over the past five years, there has been a trend towards a significant decrease in GHG emissions in the sector (Table 2.4).

Table 2.4. *Greenhouse Gas Emissions in the Energy Sector, mln t CO_2-eq*

Year	CO_2	CH_4	N_2O	Total
1990	104.9	46.1	0.6	151.6
2000	106.4	77.5	0.3	184.2
2010	96.7	66.4	0.3	163.4
2011	100.1	63.9	0.3	164.3
2012	100.4	63.2	0.3	163.8
2013	90.1	59.9	0.3	150.2
2014	92.8	58.2	0.3	151.3
2015	89.2	52.8	0.3	142.2
2016	88.5	49.9	0.3	138.7
2017	94.6	49.5	0.3	144.4
Trend				
$\Delta_{(1990\text{-}2017)}$	-9.8%	7.2%	-47.3%	-4.7%
$\Delta_{(2013\text{-}2017)}$	5.1%	-17.4%	8.1%	-3.9%
Contribution				
1990	69.2%	30.4%	0.4%	100.0%
2013	59.9%	39.9%	0.2%	100.0%
2017	65.5%	34.3%	0.2%	100.0%

By 2017, GHG emissions decreased by **4.7%** compared to the 1990 level and amounted to **144.4 mln t CO_2-eq**, including for the period. 2013-2017 by **4%**. This is due to the systematic elimination of natural gas leaks in the oil and gas industry, as well as to improvement of energy efficiency in all industries.

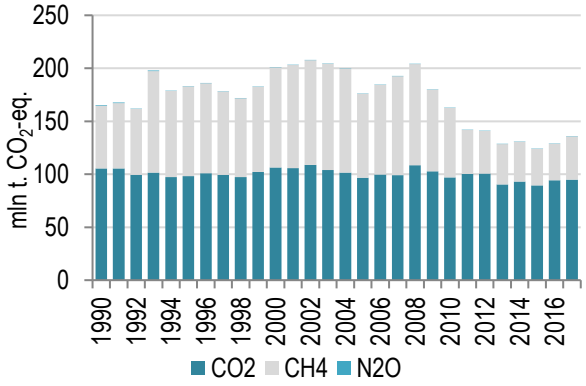

Figure 2.6 *Changes in the structure of GHG emissions in the Energy sector*

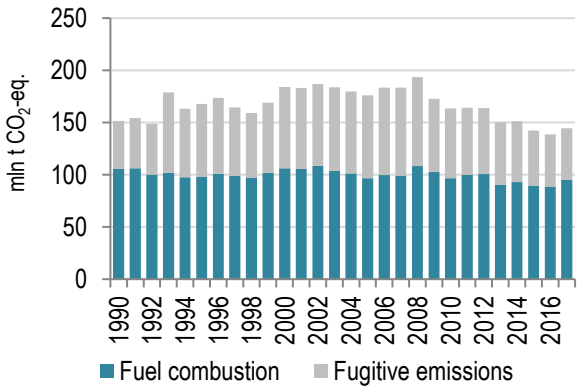

Figure 2.7 *Trends in fugitive GHG emissions and emissions from fuel combustion activities in the Energy Sector*

The main contributors to sectoral emissions are carbon dioxide and methane. In 2017, the share of carbon dioxide emissions accounted for 65.5%; methane - 34.3%, nitrous oxide - 0.2%. Figure 2.6 shows the dynamics of GHG emissions in the sector for the period 1990-2017.

The Energy sector comprises two broad categories:

- Fuel combustion activities;
- Fugitive emissions from fuels.

In 2017, GHG emissions from fuel combustion accounted for 65.8% of emissions in the sector, fugitive GHG emissions from the oil and gas industry and coal mining – 34.2% (Fig. 2.7).

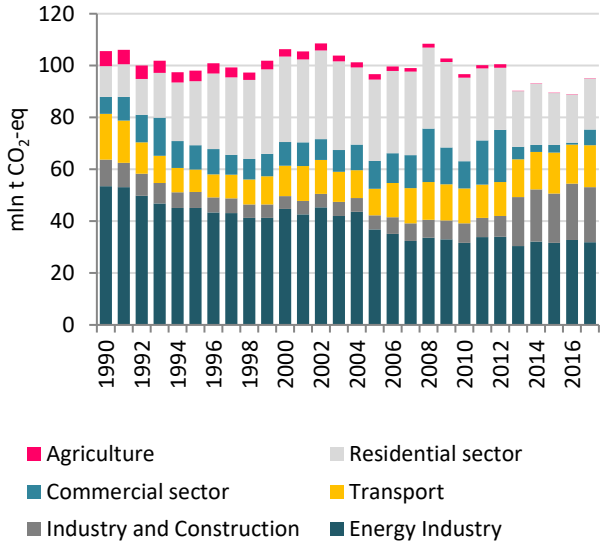

Figure 2.8 *GHG emissions from fuel combustion activities by category*

Fuel combustion activities Category. The main type of fuel used in the sectors of the economy of Uzbekistan is natural gas. According to statistics, in 2017 the share of consumption of natural gas accounted for about 76.7%, oil products - 13.0%, coal - 10.3%.

In the total GHG emissions from fuel combustion, carbon dioxide accounts for 99.3%, methane - 0.4%, and nitrous oxide - 0.3%.

The contribution of individual categories to emissions from *fuel combustion activities* is shown in Fig. 2.8 and Table 2.5.

The largest contribution to GHG emissions from fuel combustion is made by energy industry (33.6%), industry and construction (22.3%), the residential sector (20.7%) and transport (16.9%).

The most noticeable decrease in emissions from fuel combustion since 1990 has been observed in the energy sector and agriculture. The decrease in GHG emissions from energy production is explained by the replacement of solid and liquid fuels with natural gas, the introduction of modern technologies in energy generation (combined cycle plants). The decrease in emissions from transport is associated with the technical renewal of the fleet, the increased use of gas fuel in vehicles, the electrification of railways, and a reduction in fuel losses. At the same time, in the last 5 years, the growth of emissions from transport amounted to 11% (mainly due to an increase in the number of cars and, consequently, with an increase in fuel consumption).

In agriculture, the reduction in emissions is mainly associated with the massive replacement of old irrigation pumps with energy efficient ones, as well as with the change in the procedure for keeping statistical records of fuel consumption in the industry after 2012.

Significant growth in emissions in the Industry and Construction category was caused by an increase in production capacity and construction scale, as well as a change in the accounting procedure for small businesses.

The growth of GHG emissions in the "Residential Sector" relative to 1990 is due to population growth, respectively, the growth of housing construction, gasification of rural settlements. At the same time, in 2013-2017, there was a decrease in GHG emissions from this category (by 9%), which is probably due to a change in the procedure for statistical reporting (earlier, before 2012, this category included fuel consumption by small businesses).

Table 2.5. *Greenhouse gas emissions in the category of Fuel combustion activities , mln t CO_2-eq*

Year	Energy industry	Industry and construction	Transport	Commercial sector	Residential sector	Agriculture	Total
1990	54.1	10.2	17.7	6.6	11.8	5.79	106.1
2000	44.7	5.0	11.7	9.1	33.0	2.79	106.3
2010	31.6	7.6	13.4	10.5	32.2	1.44	96.8
2011	33.9	7.4	12.7	17.1	27.7	1.33	100.2
2012	34.0	8.1	13.1	20.1	24.0	1.35	100.6
2013	30.4	19.0	14.5	4.8	21.6	0.09	90.3
2014	32.1	20.2	14.4	2.7	23.6	0.08	93.1
2015	31.7	19.0	15.7	3.0	20.0	0.06	89.5
2016	32.7	21.7	15.2	6.2	18.6	0.06	94.4
2017	31.9	21.2	16.1	6.1	19.6	0.05	95.0
Trend							
$\Delta_{(1990\text{-}2017)}$	-40.9%	107.6%	-8.8%	-7.5%	66.5%	-99.1%	-10.4%
$\Delta_{(2013\text{-}2017)}$	5.2%	11.9%	10.9%	26.6%	-9.0%	-37.4%	5.2%
Contribution							
1990	50.7%	9.7%	16.7%	6.2%	11.2%	5.5%	100.0%
2013	33.6%	21.0%	16.1%	5.3%	23.9%	0.1%	100.0%
2017	33.6%	22.3%	16.9%	6.4%	20.7%	0.1%	100.0%

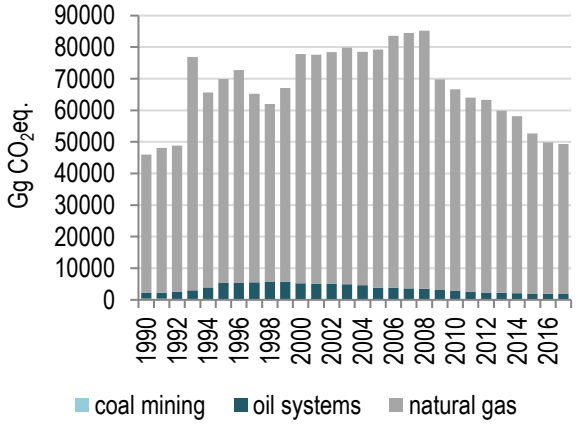

Figure 2.9 *Dynamics of fugitive emissions from fuels in the context of various sources*

Fugitive Fuel Emissions from Fuels Category. The category includes fugitive emissions not associated with combustion processes in the coal mining and oil and gas industries. The main GHG to be accounted for in this category is *methane*, with much lower emissions of *carbon dioxide and nitrous oxide.*

The oil and gas industry is the largest source of GHG emissions in the country. In the category "Fugitive emissions from fuels", the share of emissions associated with natural gas leaks is about 99%. Losses of natural gas are mainly due to corrosion of pipelines and the use of outdated equipment, in particular, valves. The indicators of natural gas losses before 2012 were also influenced by imperfections in the accounting and control system and problems with automation.

Methane leaks from coal and oil production are insignificant, as coal is mainly mined in open pit, and the volume of oil produced is limited.

Fig. 2.9 and Table 2.6 show the dynamics of GHG emissions in the category "Fugitive emissions from fuels" for the period 1990-2017 (the share of GHG emissions from coal mining is not shown in the figure due to their small value relative to other categories).

In 2017, emissions in the Fugitive Fuel Emissions category amounted to **49.4 mln t CO_2-eq**.

Compared to the 1990 level, emissions increased by 7.2%, however, compared to the 2013 level, there was a decrease by 17.6%.

In the period up to 2008, fluctuations in the values of GHG emissions in the category "Natural gas" mainly depended on the volumes of transit gas pumped annually, and a significant decrease in GHG emissions after 2010 is associated with the transition to new technologies in the production, processing and transportation of natural gas, improvement of the system accounting and control of losses, elimination of leaks on main pipelines, including during the implementation of CDM projects.

Table 2.6. *GHG emissions in the category Fugitive emissions from fuels, Gg CO_2-eq.*

Year	CO_2	CH_4	N_2O	Total
1990	240.5	45798.9	1.0	46040.4
2000	510.9	77342.5	2.2	77855.5
2010	394.2	66228.8	1.6	66624.7
2011	371.7	63679.0	1.5	64052.2
2012	354.7	62928.4	1.5	63284.6
2013	337.3	59584.5	1.4	59923.3
2014	314.2	57881.9	1.3	58197.4
2015	300.8	52410.1	1.2	52712.2
2016	296.8	49530.3	1.2	49828.3
2017	300.1	49069.0	1.2	49370.4
Total				
$\Delta_{(1990\text{-}2017)}$	24.8%	7.1%	21.7%	7.2%
$\Delta_{(2013\text{-}2017)}$	-11.0%	-17.6%	-10.4%	-17.6%
Contribution				
1990	0.5%	99.5%	0.0%	100.0%
2013	0.6%	99.4%	0.0%	100.0%
2017	0.6%	99.4%	0.0%	100.0%

2.4 INDUSTRIAL PROCESSES AND PRODUCT USE SECTOR

The Industrial Processes and Product Use (IPPU) sector (Table 2.7 and Fig. 2.10) includes:

- CO_2 emissions from the production of ammonia, cement clinker, lime, steel, zinc, the use of carbonates, lubricants;
- N_2O emissions from nitric acid production;
- CH_4 emissions from acrylonitrile and methanol production;
- emissions of hydrofluorocarbons (HFCs) from the consumption of freons.

In 2017, GHG emissions in the IPPU sector amounted to **8468,1 Gg CO_2-eq.**

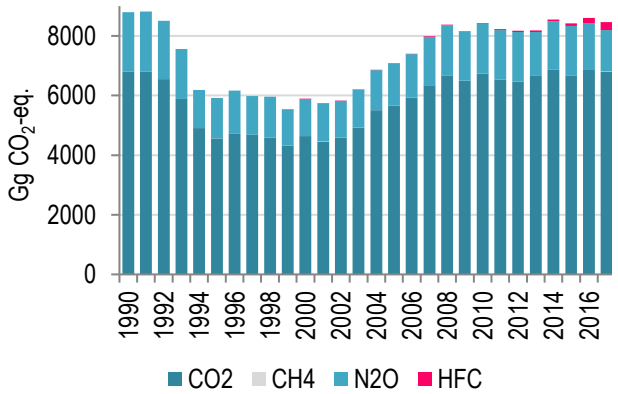

Figure 2.10 *GHG emissions in the Industrial processes and product use sector*

CO_2 emissions account for 80.3%, N_2O - 16.5%, HFCs - 3.2%, the contribution of CH_4 is insignificant (0.005%).

The main sources of CO_2 emissions in the sector are cement production (37%) and ammonia production (28%).

Table 2.7. *GHG emissions in the IPPU sector, Gg CO_2-eq.*

Year	CO_2	CH_4	N_2O	HFC	Total
1990	6797.2	0.1	2003.2	-	8800.4
2000	4640.3	0.2	1246.3	1.1	5887.8
2010	6744.5	0.4	1670.1	19.2	8434.2
2011	6534.6	0.5	1664.3	29.0	8228.4
2012	6475.2	0.5	1652.6	41.0	8169.3
2013	6656.1	0.4	1475.4	47.8	8179.7
2014	6861.0	0.4	1636.2	56.6	8554.1
2015	6684.8	0.3	1645.9	85.7	8416.7
2016	6880.8	0.2	1550.7	171.5	8603.2
2017	6804.3	0.4	1393.7	269.7	8468.1
Trend					
$\Delta_{(1990\text{-}2017)}$	0.1%	491.5%	-30.4%	-	-3.8%
$\Delta_{(2013\text{-}2017)}$	2.2%	11.1%	-5.5%	464.1%	3.5%
Contribution					
1990	77.2%	0.001%	22.8%	-	100.0%
2013	81.4%	0.004%	18.0%	0.6%	100.0%
2017	80.3%	0.005%	16.5%	3.2%	100.0%

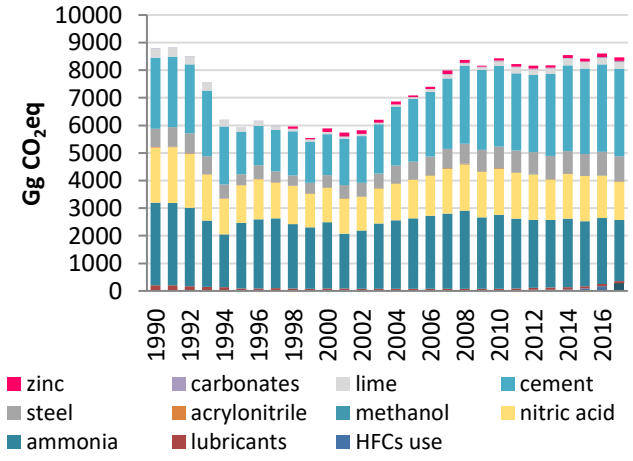

Figure 2.11 *GHG emissions in the Industrial Processes and Product Use sector by source category*

The source of nitrous oxide emissions is the production of nitric acid (16% of emissions in the sector).

Methane emissions are very insignificant, their source is the production of acrylonitrile and methanol.

Reported emissions of hydrofluorocarbons occur when used as refrigerants.

Table 2.8 and Fig. 2.11 show the dynamics of emissions by categories of the IPPU sector for 1990-2017.

During this period, there has been a decrease and stabilization of the total GHG emissions. Compared to the 1990 level, the total emissions in the sector decreased by 3.8%, compared to the level of 2013 - increased by 3.5%.

For HFCs, over the time period provided with statistical data (2000-2017), emissions increased by 243 times.

In Uzbekistan, as elsewhere in the world, HFCs are used as an alternative to ozone-depleting substances, the use of which is regulated by the Montreal Protocol.

There is no production of HFCs in Uzbekistan; the country imports all the incoming amount of HFCs in the form of mixtures of HFC-32, HFC-125, HFC-134a and HFC-143a. At the same time, HFC-125 and HFC-134a blends are used in the largest quantities, their share in the import of HFC blends accounts for 44.3% and 36.5%, respectively.

The growth in HFC consumption in the republic is mainly associated with the creation of additional capacities for the production of household appliances - household refrigerators and various air conditioning systems.

Emissions from the use of HFCs as foaming agents and for fire extinguishing purposes were not included in the current inventory due to lack of activity data. Work is underway to collect the necessary data for the further inclusion of these categories in the inventory.

Table 2.8. *GHG emissions by category in the IPPU sector, Gg $CO_{2\text{-}eq}$.*

Year	Mineral industry	Chemical industry	Metal industry	Use of HFCs	Lubricants use	Total
1990	2925.4	5010.4	661.4	-	203.2	8800.4
2000	1564.2	3674.5	565.0	1.1	83.0	5887.8
2010	3120.0	4378.5	863.1	19.2	53.5	8434.2
2011	3039.8	4218.6	885.0	29.0	55.9	8228.4
2012	3029.7	4122.2	899.8	41.0	76.6	8169.3
2013	3196.0	3932.6	925.6	47.8	77.7	8179.7
2014	3378.5	4120.4	919.1	56.6	79.5	8554.1
2015	3358.0	4008.3	884.0	85.7	80.7	8416.7
2016	3439.2	3941.1	969.0	171.5	82.4	8603.2
2017	3455.5	3617.6	1041.0	269.7	84.2	8468.1
Trend						
$\Delta_{(1990\text{-}2017)}$	18.1%	-27.8%	57.4%	-	-58.6%	-3.8%
$\Delta_{(2013\text{-}2017)}$	8.1%	-8.0%	12.5%	464.1%	8.3%	3.5%
Contribution						
1990	33.2%	56.9%	7.5%	-	2.4%	100.0%
2013	39.1%	48.1%	11.3%	0.6%	0.9%	100.0%
2017	40.8%	42.7%	12.3%	3.2%	1.0%	100.0%

For the period 1990-2017 in the sector, there is a general trend towards a decrease in GHG emissions. The most significant reduction in GHG emissions occurred in the mid-90s, which is associated with a drop in production and overcoming the economic crisis.

Emissions of other greenhouse gases attributed to the IPPU sector, but not accounted for in the current inventory**.** Information on the use of perfluorocarbons is being clarified.

Emissions of sulfur hexafluoride are planned to be estimated in the next inventory. Electrical equipment containing SF_6 is available in the country and is currently under collection of the necessary activity data.

2.5 AGRICULTURE SECTOR

In 2017, the Agriculture sector accounted for **17.8%** of total GHG emissions in Uzbekistan. The sector emissions is **33.7 mln t CO_2-eq**.

The sector has estimated GHG emissions from:

- enteric fermentation of livestock (*methane*);
- emissions from the manure management (*methane and nitrous oxide*);

- from rice cultivation (*methane*);
- emissions from managed soils as a result of the introduction of nitrogen fertilizers and manure, decomposition of plant residues, etc. (*nitrous oxide*).

Methane emissions in the sector account for 62.7%, *nitrous oxide* - 37.3%.

The main source of methane emissions in the sector is the enteric fermentation of livestock (mainly cattle).

The majority of nitrous oxide emissions are related to emissions from managed soils.

The distribution of emissions in the Agriculture sector is presented in Table 2.9 and Fig. 2.12.

In 2017, GHG emissions in the sector increased by 122.3% compared to 1990; in comparison with 2013 - by 15.2%. Intensive growth in GHG emissions is associated with an increase in livestock and the use of nitrogen fertilizers.

Table 2.10 and Fig.2.13 show the distribution of emissions in the Agriculture sector by category. The largest increase in greenhouse gas emissions for the period 1990-2017, especially in the last 10 years, is observed from the enteric fermentation of livestock, due to the increase in its livestock and from managed soils.

Table 2.9. *GHG emissions in the Agriculture sector, Gg CO_2-eq*

Year	CH_4	N_2O	Total
1990	8318.7	6820.5	15139.2
2000	9842.2	6182.0	16024.2
2010	15525.0	9996.4	25521.3
2011	16513.4	10382.4	26895.9
2012	17456.5	10621.5	28077.9
2013	18114.2	11093.7	29207.9
2014	18774.3	11565.9	30340.2
2015	19599.4	12404.6	32004.0
2016	20450.7	12425.6	32876.3
2017	21105.6	12546.7	33652.3
Trends			
$\Delta_{(1990\text{-}2017)}$	153.7%	84.0%	122.3%
$\Delta_{(2013\text{-}2017)}$	16.5%	13.1%	15.2%
Contribution			
1990	54.9%	45.1%	100.0%
2013	62.0%	38.0%	100.0%
2017	62.7%	37.3%	100.0%

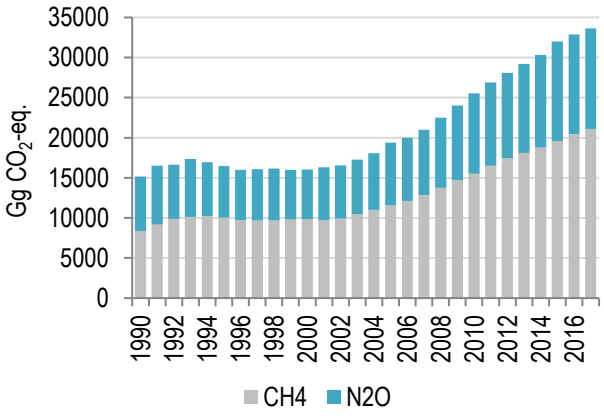

Figure 2.12 *Greenhouse gas emissions in the Agriculture sector*

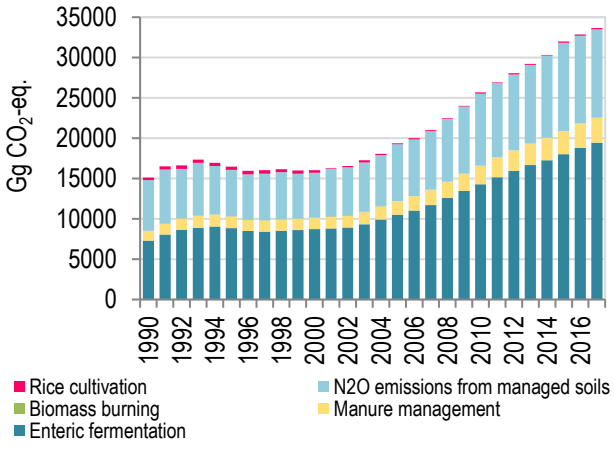

Figure 2.13 *Greenhouse gas emissions in the Agriculture sector by category*

In the category Combustion of biomass, since 2005, GHG emissions have not been calculated due to the introduction in Uzbekistan of a legislative ban on burning stubble of grain crops.

Table 2.10. *Emissions in the Agriculture sector by category, Gg CO_2-eq*

Year	Enteric fermentation	Manure management	Burning biomass	N_2O emissions from managed soils	Rice cultivation	Total
1990	7311.9	1196.2	29.0	6254.6	347.6	15139.2
2000	8724.7	1407.1	46.7	5533.6	312.1	16024.2
2010	14306.1	2295.5	0.0	8919.8	0.0	25521.3
2011	15177.6	2434.2	0.0	9229.4	54.7	26895.9
2012	15956.2	2552.5	0.0	9389.6	179.7	28077.9
2013	16655.3	2659.4	0.0	9787.9	105.3	29207.9
2014	17275.2	2755.4	0.0	10196.5	113.1	30340.2
2015	18012.2	2870.3	0.0	10955.7	165.7	32004.0
2016	18824.5	2998.5	0.0	10883.3	170.0	32876.3
2017	19446.3	3093.8	0.0	10943.4	168.8	33652.3
Trends						
$\Delta_{(1990\text{-}2017)}$	166.0%	158.6%	-	75.0%	-51.4%	122.3%
$\Delta_{(2013\text{-}2017)}$	16.8%	16.3%	-	11.8%	60.3%	15.2%
Contribution						
1990	48.3%	7.9%	0.2%	41.3%	2.3%	100.0%
2013	57.0%	9.1%	0.0%	33.5%	0.4%	100.0%
2017	57.8%	9.2%	0.0%	32.5%	0.5%	100.0%

2.6 FORESTRY AND OTHER LAND USE SECTOR

In the sector "Forestry and other land use" (FOLU), emissions/sinks of carbon dioxide are estimated in the following categories:

- Forest land remaining forest land (change in carbon content in biomass and soils);
- Cropland remaining cropland (change in carbon content in biomass and soils);
- Grassland remaining Grassland (change in soil carbon content, biomass is assumed to be in equilibrium by default).

Estimates of removals/emissions in the sector were

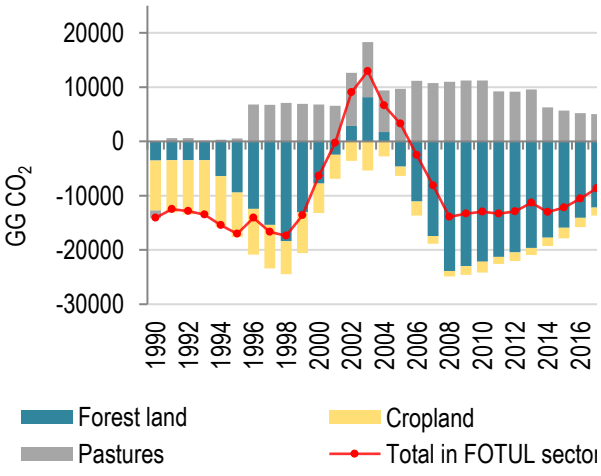

Figure 2.14 *Emissions/sinks in the FOLU sector*

carried out only for lands remaining in the same category due to the lack of information on the areas of land transferred from one category to another.

Estimates of CO_2 emissions/sinks from other categories of the sector, namely: wetlands and settlements, have not been carried out in the current inventory. They are assumed to be small. Currently, information is being collected on these categories.

Table 2.11. *Emissions/sinks in the sector Forestry and other land use by category, Gg CO_2*

Year	Forest land	Pastures	Cropland	Total
1990	-3517.7	-1339.2	-9207.3	-14064.2
2000	-7782.3	6811.1	-5411.1	-6382.4
2010	-22147.9	11200.4	-2002.1	-12949.6
2011	-21297.4	-1267.5	9223.6	-13341.3
2012	-20447.0	-1608.7	9174.4	-12881.3
2013	-19596.6	9584.2	-1313.7	-11326.1
2014	-17749.4	6245.1	-1525.5	-13029.8
2015	-15902.2	5664.9	-1938.0	-12175.2
2016	-14054.9	5227.2	-1710.9	-10538.7
2017	-12207.7	5024.2	-1448.7	-8632.2

The obtained estimates of CO_2 emissions/sinks for the FOLU sector for 1990-2017 are presented in Table 2.11 and Fig. 2.14.

The FOLU sector is a net GHG sink in Uzbekistan.

Both emissions and sinks of CO_2 are observed in the sector. In 2017, the total sink of carbon dioxide amounted to -8632.2 Gg. This value is about 4.5% of the total GHG emissions in Uzbekistan.

Compared to 1990, CO_2 sink decreased 1.6 times. In 2002-2005, not skins, but emissions of CO_2 were observed in the sector. Land use categories such as grassland and forest land are the main contributors to total emissions/skins in the FOLU sector.

The transition from skins to CO_2 emissions in the forestry sector is mainly determined by changes in carbon stocks in pastures (which account for about 70-80% of the area of all considered categories of land use) and forest lands.

The transition from emissions to skins in the FOLU sector in 2006-2017 is associated with a significant increase in the area of forest land, as a result of the purposeful planting of forest plantations on desert lands in the Aral Sea region and in the territories of Navoi and Bukhara regions.

2.7 WASTE SECTOR

The "Waste" sector includes the following categories:

- methane emissions from solid waste disposal in landfills;
- methane emissions from industrial wastewater;
- emissions of methane and nitrous oxide from domestic wastewater.

In 2017, emissions in the Waste sector amounted to **2,679.5 Gg CO_2-eq.**, which is 1.4% of total GHG emissions.

Methane emissions in the sector account for 94.8% of emissions, nitrous oxide emissions - respectively 5.2%.

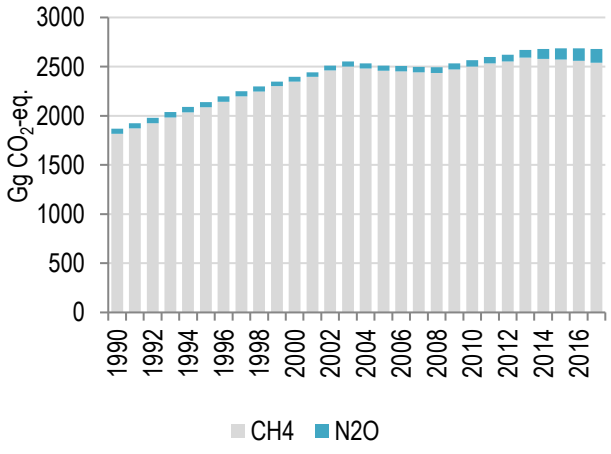

Figure 2.15 *Greenhouse Gas Emissions in the Waste Sector*

GHG emissions for 1990 2017 by individual gases are presented in Table 2.12 and Figure 2.15.

Compared to the 1990 level, in 2017, GHG emissions in the sector increased by 43.3%, compared to the 2013 level - by 0.3%.

The trend towards stabilization of methane emissions over the past five years is associated with a new policy for the management of solid waste in the country, including:

- with an increase in the share of waste processing;
- with a decrease in the amount of waste disposed at landfills due to the implementation of measures to radically improve and develop the waste management system.

Table 2.13 and Fig. 2.16 present the estimates of emissions in the Waste sector by individual categories.

The largest contribution to emissions in the Waste sector is made by the category Solid waste landfills - 2,171 Gg CO_2-eq (81.0%).

Compared to 1990, the growth in emissions in the sector amounted to 43.3%.

Table 2.12. *Greenhouse gas emissions in the Waste sector, Gg CO_2-eq.*

Year	CH_4	N_2O	Total
1990	1818.0	51.5	1869.5
2000	2347.9	47.1	2395.1
2010	2500.5	65.0	2565.6
2011	2532.0	67.5	2599.5
2012	2552.2	68.4	2620.6
2013	2590.5	80.1	2670.6
2014	2579.1	99.0	2678.1
2015	2571.7	115.2	2686.9
2016	2560.2	124.6	2684.8
2017	2540.9	138.6	2679.5
Trends			
$\Delta_{(1990\text{-}2017)}$	39.8%	169.1%	43.3%
$\Delta_{(2013\text{-}2017)}$	-1.9%	73.1%	0.3%
Contribution			
1990	97.2%	2.8%	100.0%
2013	97.0%	3.0%	100.0%
2017	94.8%	5.2%	100.0%

Table 2.13. *Greenhouse gas emissions in the Waste sector by category, Gg CO_2-eq.*

Year	Solid waste landfills	Industrial wastewater	Domestic wastewater	Total
1990	1630,7	70,8	168,0	1869,5
2000	2176,6	39,5	179,0	2395,1
2010	2282,4	65,9	217,3	2565,6
2011	2304,8	71,5	223,2	2599,5
2012	2323,5	72,7	224,5	2620,6
2013	2341,9	70,5	258,2	2670,6
2014	2297,8	80,5	299,7	2678,1
2015	2254,8	92,8	339,3	2686,9
2016	2212,8	98,7	373,3	2684,8
2017	2171,0	95,5	413,1	2679,5
Trends				
$\Delta_{(1990\text{-}2017)}$	+33,1%	+34,9%	+145,8%	+43,3%
$\Delta_{(2013\text{-}2017)}$	-7,3%	+35,4%	+60,0%	+0,3%

Tabl 2.13 cont

Year	Solid waste landfills	Industrial wastewater	Domestic wastewater	Total
		Contribution		
1990	87,2%	3,8%	9,0%	100,0%
2013	87,7%	2,6%	9,7%	100,0%
2017	81,0%	3,6%	15,4%	100,0%

A significant increase in methane and nitrous oxide emissions in the category "Domestic wastewater" is associated with an increase in the population and its coverage with sewerage services.

The dynamics of methane emissions from industrial wastewater is due to changes in the volume of industrial production of products that were included in the calculations (production of food products, alcoholic beverages, cotton fabrics, paints and varnishes).

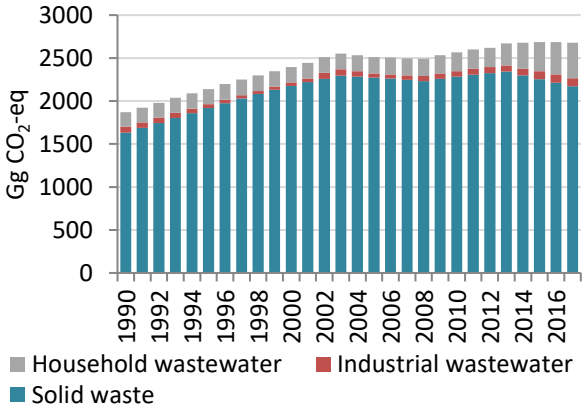

Figure 2.16 *Greenhouse gas emissions in the Waste sector by category*

2.8 ANALYSIS OF KEY CATEGORIES

The analysis of key categories of the inventory was carried out in accordance with the recommendations of the IPCC Guidelines, 2006. Key categories of the inventory are categories, the sum of emissions for which is about 95% of total greenhouse gas emissions (Table 2.14). Tier 1 methodology was used.
2017, 21 key categories were identified. of them:

- 10 categories of the Energy sector;
- 2 categories of the sector Industrial processes and product use;
- 8 categories of the sector Agriculture and Food Industry;
- 1 category of the Waste sector.

The following categories make the largest contribution to GHG emissions:

- CH_4 leaks from gas systems (22.5%);
- CO_2 emissions from natural gas consumption during energy production (13.1%);
- CO_2 emissions from natural gas consumption in the processing industry and construction (9.9%);
- CH_4 emissions from intestinal fermentation of domestic animals (9.3%);
- CO_2 emissions from natural gas consumption in the residential/commercial sector (8.4%).

Together, they account for 63.2% of GHG emissions in 2017.

Table 2.14. *Key sources of GHG emissions in 2017 (taking into account the FOLU sector)*

IPCC Category Code	IPCC Category Name	GHG	2017 emission, E Gg CO_2-eq	Emission modulus |E| Gg CO_2-eq	Level assessment, %	Cumulative Sum of Column F, %
1.B.2.b	Natural gas	CH_4	47185,20	47185,20	22,7	22,7
1.A.1	Power Generation. Gaseous Fuels	CO_2	27557,88	27557,88	13,3	36,0
1.A.2	Process industry and construction. Gaseous fuels	CO_2	20838,20	20838,20	10,0	46,0
3.A.1	Internal fermentation	CH_4	19446,30	19446,30	9,4	55,4
1.A.4	Residential sector. Gaseous fuels	CO_2	17521,89	17521,89	8,4	63,8
3.B.1.a	Forests Remaining Forests	CO_2	-12207,72	12207,72	5,9	69,7
1.A.3.b	Road transport	CO_2	11484,16	11484,16	5,5	75,2
3.C.4	Direct N_2O emissions from cultivated soils	N_2O	7948,09	7948,09	3,8	79,0
3.B.3.a	Grassland Remaining Grassland	CO_2	5024,20	5024,20	2,4	81,4
1.A.4	Commercial Sector. Gaseous Fuels	CO_2	3819,30	3819,30	1,8	83,2
1.A.3.e	Other modes of transport	CO_2	3781,49	3781,49	1,8	85,0
1.A.1	Power Generation. Solid Fuels	CO_2	3696,07	3696,07	1,8	86,8
2.A.1	Cement production	CO_2	3173,36	3173,36	1,5	88,3
3.C.5	Indirect N_2O emissions from cultivated soils	N_2O	2565,03	2565,03	1,2	89,5
2.B.1	Ammonia production	CO_2	2217,25	2217,25	1,1	90,6
4.A	Solid waste disposal	CH_4	2170,97	2170,97	1,0	91,6
1.B.2.a	Oil	CH_4	1756,16	1756,16	0,8	92,4
3.A.2	Manure management	N_2O	1603,29	1603,29	0,8	93,2
1.A.4	Commercial sector. Liquid fuels	CO_2	1587,28	1587,28	0,8	94,0
3.A.2	Manure management	CH_4	1490,53	1490,53	0,7	94,7
3.B.2.a	Cropland Remaining Cropland	CO_2	-1448,72	1448,72	0,7	95,4
Total			180575,31	207888,19		

2.9 UNCERTAINTY ASSESSMENT

Uncertainties of activity data as well as uncertainties of emission factors are introduced into the estimation of the uncertainty of greenhouse gas emissions. At the same time, the uncertainty of emission factors is reduced when using national values, which is especially important for key categories.

As a result of the work, the uncertainty of all categories of the inventory was estimated. The total uncertainty of the current inventory in 2017 was **±10.5%**.

Uncertainty of **carbon dioxide** emissions for all assessed sectors was **±14.7%**; **methane - ±16.2%; nitrous oxide - ±6.1%**.

Uncertainties are also assessed by sector. The greatest uncertainty of emissions is observed in the sector "Agriculture, forestry and other land use" due to the high uncertainty of activity data.

2.10 ESTIMATION OF THE COMPLETENESS OF INVENTORY

Geographic coverage. The inventory covers the entire territory of Uzbekistan, the main sources of emissions and removals in the country (about 90% of sources).

Gases. The following greenhouse gases are included in the inventory:

- CO_2 - carbon dioxide;
- CH_4 - methane;
- N_2O - nitrous oxide;
- HFCs - hydrofluorocarbons.

SF_6 (sulfur hexafluoride) and PFC (perfluorocarbons) are not included in the current inventory due to the lack of government reporting on their consumption. Information is currently being collected to estimate emissions of GHG data.

Sources of emissions and absorptions. The assessment of GHG emissions in the current inventory was carried out in accordance with the methodology of the 2006 IPCC Guidelines for the following sectors: Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use and Waste.

Due to the lack of the necessary data in this inventory, it was impossible to estimate GHG emissions from some of the sources listed in Annex 2. However, the unconsidered emission sources are currently included in the Plan for further improvement of the inventory. Currently, work is underway to collect the necessary data to ensure the completeness of coverage of all emission sources available in the country. At the same time, it is assumed that currently unconsidered emission sources will not have a significant impact on the value of the total greenhouse gas emissions.

2.11 RESULTS OF CONVERSIONS OF GHG EMISSIONS RELATED TO INVENTORY 1990-2012

As a result of the recalculation of GHG emissions for 1990-2012 due to the transition to the use of the methodologies of the 2006 IPCC Guidelines and global warming potentials (GWPs) according to the 4th IPCC Assessment Report, as well as the refinement of activity data for a number of categories, changes occurred in the estimates of emissions for a given period.

Differences in the estimates of GHG emissions obtained during the preparation of the inventory for 1990-2012 (within the framework of the Third National Communication) and the current inventory are presented in Table 2.15.

In general, the current estimates of GHG emissions are higher than those obtained in the TNC. This is due to a change in methodological approaches, an increase in the number of calculated categories in sectors, a change in the values of emission factors, a change in the values of global warming potentials used in the calculations.

The largest differences in emission estimates were obtained for the Energy sector for the period 1993-2005, which is due to the refinement of activity data in the categories "Fuel combustion activities" and "Fugitive emissions from fuels", as well as emission factors in the category "Fugitive emissions from fuels ".

Table 2.15. *Results of recalculation of total GHG emissions for the period 1990-2012, mln t CO_2-eq.*

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
TNC	179.2	183.3	178.0	208.2	191.9	197.3	202.8	193.8	188.8	197.9	213.3	212.2
FBUR	177.4	181.5	175.9	205.7	188.4	192.5	197.9	188.8	183.7	192.8	208.5	207.6
$\Delta_{(FBUR-TNC)}$	-1.8	-1.8	-2.1	-2.5	-3.5	-4.8	-4.9	-5.0	-5.1	-5.1	-4.8	-4.6
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	
TNC	216.5	214.4	211.6	208.4	216.7	218.3	230.2	210.1	202.5	204.4	204.9	
FBUR	211.8	209.8	207.3	204.9	213.2	215.0	221.4	207.3	199.9	202.0	202.7	
$\Delta_{(FBUR-TNC)}$	-4.7	-4.6	-4.3	-3.5	-3.5	-3.3	-8.8	-2.8	-2.6	-2.4	-2.2	

3 MEASURES TO MITIGATE GREENHOUSE GAS EMISSIONS

3.1 COUNTRY TASKS IN MITIGATION

At present, the subject of climate change has been brought to a high political level. In his speech at the 75th UN General Assembly (UNGA), the President of Uzbekistan emphasized that "... an acute problem of our time is global climate change. Today every country is feeling the destructive impact of this process. Unfortunately, these negative changes pose a serious threat to the sustainable development of Central Asia."

In response to the problem of global climate change, Uzbekistan joined the Paris Agreement in April 2017[57]. The Nationally Determined Contribution (NDC) provides for a 10% reduction in the carbon intensity of GDP by 2030 compared to 2010. The NDC document is developed for three types of greenhouse gases: CO_2 - carbon dioxide, CH_4 - methane, N_2O - nitrous oxide. It defines:

- the main industries in which emissions will be reduced - energy (energy efficiency (EE) improvement on the side of energy generation, development of renewable energy sources (RES), reduction of losses as a result of natural gas leaks), industrial sector (modernization and technical renewal of industrial capacities), transport (ensuring the expansion of transport and logistics communication systems);
- priority areas in the field of adaptation: agriculture and water management, social sphere, strategic infrastructure, mitigation of the consequences of the Aral Sea disaster.

In support of the fulfillment of the obligations to the Paris Agreement and the implementation of the Strategy of Action for Five Priority Areas of Development in 2017–2021, which is focused on structural transformations, modernization and diversification of the basic sectors of the economy, the country has developed and adopted a "*Strategy for Transition to a Green Economy*" (October, 2019)[58].

The main tasks of the transition to a green economy are:

- increasing the energy efficiency of the economy and rational consumption of natural resources through technological modernization and the development of financial mechanisms;
- inclusion of "green" criteria based on advanced international standards in priority areas of public investment and spending;
- assistance in the implementation of pilot projects in the areas of transition to a "green" economy through the development of mechanisms of state incentives.

The strategy is an important base document that involves the implementation of a whole range of measures at the state and public levels (Table 3.4). In order to effectively organize the work, an *Interagency Council on Promoting and Implementing of a* "*Green Economy*" *in the Republic of Uzbekistan* was formed, whose tasks include the development and submission for approval to the Cabinet of Ministers of the Republic of an annual action plan for the implementation of the Strategy. The Council consists of ministers and chief executives of key ministries and agencies. The Ministry of Economic Development and Poverty Reduction is responsible for coordinating the activities envisaged by the Strategy.

In accordance with the UN General Assembly Resolution No. 70, adopted at the Summit on Sustainable Development (September, 2015), the Government of Uzbekistan developed and approved the National Sustainable Development Goals (NSDGs), the Roadmap and indicators for their achievement until 2030. The resolution provides for a gradual

[57] ZRU No.491 of 2.10.2018 «On the ratification of the Paris Agreement».

[58] PP No.4477 of 4.10.2019 «On approval of the strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019 - 2030».

integration of the SDGs into central, sectoral, regional and other development strategies, as well as into annual legal, budgetary and reporting processes. The adopted NSDGs are a system of criteria for monitoring and assessing progress in various areas, including the tasks, the implementation of which is aimed at reducing greenhouse gas emissions (Table 3.1).

Table 3.1. *National SDG targets aimed at reducing greenhouse gas emissions*

National SDG Target	Indicator
Goal 7 Affordable and clean energy	
7.2 By 2030, significantly increase the share of renewable energy in the energy balance	7.2.1 Share of energy generated by renewable energy sources in the total amount of energy
7.3 By 2030, double the energy efficiency rate	7.3.1 Energy intensity calculated as the ratio of primary energy consumption to GDP
7.b By 2030, expand infrastructure and modernize technologies for a modern and sustainable energy supply	7.b.1 Share of investment in energy in total investment in fixed assets
Goal 9 Industrialization, innovation and infrastructure	
9.4 By 2030, modernize infrastructure and reequip industrial plants to make them sustainable through improved resource efficiency and increased use of clean and environmentally sound technologies and industrial processes	9.4.1 Reduction of CO_2 emissions per unit of value added
Goal 12 Responsible consumption and production	
12.5 By 2030, substantially reduce waste through prevention, recycling and reuse measures	12.5.1 Increase the level of solid waste processing, %
Goal 13 Combat climate change	
13.2 Include climate change response measures in the policy, development strategy at the national level, paying special attention to the measures implemented in the Aral Sea zone	13.2.1 Existence of comprehensive development programs and strategies that include measures and actions aimed at reducing GHG emissions and increasing the level of climate resilience
Goal 15 Conserve terrestrial ecosystems	
15.1 Ensure the conservation, restoration and sustainable use of ecosystems, including forests	15.1.1 Forest area as a percentage of total land area
15.2 Promote sustainable management of all types of forests, halt deforestation, restore degraded forests and significantly scale up afforestation and reforestation	15.2.1 Progress towards sustainable forest management: a) change in net forest area; b) stocks of terrestrial biomass in forests; c) proportion of forest area located in legally protected areas; d) proportion of forest area for which a long-term forest management plan has been developed;

The signing of the Paris Agreement, the approval of the "Strategy for the transition to a green economy" and the SDG targets are an important stage in the formation of the country's climate policy. In Uzbekistan, in accordance with global trends, measures are being implemented to reduce greenhouse gas emissions on the basis of associated benefits and are integrated into state and sectoral development programs.

As a result of the development and approval of these documents in the country, a fairly clear understanding of the goals and direction of actions by the state and the business in the field of combating climate change has been formed.

3.2 LEGAL FRAMEWORK IN SUPPORT OF MITIGATION MEASURES

One of the key tasks being carried out in Uzbekistan is modernizing the energy sector, reducing the energy intensity of the gross domestic product (GDP) and introducing an effective energy saving system.

In order to provide conditions for the implementation of investment projects and stimulate investment in the field of increasing the energy efficiency of production and promoting clean energy technologies, a number of regulatory, economic and regulatory instruments of state policy have been developed in Uzbekistan in the period 2015-2019 (Table 3.2 - Table 3.3).

Table 3.2. *Changes in legislation for improvement of energy efficiency and development of RES*

Law	Main content
"On amendments and additions to some legislative acts of the Republic of Uzbekistan" No. ZRU-396 of 29.12.2015	The law changed the requirements for enterprises subject to mandatory energy inspections, as defined in the Law No. 412-I of 25.04.1997 "On the rational use of energy". In order to assess the efficiency of energy production and consumption, enterprises, institutions and organizations with a total annual consumption of energy resources of more than 2 thousand tons of fuel equivalent are subject to mandatory energy surveys. (previously - six) or more than 1,000 tons of motor fuel.
"On the ratification of the Statute of the International Renewable Energy Agency (IRENA)" No. ZRU-432 of 1.06.2017.	Ratification of the agency's charter will serve to further deepen international cooperation in the implementation of energy-saving technologies and renewable energy sources.
"On the use of renewable energy sources" No. ZRU-539 of 21.05.2019	The law provides for tax and customs exemptions for the import of renewable energy installations. Also, renewable energy producers are exempt from paying property tax for renewable energy installations and land tax for a period of 10 years. Renewable energy plant manufacturers are exempt from all types of taxes for a period of five years. Tariffs for electricity generated from renewable energy sources will be determined on the basis of competitive bidding.
"On public-private partnership" No. ZRU-537 of 10.05.2019	According to the Law, a public-private partnership is a cooperation between public and private partners, legally formalized for a certain period, based on the pooling of their resources for the implementation of a PPP project. Its principles define the equality of partners before the law, transparency of procedures, competition, inadmissibility of discrimination and corruption. The Agency for the Development of Public-Private Partnerships under the Ministry of Finance has been identified as the regulator in this area. The document provides for mechanisms to protect the interests of a private partner and establishes a procedure for monitoring and reporting on the implementation of PPP projects. The mechanisms of financial support for PPP have been identified, the main types of which are grants and subsidies, tax incentives, contributions in the form of assets, loans, government guarantees and others.

Information on regulatory and legal instruments aimed at: (i) introduction of mechanisms to stimulate state support for renewable energy sources; (ii) ensuring the requirements for energy efficiency and energy saving in the procurement of goods, performance of works and services for state needs; (iii) development and introduction of new national standards corresponding to international requirements, energy efficiency classes of public buildings; (iv) reform of the energy audit system is shown in Table 3.3.

Table 3.3 *Energy efficiency regulatory instruments approved by the government in the period 2015-2019*

Instruments	Envisaged measures and actions
Promotion of RES	A number of benefits and preferences have been approved for organizations that generate energy using installations for the production of energy from renewable sources (with a nominal capacity of 0.1 MW or more), or specialize in the production of such installations. The regulations for connecting to the unified electric power system (UEPS) of business entities that produce electric energy, including RES and micro-HPPs, were approved, which determine the main technical aspects of the integration of RES facilities into the UEPS of Uzbekistan. A procedure has been introduced according to which, from 01.01.2020, at the expense of the State budget of the Republic of Uzbekistan, individuals and legal entities will be provided with compensation for the costs of purchasing solar PVPPs and water heaters, as well as the EE gas burners.
Development of biogas technologies	The Uzstandard agency has put into effect the State standard "0'zDSt 2798:2013 Biogas plants. General technical conditions". As of 01.01.2016, within the framework of the existing statistical reporting forms, the accounting of the number of introduced biogas plants and the volume of their production is provided. A set of measures for 2017-2021 was approved to stimulate the production and implementation of biogas plants, improve the regulatory framework, expand the production of equipment and components for them (up to 100 BGl/year)[59].
PPP mechanisms	The Government of the Republic of Uzbekistan and the International Finance Corporation (IFC, the World Bank Group) signed an agreement on the provision of consulting services aimed at attracting foreign capital, the development of solar energy based on PPP mechanisms. A project for the construction and operation of a solar power plant with a capacity of 100 MW is being considered with the prospect of replicating the experience and increasing the total capacity of future solar power plants to 1 GW. The Ministry of Energy, the Ministry of Investment and Foreign Trade and the Asian Development Bank signed a Memorandum on the provision of consulting services in the framework of the implementation of investment projects of solar PVPPs with a total capacity of up to 1 GW in 2019-2025.
Household appliances marking	From 01.01.2016 new EE requirements for household electrical appliances sold in the country have been introduced. All household electrical appliances are subject to mandatory energy labeling and certification. EE classes of the electrical appliance have been established: "A", "B", "C", "D", "E", "F", "G" (class "A" characterizes the highest EE of the electrical appliance, and, accordingly, class "G" - the lowest)[60].
Equipment marking	As of 01.09.2019, the import of used power generating equipment, power reducing transformers, electric motors, as well as energy-consuming equipment of category EE "D" is prohibited[61]. As of 01.01.2020, the identification of the class or technical indicators of the EE products (equipment, goods) and technologies is mandatory during their certification by accredited bodies in the Republic of Uzbekistan.
Phasing out incandescent bulbs	As of 01.01.2017, the use of incandescent lamps with a power of more than 40 W is prohibited in the country and the sale has been discontinued[62].

[59] PKM No.338 of 01.06.2017 "On measures to expand production and introduction of biogas plants in the republic in the period 2017 - 2019".
[60] PKM No.86 of 09.04.2015 "On measures to introduce, in the republic, a system of mandatory energy labeling and certification of current household electrical appliances, newly built buildings and structures".
[61] PP No.4422 of 22.08.2019 «On accelerated measures to improve the energy efficiency of economic and social sectors, the introduction of energy-saving technologies and the development of renewable energy sources».
[62] PKM No.299 of 20.10.2015 «On measures to expand domestic production of energy-saving lamps».

Table 3.3 cont.

Instruments	Envisaged measures and actions
Energy Efficiency Standards for New Buildings Introduction of RES in the construction and operation of buildings	As of 01.01.2018, during the design, reconstruction, construction and commissioning, a procedure has been established in accordance with which: – for buildings and structures of state bodies and institutions, as well as multi-apartment housing stock, compliance with urban planning norms and rules regarding the use of energy efficiency and energy-saving technologies are being conducted; – for all buildings and structures, except for individual housing construction, the mandatory installation of certified solar water heating installations for hot water supply and energy-saving lamps is provided. As of 01.01.2020 for all buildings and structures, except for individual housing construction, it is mandatory to provide: – ensuring energy efficiency of buildings in accordance with building codes; – taking into account the EE indicators of buildings and structures, taking into account the requirements of building codes and regulations during the examination of project documentation. As of January 1, 2022, state bodies and organizations: – in buildings and structures that are on their balance sheet, they are obliged to use exclusively certified solar water heating installations for hot water supply, as well as energy-saving lamps for lighting industrial premises; – disconnected from the centralized hot water supply due to the introduction of solar collectors.
Introduction of Energy Management System	The O'zDSt ISO 500001 : 2011 standard "Energy management system. Requirements and guidance for use" was approved in accordance with international requirements[63] . The system provides for: – transparency and objectivity in assessing the efficiency of energy consumption, reducing the energy intensity of enterprises, as well as reducing emissions into the atmosphere; – efficient energy management with minimal resource consumption.

3.3 DEVELOPMENT STRATEGIES BY MITIGATION MEASURES

In order to solve systemic problems, increase the efficiency of public administration, an administrative reform was initiated in the country, within the framework of the ongoing large-scale transformations. According to the approved "Concept of Administrative Reform in the Republic of Uzbekistan"[64], it is envisaged "to create a strategic planning system that allows to form future models of innovative development of priority areas and industries based on long-term scenarios for increasing the intellectual and technological potential of the country ..."

A number of strategies and concepts have been developed for individual sectors of the economy to determine the priorities and tasks of the country's development for the period up to 2030. The most significant strategic documents in the context of climate change mitigation measures are presented in Table 3.4.

Medium-term development priorities are defined in the State Development Programs, which are formed for a three-year period on the basis of approved development concepts/strategies, taking into account the timing of the implementation of investment and infrastructure projects and funding sources, with annual clarification and updating of their main indicators[65]. State development programs include roadmaps, project portfolios and targets to be achieved through their implementation. The main policy documents that contain measures and actions that contribute to the reduction of GHG emissions are shown in Table 3.5.

[63] PP No.2343 of 05.01.2015 "On the Program of Measures to Reduce Energy Intensity, Implementation of Energy-Saving Technologies in the Sectors of the Economy and Social Sphere for 2015-2019".
[64] UP No.5185 of 8 September 2017 "On approval of the concept of administrative reform in the Republic of Uzbekistan".
[65] PP No.3437 of 18.12.2017 "On the introduction of a new procedure for the formation and financing of state development programs of the Republic of Uzbekistan".

Table 3.4 Main existing strategic documents in the context of climate change mitigation measures

Title of the document	Sector	Main Content	Indicators
Strategy of innovative development of the Republic of Uzbekistan for 2019-2021. Approved: UP No.5544 of 21.09.2018	Economy-wide	**Goal:** Development of human capital as the main factor that determines the level of the country's competitiveness in the world arena and its innovative progress. **Main target:** Entry of the Republic of Uzbekistan by 2030 into the 50 leading countries of the world according to the rating of the Global Innovation Index. **Priority directions:** – development of science, ingenuity and technology transfer; – improving the system of financing innovative activities; – development of infrastructure and information and communication technologies; – improving the education system and developing human capital; – development of competition and reduction of administrative barriers.	– by 2025, an increase in the share of electricity production from RES and alternative energy sources by more than 20%; – by 2030, increase the share of GDP (PPP) per unit of energy consumption from 10.2 (in 2015) to 40 USD/toe;
Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019 - 2030. Approved: PP No.4477 of 04.10.2019	Economy-wide	**Goal:** Achieving sustainable economic progress that contributes to social development, reducing greenhouse gas emissions, climate and environmental sustainability, through the integration of green economy principles into ongoing structural reforms. **Main target:** By 2030, a decrease in specific greenhouse gas emissions per unit of GDP by 10% of the 2010 level. **Priority directions:** 1. Increasing the energy efficiency of the basic sectors of the economy: – power industry: reconstruction and modernization of generating capacities of operating power plants with the introduction of highly efficient technologies based on CCGT and GTUs, complete equipping of power consumption systems with automatic control and metering devices; – heat power engineering: introduction of new technologies for heat energy generation, modernization and reconstruction of outdated boiler equipment, equipping consumers with modern metering devices, use of solar collectors for heating water in boiler houses; – oil and gas industry: reduction of losses of natural gas during its production, processing, transportation and distribution due to the modernization of compressor stations, gas distribution networks of low and medium pressure, as well as the gas transmission system with the introduction of effective technologies for controlling the loss of hydrocarbon resources (SCADA) , the introduction of alternative energy sources at oil and gas production facilities;	By 2030 – a twofold increase in the EE indicator and a decrease in the carbon intensity of GDP; – development of RES, bringing their share to 25% or more of the total volume of electricity generation; – ensuring access to modern, inexpensive and reliable energy supply for up to 100% of the population and sectors of the economy; – modernization of the infrastructure of industrial enterprises, ensuring their sustainability by increasing EE by at least 20% and using clean and environmentally friendly technologies and industrial processes; – a significant increase in the efficiency of water use in all sectors of the economy; – achieving a neutral balance of land degradation.

Title of the document	Sector	Main Content	Indicators
	Economy-wide	– diversification of energy consumption and development of the use of RES; – RES: improving the tariff policy, modernizing and restructuring the power supply system, localizing the production of equipment for generating energy from RES; – construction and operation of buildings: implementation of state programs to improve the EE of buildings, including the reconstruction of multi-storey residential buildings, revision of building codes and regulations every 5 years towards stricter EE requirements, widespread introduction of a "closed" heat supply system, development of a system of differentiated tariffs to create incentives for energy conservation, introduction of EE standards for household equipment; – transport: expanding the production and use of vehicles with improved EE and environmental friendliness in accordance with Euro 4 and higher standards, electric vehicles, cars with hybrid engines, gas-fueled, ensuring the phase-out of the use of hydrocarbon fuels and stimulating the development of electric transport, design and development of new transport and logistics systems, development of road infrastructure; – water management: prevention of further salinization and deterioration of land quality, construction and reconstruction of hydraulic structures, pumping stations and reservoirs, widespread use of ICT and innovations in water management and the use of EE and water-saving technologies for irrigation of crops; – solid waste (SW): development of sanitary cleaning infrastructure aimed at full coverage of the population with services for the collection and removal of SW, creation of an effective and modern system for processing SW, use of SW facilities in the form of sources of alternative energy. – Adaptation and mitigation of the effects of climate change, increasing the EE of the use of natural resources and preserving natural ecosystems: – agriculture: restoration of degraded pastures and introduction of sustainable pasture management mechanisms; introduction of organic farming methods. – forestry: reforestation and preservation of natural vegetation cover in all natural zones; increasing the area of forests in the mountainous, foothill and desert zones of the country as well as ensuring their conservation, protection and sustainable development; expansion of plantations of fast-growing local tree species; creation of soil-protective forest plantations and afforestation of degraded lands (agroforestry). 2. Development of financial and non-financial mechanisms to support the "green" economy. 3. Development of the institutional framework, improvement of the regulatory framework for the implementation of green technologies, development of mechanisms for regulation and control of EE, integration of the principles of the green economy into education and science, capacity building and support for green investments.	

Title of the document	Sector	Main Content	Indicators
Strategy for solid waste management in the Republic of Uzbekistan for the period of 2019-2028. Approved: PP No.4291 of 17.04.2019	Waste	**Goal:** Ensuring thorough improvement and development of the waste management system. **Main target:** Bringing the coverage of the population with services of collection and removal of SW to 100%. **Priority directions:** – development of sanitary cleaning infrastructure aimed at ensuring full coverage of the population with services of collection and removal of SW; – creation of an efficient and modern system of SW processing; – reduction of the volume of SW sent for burial to landfills, creation of modern landfills for SW that meet the requirements of sanitary and environmental standards, as well as taking measures to close and reclaim landfills; – improvement of pricing and optimization of tariffs in the field of sanitary cleaning; – use of SW objects in the form of sources of alternative energy.	By 2028 – ensuring the processing of at least 60% of generated SW; – reduction of the volume of SW sent for burial to landfills by up to 60%; – bringing the state of all landfills in line with the established requirements, full reclamation of the lands of the liquidated landfills; – use of alternative energy sources at SW management facilities up to 35%; – ensuring monitoring of the state of landfills up to 100%.
Agriculture Development Strategy of the Republic of Uzbekistan for 2020-2030. Approved: UP No.5853 of 23.10.2019	Agriculture	**Goal:** Creation of a favorable agribusiness climate and value chain, reducing the role of the state in the industry, expanding the use of scientific achievements and digital technologies. **Priority directions:** among the 9 strategic priorities formulated in the document, the following are associated with measures to mitigate climate change: – ensuring the rational use of natural resources and environmental protection, increasing soil fertility and introducing water-saving technologies; – rural development; – development of a transparent system of industry statistics.	By 2030 (from 2016 level) – reduction of greenhouse gas emissions of agricultural origin by 50% – increase in the use of RES in agriculture by 30%
The concept of environmental protection of the Republic of Uzbekistan until 2030. Approved: UP No.5863 of 30.10.2019	Environmental protection	**Goal:** Ensuring sustainable economic development through the introduction of innovative technologies; sustainable use of environmental objects and reproduction of bio-resources. **Priority directions:** – conservation and protection of environmental objects; – greening the economy, introducing economic mechanisms for the use of natural resources, prioritizing the use of materials, products, production and other facilities that pose the least environmental hazard; – improvement of state control in the field of environmental protection and rational use of natural resources, as well as the system of environmental monitoring; – improvement of the waste management system, taking into account environmental safety.	By 2030 – bringing the area of forest plantations on the Uzbek part of the dried bottom of the Aral Sea to 60% of its territory; – creation of a "green belt" around the cities of Nukus, Urgench and Khiva; – Increase of the forest area covered with forests up to 4.5 mln hectares; – transfer of 80% of public transport to gas fuel and electric traction;

Title of the document	Sector	Main Content	Indicators
			– bringing the coverage of the population with services of collection and removal of SW to 100%; – increase in the volume of processing of generated SW up to 65%.
Concept of providing the Republic of Uzbekistan with electric energy for 2020-2030. http://minenergy.uz	Energy	**Goal:** Meeting the growing energy demand and ensuring the further balanced development of the electric power industry, taking into account the world's best practices. **Priority directions:** – modernization and construction of new power facilities; – improvement of the electricity metering and dispatching system through the introduction of advanced ICT; – increasing the efficiency and rational use of electrical energy at all stages of the technological process based on energy-saving technologies and optimization of generating capacities; – ensuring diversification in the electric power industry and thermal power engineering by increasing the share of RES with the creation of mechanisms for RES investment projects on PPP terms; – improvement of the state policy in the field of renewable energy development.	By 2030 – The volume of electricity generation will reach 120.8 billion kWh, including: • TPP - 58.5%; • RES - 27.6% (HPP –10.8%; PVPP –8.2%; WPP - 8.6%); • NPP - 14.9%. – saving the use of fossil fuels; – reduction of losses during transmission and distribution of electrical energy.
Draft Concept for reforming heat supply for the period 2018-2030.	Energy	**Goal:** Further development of the heat supply system through the renewal and modernization of fixed assets, the introduction of modern economical and energy-saving technologies, the efficient and rational use of raw materials and financial resources, the introduction of RES, an increase in the efficiency of work and the formation of financial stability of heat supply organizations and the quality of the provided utilities for heat supply. **Priority directions:** – conducting a technical audit at each object of the heat supply system; – development of a complex scheme for the development of heat supply in 30 large cities of the republic on the basis of conducting and analyzing an inventory; – application of a local heat supply system; – Replacement of obsolete boilers with modern EE boilers with high efficiency, contributing to the saving of fuel and energy resources by 35%; – reconstruction of heating networks; – equipping with metering devices for heat energy and hot water, introduction of an automated metering system.	– saving consumption of natural gas and electricity in the production, transportation and consumption of heat energy.

Title of the document	Sector	Main Content	Indicators
Draft Concept for the development of the building materials industry for the period up to 2025. https://regulation.gov.uz/ ID-4086	Industry	**Goal:** Increase in the production of high-quality, innovative, import-substituting and EE building materials and products, the needs of the construction industry and an increase in the export of products. **Priority directions:** – due to the introduction of innovative technologies, an increase in the production of export-oriented and import-substituting building materials with high added value, as well as the EE types of wall materials; – improvement of construction norms and rules, taking into account the introduction of new technologies and the use of innovative and energy-saving building materials, – introduction of modular construction technologies, allowing to reduce construction time and improve the quality of installation work.	– reducing the consumption of heat and power resources in the production of building materials; – by 2022, to bring the capacity of the "dry" method of cement production to 100% of the total capacity; – gradual reduction in the use of baked bricks, and an increase in the use of EE types of materials.
Water sector development concept for 2020-2030. Approved: UP No6024 of 10.07.2020	Water resources	**Goal:** Ensuring effective management and use of water resources, reclamation of irrigated lands, achieving water and food security in the context of an increasing shortage of water resources, as well as global climate change. **Priority directions:** – introduction of market principles, improvement of financing of water management; – improvement of water policy and water resources management mechanisms; – modernization of infrastructure and development of the water sector services; – development of human resources, scientific and innovative potential of water management.	By 2030 – reduction of the annual electricity consumption of pumping stations by 2 billion kWh; – reduction of the total area of saline lands by 213 thousand hectares, medium and highly saline lands - by 177 thousand hectares
Draft Strategy for the Development of the Transport System of the Republic of Uzbekistan until 2035. https://regulation.gov.uz/ ID-3867	Transport	**Goal:** Establishment of an integrated and unified transport system in Uzbekistan, ensuring conditions for sustainable economic growth and satisfying the population's demand for quality transport services. **Priority directions:** – increasing the efficiency of institutions that form and implement a single national transport policy; – ensuring the quality and availability of transport services in the field of freight transportation to ensure the accelerated modernization of the economy; – improving the quality and availability of transport services for the population; – realization of transport and transit potential through advanced development of efficient transport and logistics infrastructure, active entry into international transport corridors; – ensuring a high level of security of the transport system; – ensuring environmental friendliness of transport, creating conditions for the development of "green" transport; – increasing the innovativeness of the transport system, accelerated digitalization of the transport sector.	– reduction of CO_2 emissions per 1 reduced t-km (from 2017 level) by automobile transport- by 2025 by 5%, by 2035 by 10%, by railway transport- by 2025 by 15%, by 2035 by 24%, – an increase in the share of alternative fuels in the total fuel consumption of vehicles by 2025 by 9.3%, by 2035 by 18.7%, incl. share of gas engine fuel by 2025 by 9.7%, by 2035 by 18.7%, – an increase in the share of the fleet of vehicles with hybrid, electric and alternative fuels by 2025 by 10%, by 2035 by 20%.

Table 3.5 Development programs containing measures and actions on reduction of GHG emissions

Title of the action for prevention of CC	Status	Description of the action for prevention of CC	Sector	Implementing agency	Planned reduction of GHG emissions
Environmental Protection Program 2013-2017. PKM No.142 of 27.05.2013	Completed	The main directions of the program implementation: – greening the economic sectors, improving technological processes and environmental protection; – prevention of environmental pollution from industrial and economic waste.	Transport, industry, energy, green plantations	Goscomecology	CO_2, CH_4, N_2O
The program of measures to ensure structural transformation, modernization and diversification of production for 2015-2019 PP No.4707 of 04.03.2015	Completed	The program provides for the implementation of investment projects for the modernization, technical and technological renovation of production facilities and projects aimed at decommissioning obsolete equipment and capacities, replacing them with modern and energy efficient ones. The total cost of investment projects included in the program is over $ 40.8 billion.	Transport, industry, energy	Ministry of Investment, Ministry of Economy	CO_2, CH_4, N_2O
The program of measures to reduce energy intensity, introduce energy-saving technologies in the sectors of the economy and the social sphere for 2015-2019. PP No.2343 of 05.05.2015	Completed	Priority areas for reducing energy intensity: – reducing the energy intensity of manufactured products through further modernization, technical and technological re-equipment and the creation of new production facilities based on modern EE and energy-saving technologies; – development of organizational and technical measures to save FER and sectoral energy conservation programs, energy audit of enterprises in accordance with international practice; – accelerated development of RES; – Expansion of production of modern types of energy-saving equipment, automated systems for metering the consumption of FER, with their widespread introduction in the sectors of the economy and the social sphere; – ensuring energy efficiency in the construction of new and reconstruction of existing residential and office buildings, industrial facilities.	Industry, energy	Ministry of Economy	CO_2, CH_4, N_2O

Title of the action for prevention of CC	Status	Description of the action for prevention of CC	Sector	Implementing agency	Planned reduction of GHG emissions
The program of measures for further development of hydropower for 2017-2021 PP No.2947 of 02.05.2017	Ongoing	The program envisages: by 2026 - to increase the capacity of HPPs by 1.7 times: – construction of 18 HPPs with a total capacity of 984.7 MW, with an average annual electricity generation of 2,716.8 mln kWh; – modernization of 14 HPPs with a total capacity of 2,053.1 MW, with an average annual power generation of 4,862.6 mln kWh. Total cost - $ 2.65 billion by 2030, 42 promising projects are planned - with a total capacity of 1,225.3 MW, with an average annual electricity generation of 4991.1 mln kWh, including: – new construction (24 projects) 637.3 MW, 2,046.4 mln kWh; – modernization (18 projects) 588.0 MW, 2,944.7 mln kWh. Estimated cost - about $ 1.7 billion.	Energy	JSC "Uzbekhydroenergo"	CO_2 by 2026 4,032.2 thousand tons of CO_2/year by 2030 2,655.3 thousand tons of CO_2/year
The program of additional measures to expand the use of the republic's hydropower potential through the implementation of pilot projects for the construction of micro-HPPs (2017-2021) PKM No.724 of14. 09. 2017	Ongoing	A list of pilot projects for the construction of 19 micro-HPPs with a total capacity of 10.06 MW on natural and artificial watercourses of Andijan, Jizzakh, Namangan, Kashkadarya, Samarkand and Fergana regions was approved. Total cost - $ 12.14 mln	Energy	JSC "Uzbekhydroenergo"	CO_2
A set of measures to expand the production and introduction of biogas plants in the republic in the period of 2017-2019. PKM No.338 of 01.06.2017	Ongoing	The document approved: – forecasted number of projects for the introduction of 726 biogas plants in large livestock and poultry farms (60.8 mln m^3 of biogas); – a set of measures to further stimulate the production and introduction of biogas plants Total cost - $ 30 mln	Energy	Ministry of Finance, NHC "Uzbekneftegaz", Ministry of Agriculture	CO_2

Title of the action for prevention of CC	Status	Description of the action for prevention of CC	Sector	Implementing agency	Planned reduction of GHG emissions
The program of measures for the further development of renewable energy, improving energy efficiency in the sectors of the economy and the social sphere for 2017-2021 PP No.3012 of 26.05.2017	Ongoing	For the period of 2017-2021 approved: – schedule for the introduction of more than 17 thousand energy efficient heating boilers in 6333 budgetary organizations (saving 56.5 mln m3 of natural gas) – schedule for the introduction of 879 energy-efficient pumps and 1523 electric motors in pumping stations of water management organizations of the Ministry of Water Resources of the Republic of Uzbekistan (saving 807.3 mln kWh of electric energy)	Energy	Ministry of Economy, NHC "Uzbekneftegaz", JSC "Uzbekenergo", JSC "Uzbekhydroenergo"	CO_2 107.8 thousand t CO_2 429.5 thousand t CO_2
Heat supply system development program for the period of 2018-2022 PP No.2912 of 20.04.2017	Ongoing	Priority tasks have been identified and parameters have been approved for the further development of the heat supply system: – introduction of new energy and resource-saving technologies and equipment in the heat supply system, including with the use of RES; – development of a decentralized heat supply system for MHS, social and other facilities through the construction of EE local boiler houses, including the use of solar installations, as well as the installation of individual intra-apartment heat supply systems; – modernization and reconstruction with the replacement of outdated uneconomical boiler units, obsolete main and distribution heating networks; – Organization of normative accounting of consumption and production of energy resources, introduction of an automated system for accounting for consumers, charging and paying for heat supply services. Total cost – 2,852,437 mln. UZS	Communal services, energy	Ministry of Housing and Communal Services, khokimiyats	CO_2
Measures for the accelerated development and financial sustainability of the electric power industry for 2018-2020. PP No.3981 of 23.10.2018	Ongoing	The "Road Map" was approved envisaging: – implementation of projects for the modernization of existing and commissioning of new generating capacities; – modernization of electrical networks; – implementation of projects for the implementation of AEMCS (Automatic electricity metering and control system)	Energy	JSC "Uzbekenergo"	CO_2

Title of the action for prevention of CC	Status	Description of the action for prevention of CC	Sector	Implementing agency	Planned reduction of GHG emissions
Program for further modernization and renovation of low-voltage electrical networks for the period of 2017-2021. PP No.2661 of 23.11.2016	Ongoing	Improvement of power supply to more than 42.7% of consumers through modernization and renovation of low-voltage power grids and transformer stations. The total cost is $ 835.9 mln.	Energy	JSC "Uzbekenergo"	CO_2
Program of measures for through improvement and development of the waste management system for 2017 – 2021 PP No.2916 of 21.04. 2017	Ongoing	Targeted programs approved: – on arrangement of 168 SW landfills and forecast parameters for organizing cluster production at landfills, including sorting and processing to extract valuable components from waste; – on the use of SW as a secondary raw material for the production of consumer goods, fuel and organic fertilizers; – on preparation for environmentally safe storage of waste. Total cost - $27,178.0 thousand. (including funds of entrepreneurs: $ 7,978.0 thousand; loans of the National Bank: $ 19,200.0 thousand)	Communal services	Goscomecology	CH_4
A comprehensive program for the further improvement of energy efficient sectors of the economy and social sphere, the introduction of energy-saving technologies and the development of renewable energy sources in the Republic of Uzbekistan in 2019 - 2022. PP No.4422 of 22.08.2019	Ongoing	Approved: – by 2030, bringing the share of RES to 25% or more of the total volume of electricity generation; – "Roadmap" for further improvement of EE and economic and social sectors, as well as the development of RES. – Measures to ensure uninterrupted supply of energy resources to social facilities in the regions and to reduce energy consumption in cities through the phased installation of modern solar PVPPs and solar water heaters; EE heating systems; improving the thermal protection system of buildings; installation of solar PVPPs (on average 2 kW) and solar water heaters (on average 200 liters) in private households; replacement of non-standard gas burners with modern and EE ones; – Phased implementation of the energy management system in accordance with the international standard (ISO 50001) at 24 domestic enterprises and organizations.	Energy	Ministry of Energy, Ministry of Economics and Industry, Mininnovations, Ministry of Finance	CO_2

Title of the action for prevention of CC	Status	Description of the action for prevention of CC	Sector	Implementing agency	Planned reduction of GHG emissions
On additional measures to reduce the dependence of economic sectors on fuel and energy products by increasing the energy efficiency of the economy and using available resources (2020-2022) PP No.4779 of 10.07.2020	ongoing	Approved for the period 2020-2022: – target parameters of FER saving in sectors of the economy, providing for savings of 3.3 billion kWh of electricity, 2.6 billion m^3 of natural gas, 16.5 thousand tons of oil products; – schedule for energy audits of enterprises with total annual FER of more than 2,000 tons of fuel equivalent or more than 1,000 tons of motor fuel; – creation of an off-budget Intersectoral Energy Saving Fund to finance the preparation of feasibility studies for EE improvement projects; creation of training centers; startup projects; energy audit; measures to support the development of RES.	Industry	Ministry of Energy, Ministry of Water Resources, JSC "Uzbekhydroenergo"	CO_2 Over the entire period 6,776.3 thousand tons of CO_2
Chemical Industry Development Program for 2017-2021. PP No.3236 of 23.08.2017	ongoing	Approved – target parameters for the development of the chemical industry; – a list of investment projects for the construction, modernization, reconstruction and expansion of existing chemical industries; – a set of measures - "Road Map" to ensure the stabilization of production cycles and financial stability of enterprises of JSC "Uzkimyosanoat".	Industry	JSC "Uzkimyosanoat"	CO_2, CH_4, N_2O
Comprehensive program of measures to mitigate the consequences of the Aral Sea disaster, recovery and socio-economic development of the Aral Sea region for 2015-2018. PKM No.255 of 29.08.2015	Implemented	It is advisable to implement this project until 2030 with an annual sowing of 40-50 thousand hectares of the area of the drained bottom of the Aral Sea. – creation of protective forest plantations on the lands of the forest fund in 5 districts of the Bukhara region on an area of 40 thousand hectares; – creation of protective forest plantations on an area of 20 thousand hectares of the drained bottom of the Aral Sea with local trees and shrubs; – promotion of natural renewal of tugai on 5 thousand hectares of riparian areas of the Amu Darya delta and strengthening the material and technical base of forestry enterprises in 2016 - 2019; – implementation of measures to create protective zones from forest plantations on the drained bottom of the Aral Sea.	Forestry	Goskomles, TIKA (Turkish International Cooperation Agency)	CO_2

Title of the action for prevention of CC	Status	Description of the action for prevention of CC	Sector	Implementing agency	Planned reduction of GHG emissions
State program for the development of the Aral Sea region for 2017-2021. PP No.2731 of 18.01.2017	ongoing	Priority directions approved: – development of a water supply system and an increase in the level of provision of the population with clean drinking water, improvement of sewerage systems, sanitation and utilization of household waste; – further implementation of measures aimed at improving the living conditions of the population living in the region; – development of transport, engineering and communication infrastructure of the region's settlements, improvement of the irrigation network and outdoor lighting networks, improvement of heat supply systems in the cities of Nukus and Urgench, providing for the introduction of modern energy-saving technologies. – creation of forest plantations on an area of 20 thousand hectares of the drained bottom of the Aral Sea ($ 23.2 mln) Cost 8,422.51 billion UZS ($ 64.2 mln)	Multisectoral	GEF (IFAS), State Forestry Committee	CO_2
Forestry development program for 2020-2024. PP No.4424 of 23.08.2019	ongoing	A set of forecast indicators for the period of 2020-2024 was approved, incl. – indicators of the creation of forests on the lands of the forest fund in the context of regions. Creation of forests on the lands of the forest fund: 558,993 hectares by 2024; – parameters for the development of livestock, poultry and beekeeping; – indicators of the creation of protective forest plantations to protect against wind and water erosion, aimed at increasing the productivity of agricultural land and around land reclamation facilities (12,020 hectares of protective plantations by 2024)	Forestry and agriculture	Goscomles	CO_2
The program of measures for the modernization of outdoor lighting systems in Tashkent regional centers and cities based on LED technologies in 2016 - 2019. PKM No.68 of 04.03.2016	Implemented	Priority directions approved: – to implement a set of measures to bring outdoor lighting networks into a technically usable state in accordance with the requirements and rules of operation of outdoor lighting installations, in order to ensure high-quality lighting of streets and highways, as well as energy saving.	Energy	Ministry of Economy, Ministry of Finance, "Uzkommunkhizmat"	CO_2

3.4 PRIORITIZING MITIGATION MEASURES

Currently, the economy of Uzbekistan is going through a phase of structural transformation and modernization in order to change the raw materials orientation and eliminate imbalances in the development of industries and territories. The complex of measures being implemented in the country to mitigate the impacts of climate change includes technical measures to reduce direct greenhouse gas emissions, increase EE of various sectors of the economy, and carbon sequestration in agriculture and forestry.

The main areas of activity are:

- Modernization and renewal of generating capacities and energy-intensive industries and reduction of losses in electrical networks;
- Development and implementation of RES (including hydropower, small hydroelectric power plants, biogas plants, etc.);
- Elimination of natural gas leaks in the oil and gas industry;
- Introduction of energy-saving technologies in industry;
- Limiting emissions and reducing energy consumption in transport;
- Introduction of energy-saving technologies in water management;
- Improvement of the SW management system;
- Expansion of forest areas and improvement of land fertility.

Tables 3.6-3.7 provide an overview of the most significant projects with mitigation actions in the basic sectors of the economy that are completed, underway or planned for the near future with guaranteed financing.

A quantitative assessment of emission reductions was carried out on the basis of information on projects or with the help of expert assessments of consultants representing interested ministries and agencies. For calculations, a standardized baseline for the energy sector of Uzbekistan was used: 0.532 t CO_2-eq/thousand kWh[66] and the MGEK methodology (level 1.2). In some cases, the values of GHG emission reductions were taken from project documents, for CDM projects - from monitoring documents.

Analysis of more than 70 activities carried out for the period of 2010-2017 showed that the main reduction in emissions was achieved in the energy sector (Fig. 3.1).

The most effective measures were in the oil and gas industry, where a number of investment projects were implemented, aimed at utilization of associated petroleum gases and water heat of gas turbine engines at compressor stations, the introduction of the latest mini-power plants to generate electricity for their own needs, automated gas metering systems. Within the framework of seven CDM projects in 9 regions of the country, the reconstruction of medium and low-pressure gas networks was carried out to eliminate the existing methane leaks at the stop valves using modern seals and other expendables.

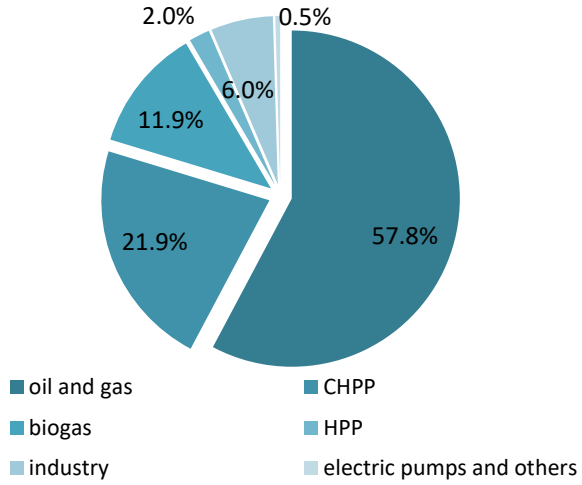

Figure 3.1 *Structure of GHG emission reductions by category of implemented projects*

[66] Clean development mechanism ABS0003 ASB0003Standardized baseline: Grid emission factor for the Republic of Uzbekistan.

On the energy generation side, the reduction of GHG emissions was achieved as a result of improving the energy efficiency of CHPPs and boiler units by upgrading existing condensing power plants, and replacing obsolete power units at CHPPs with modern CCGT and gas turbine units (GTU) (increasing the efficiency of units up to 50-57%). The contribution of alternative energy sources amounted to 14% of the total amount of reduced emissions from implemented projects, of which the share of newly built HPPs and the modernization of existing ones account for 2%, and the construction of biogas plants within the framework of the WB/GEF project made it possible to reduce 1,980 thousand tons of CO_2-eq.

In *industry*, one of the instruments for reducing energy intensity was the project "Improving the Energy Efficiency of Industrial Enterprises", which was implemented jointly with the World Bank Group. The project introduced a mechanism for lending to energy efficiency subprojects (no less than 20%). Enterprises of energy-intensive industries - mining and metallurgical, chemical, oil and gas, electricity, processing, building materials - used IDA loans on concessional terms to purchase modern energy-efficient equipment specific for the production of products.

Building materials industry. In this segment, cement production facilities are the most energy-intensive. During 2012-2016, the volume of cement production in the republic increased by 24%. At the end of 2018, 12 cement plants were engaged in the industry. The capacities of enterprises using the energy-efficient "dry" method of cement clinker production amounted to 64% with a total capacity of 9.6 mln t. By saving natural gas (61 m^3/t), the reduction in GHG emissions is estimated at 714.8 thousand t/y.

Food industry. Based on the results of energy audits carried out at 14 enterprises of the Association of Food Industry Enterprises, projects were developed and implemented to improve energy efficiency and save FER within the framework of the Energy Efficiency Measures Program for 2015-2019, which reduced about 60 thousand tons of CO_2.

Flour industry. As a result of modernization and improvement of energy efficiency of technological equipment at 28 grain processing enterprises of the company, the reduction of GHG emissions amounted to 7 thousand tons of CO_2.

Transport. In the period of 2013-2017, over 181.309 thousand vehicles switched to NGV (natural gas vehicles) fuel by enterprises, organizations and individuals. Currently, the share of gas-powered vehicles has reached 62%. As a result, according to expert estimates, the reduction in emissions of pollutants into the atmosphere amounted to 113 thousand tons, the reduction in GHG emissions - more than 18 thousand tons.

Water management. In Uzbekistan, the volume of electricity used in the pumping irrigation system accounts for 16% of the total electricity consumed by the country. Most of the pumping stations have been in operation for more than 30-40 years and need reconstruction or major repairs. The main energy saving and GHG emission reduction measures in this sector are related to the renovation and modernization of pumping units, electrical equipment on irrigation systems and vertical drainage systems. As a result of the implementation of projects for the reconstruction of existing and construction of new pumping stations, the reduction in GHG emissions amounted to 51 thousand tons of CO_2/year.

Table 3.6 Measures and actions to reduce GHG emissions on power generation side

ENERGY sector
Mitigation measures: Modernization and renovation of generating capacities and electric networks
Goal project: Improve energy efficiency in power generation, improve the reliability of energy supply and mitigate the impact of climate change
Action zone: Reducing CO_2 emissions
Methodologies/assumptions: Modernization of power units and expansion of existing TPPs through the construction of CCGT and GTU reduces the consumption of natural gas required to produce 1 kWh of electricity

	Technologies	Description of mitigation measures	Terms of implementation, stages (years)	Reducing emissions thousand tons CO_2-eq/year	Investor, financing USD mln	Notes
Completed	Construction of CCGT at operating CHPPs	Expansion of the Navoi TPP with the construction of CCGT-1 (478 MW), saving natural gas on average 430.0 mln m^3/year	2010-2012	743.6	FRDRU (Fund for Reconstruction and Development of the Republic of Uzbekistan, NBU, Uzbekenergo JSC	
		Construction of a CCGT unit (370 MW) at the Tashkent TPP, natural gas savings 350.9 mln m^3/year	2012-2015	682.3	State Development Bank of China, JICA, SYNESTA a.s. (Slovakia)	
		Expansion of the Talimarjan TPP (TPP-1) with the construction of 2 CCGT units (450 MW each), natural gas savings of 550.0 mln m^3/year	2010-2017	1,270.0	ADB, JICA (Japan)	PP No.2343 of 05.05.2015
		Expansion of the Navoi TPP with the construction of CCGT-2 (450 MW), saving natural gas on average 829 mln m^3/year	2015-2019	684.1	JICA, FRDRU, Uzbekenergo JSC	
	Modernization of existing power plants	Full-scale modernization of 2 power units (No. 1,2) of the Syr Darya TPP with an increase in capacity by 50 MW	2012-2013	232.1		
		Installation of expander generators at Syr Darya and Talimarjan TPPs (20 MW)	2010-2013	10.8	FRDRU	
		Introduction of a cogeneration GTU (27.15 MW) and a waste-heat boiler (23 MW) at the "Tashkent CHPP" JSC, natural gas savings of 39 mln m^3/year	2009-2013	41.0	NEDO (Japan)	

	Technologies	Description of mitigation measures	Terms of implementation, stages (years)	Reducing emissions thousand tons CO_2-eq/year	Investor, financing USD mln	Notes
At implementation stage	Construction of CCGT	Construction of two CCGT units at Turakurgan TPP (450 MW each)	2014-2020	1,470.0	JICA (Japan), FRDRU, "TPP" JSC	"Roadmap for increasing generating capacities, modernizing electrical networks, improving metering and control of electricity consumption" (PP No.3981 of 23.10.2018)
		Construction of two CCGT units (230-280 MW each) at Takhiatash TPP, saving natural gas on average 488 mln m^3/year	2015-2020	972.2	ADB (300), FRDRU, state budget, "TPP" JSC	
		Construction of two CCGT units (450 MW each) at Talimarjan TPP (TPP-2)	2017-2024	179.6	ADB, EBRD, FRDRU	
	Modernization of existing power plants	Implementation of highly efficient cogeneration gas turbine technologies at Fergana CHPP- (17 MW) and Fergana boiler house (7 MW), saving natural gas on average 2.9 mln m^3/year	2017-2020	0.052	NEDO (Japan)	
		Phased modernization of power units at Syr Darya TPP (additional capacity of 150 MW)	2018-2021	119.9	Vnesheconombank (Russia), commercial bank loans, "TPP" JSC	
	Introduction of EE heating boilers	Replacement of energy efficient 17,251 heating boilers in 6,333 budgetary organizations, natural gas savings of more than 56.5 mln m^3	2017-2021	107.8	State budget funds	PP No.3012 of 26.05.2017
Planned	Construction of CCGT	Construction of two gas turbine units (27 MW each) at the Tashkent CHPP, saving natural gas on average 46 mln m^3/year	2019-2022	87.7	JICA (Japan)	
		Construction of CCGT-3 (650 MW) at Navoi TPP, saving natural gas up to 550-600 mln m^3/year	2020-2024	1,037.8	JICA (Japan)	
		Construction of a new TPP (1,500 MW) in the Syr Darya region using modern CCGT units with an efficiency of more than 60% with a capacity of more than 10 billion kWh/year Saving natural gas over 2.0 bcm/year	2020-2024	4,151.0	Saudi Arabia	PP No.4799 of 10.08.2020
		Construction of a CHPP in the Tashkent region (240 MW) using a CCGT unit with an energy production of 2 billion kWh			AKSA ENERJI ÜRETIM A.Ş.» (Republic of Turkey)	

Mitigation measures: DEVELOPMENT AND IMPLEMENTATION of RES

Goal of the projects: increase the share of energy generation based on RES - implementation of projects for the introduction of RES, construction of new HPPs, modernization and rehabilitation of existing HPPs

Action zone: reduction of CO_2 emissions

Methodologies/assumptions: Use of a standardized baseline for the energy sector of Uzbekistan: 0.532 t CO_2-eq/thousand kWh

	Technologies	Description of mitigation measures	Increase in the production of electricity, (mln kWh/year)	Implementation period	Reducing emissions, thousand tons of CO_2-eq/year	Investor	Notes
Completed	Pilot projects on the introduction of renewable energy	Project "Development of sustainable agriculture and mitigation of the effects of climate change". Construction of 21 biogas units		2013-2018	1,980	WB, GEF According to the report	
		Construction of a solar PVPP (0.13 MW) in Pup district of Namangan region with connection to the unified power system	500-600 kW * h/day	2014	0.125	Ministry of Energy of the Republic of Korea grant	
		Construction of an experimental wind power plant (0.75 MW) in Bostanlyk district		2016	2.1	«XIAN Co.Ltd», Korea	
		Installation of 51 sets of solar collectors in the subdivisions of the Almalyk Mining and Metallurgical Factory		2015	0.320	AGMK (Almalyk Mining and Metallurgical Factory)	
		Construction of a hybrid solar-wind-diesel power plant of JSC "Uzbektelecom"		2015	0.05		UNDP Project "Sustainable Electricity Supply in Rural and Remote Areas"
		Development of a mobile solar power plant (1.2 MW) in Bukhara region		2016	1.2	ERIELL, ENESOL (UEA)	Lukoil's Kandym field project
	Construction of new HPPs	Akhangaran HPP (21 MW), Andijan-2 HPP (50 MW), Gissarak HPP (45 MW), Ertashsay SHPP (2 MW)	324.6	2010-2013	172.7	Specialized Association "Uzsuvenergo"	
		Construction of 2 SHPP (23.4 MW)	111.2	2019	59.2	Eximbank, PRC	

	Technologies	Description of mitigation measures	Increase in the production of electricity, (mln kWh/year)	Implementation period	Reducing emissions, thousand tons of CO_2-eq/year	Investor	Notes
	Modernization of HPPs	Charvak HPP with replacement of impellers (additional 45 MW)	165.4	2017	88.0	FRDRU	
		"Cascade of Shakhrikhan HPPs" at SFC-1 (additional 2.2 MW)	17.6	2019	9.4	IDA (WB) 5.5	
Under implementation	Construction of new HPPs	4 SHPPs (47.51 MW) cascade of Zarchob SHPPs (75.6 MW)	185.3 201.3	2017-2020	205.7	Eximbank, PRC Vnesheconombank, Russia	
		3 SHPPs (25.3 MW)	113.2	2019-2021	60.3	Eximbank, PRC Roseximbank, Russia	
		Nizhniychatkal HPP (76 MW)	282	2017-2023	150,0	Vnesheconombank, Russia	
		Pskem HPP (404 MW)	900	2017-2024	478,8		
		3 SHPPs (25 MW) and 3 micro-HPPs (1 MW)	97	2019-2024	52	ADB	Sustainable Hydropower Project
	Hydroelectric power plant modernization	UE "Cascade of Kadirin HPPs" (HPP-3) up to 15.34 MW UE "Cascade of Nizhniy Bozsu HPPs" (HPP-14) up to 15 MW UE "Cascade of Tashkent HPPs" (HPP-9) up to 16.6 MW branch of "Cascade of Shakhrikhan HPPs" (SFC-2) up to 7.05 MW	124 90.1 95.0 55.1	2017-2020	193.8	Eximbank, PRC	
		Tupalang HPP (175 MW)	467.0	2017-2021	248.4	Vnesheconombank, Russia	
		UE "Farhad HPP" up to 127 MW	531.2	2018-2021	282.6	Vnesheconombank, Russia	
		UE "Cascade of Tashkent HPPs" (HPP-1) up to 6.0MW UE "Cascade of Chirchik HPPs" (HPP-10) up to 29.0 MW UE "Cascade of Samarkand HPPs" (HPP-2B) up to 26.6 MW	44.4 213.8 139.6	2019-2021	211.6	Eximbank, PRC	

	Technologies	Description of mitigation measures	Increase in the production of electricity, (mln kWh/year)	Implementation period	Reducing emissions, thousand tons of CO_2-eq/year	Investor	Notes
	Introduction of solar installations	Introduction of solar PVPPs and solar water heaters at social and administrative facilities of "Kyzylkumcement" JSC and "Uzneftegaz" JSC		2017-2019	0.104	Funds of enterprises and commercial banks	Resolution PP No 012 of 26.05.2017
Planned	Modernization of HPPs	Modernization of HPPs included in the Nizhniy-Bozsu cascade of HPPs: HPP-18 (up to 7.5 MW), HPP-19 (up to 12 MW), HPP-22 (up to 4.7 MW), HPP 23 (up to 17.6 MW))	197,4	Concepts reviews	105.0	EBRD financing	
	RES construction	PVPP (100 MW) in Samarkand region		2017-2021	98.2	"Total Eren", France	
		PVPP (100 MW) in Navoi region		2019-2021	98.2	EBRD, "Masdar"(UAE)	
		PVPP (600 MW) in Surkhandarya, Samarkand, Jizzakh regions		2019 -2023	589.2	Tender	
		Wind farm (400 MW) in Navoi region		2020-2022	400.0	"Masdar" (UAE)	

Mitigation measures: UTILIZATION OF ASSOCIATED PETROLEUM GASES AND REDUCTION OF LEAKS IN THE OIL AND GAS INDUSTRY
Goal of the projects: Reduction of losses during gas transportation and distribution networks
Action zone: reduction of CO_2, CH_4 emissions
Methodologies/assumptions: national expert assessments, monitoring results of CDM projects

	Technologies	Description of mitigation measures	Implementation period	Reducing emissions, thousand tons of CO_2-eq/year	Investor	Notes
Completed	Utilization of APG and LPG	APG utilization with the construction of a booster compressor station at the Severny Shurtan field and HF "Shurtan"	2015	819.526	Funds of "Shurtangaz" LLC	
		Utilization of the LPG fields of the Mubarek oil and gas production department Utilization of the APG fields of the Kokdumalak	2017	1,634.506	«Enter Engineering»	
	Implementation of mini-power plants operating on APG	Generation of up to 4 MW of electricity using the latest mini-power plants (Yangi Karatepa, Turtsari, Sherkent fields, Shurtan booster compressor station site)	2016	11.239	IDA, WB	
		Generation of up to 4 MW of electricity using the latest mini-power plants operating on APG from the Sardob field of the Mubarek oil and gas production department	2016	3.4		
	Reduced leakage	Reduction of natural gas leaks at gas transmission system of "Uztransgaz" JSC		527.5		
		7 CDM projects in 9 regions to reduce leaks in the overhead gas distribution system in gas distribution networks, at compressor stations	2012-2014	6,654.9		
Ongoing	APG utilization	APG utilization at the Sardob field using mini-power plants of "Mubarekneftegaz"	2017-2019	7.5	IDA, WB	
		Utilization of waste gas heat from gas turbine engines (GTE) at the Khojaabad compressor station	2020			

	Technologies	Description of mitigation measures	Implementation period	Reducing emissions, thousand tons of CO_2-eq/year	Investor	Notes
	Gas infrastructure modernization	"Uzbekistan: preparation of investment projects in the field of sustainable energy" Support in the preparation of a number of projects: (i) the Gas Sector Development Program; (ii) Distribution Grid Modernization Program; (iii) Regional transmission and dispatching of energy	2019-2020	undefined	ADB	ADB project: TA 9708-UZB
		Uzbekneftegaz Corporate transformation. Development of a master plan for the development of the gas sector	2018-2020		ADB	ADB project: TA 9565-UZB; TA 9565-UZB (additional)
		Republic of Uzbekistan: Preparation of a project to modernize gas infrastructure in Uzbekistan	2018-2020		ADB	ADB project: TA 9933 Preparation of a project for the implementation of a SCADA system in the gas sector Feasibility study of the pilot SCADA project at the section "Yangier-Khodjaabad

Table 3.7 Measures and actions to reduce GHG emissions on power consumption side

Title	Goals/tasks	Status	Progress indicators Baseline (BL)	Estimated reduction of GHG emissions	Notes
Mitigation measure: reduction of energy losses during power transmission					
PTL project of the North-West region	– Construction of 364 km of PTL-220 kV; – Construction/reconstruction of 3 substations; – Modernization of the planning and automation of the dispatching system for the transmission of electricity.	Completed 2014-2017	Decrease – losses in the power transmission network up to less than 4%. (BL: 2014 5%) – losses of electric power due to PTL disconnection to less than 80 GWh (BL. 2014: 120 GWh)	21.3 thousand t CO_2	Project
Modernization of power equipment of the South-West region (1st, 2nd stage)		Completed 2011-2016	– Increase in electricity supply (GWh/year): from 16,333.0 (BL: 2011) to 22,200.0 (2015)		Project PKM No.18 of 3.02.2015
Modernization and improvement of transmission substations	– Improving the technical efficiency and reliability of power transmission networks; – Rehabilitation of 22 substations.	On-going 2016-2022	– Electricity losses per year in the project area (in%, on order): from 0.71 (BL, 2016) to 0.25 (2022)	undefined	Project PP No3981 of 23.10.2018
Modernization of the Navoi transmission line	– Solving problems in the power supply of industrial, mining enterprises and reducing network losses.	Planned	– Laying of 188.5 km of PTL-500 kV	undefined	Project
Mitigation measure: reduction of energy losses during energy distribution					
Improved electricity metering project	– Improvement of the accounting infrastructure. – Reduction of commercial losses in Tashkent city, Tashkent and Syr Darya regions.	Completed 2012- 2017	– Installation of 1.2 mln units of new electricity metering devices		Project

Title	Goals/tasks	Status	Progress indicators Baseline (BL)	Estimated reduction of GHG emissions	Notes
Implementation of an automated system for accounting and control of electricity consumption. Electricity consumption metering system of 0.4 kW consumers of Bukhara, Jizzakh and Samarkand regions of the Republic of Uzbekistan - AEMCS Phase 1	– Modernization of the accounting system in the regions for all types of consumers.	Ongoing	– Connection to AEMCS – 7 mln consumers, Reducing losses of the national system from 21% (BL: 2010) to 15% by 2020		Project PP No.3981 of 23 October 2018
Energy metering improvement project (Andijan, Fergana, Kashkadarya, Namangan, Surkhandarya) - AEMCS Phase 4	– Modernization of the accounting system in the regions for all types of consumers.	Planned	– By 2021, reduction of losses in electricity distribution from BL: - 2014: from 21.3% to 11.6% in Andijan; from 14.6% to 8.7% in Fergana; from 28.7% to 12.2% in Kashkadarya; from 15.9% to 9.2% in Namangan; from 11.1% to 8.9% in Surkhandarya.		Project
Mitigation measure: Improving energy efficiency of buildings					
Improving the energy efficiency of public buildings	Reducing energy consumption in public buildings by: – improvement of building codes and standards, – demonstration of integrated approaches to building design.	Completed 2009-2016 GEF - 4	– Introduced new building codes considering EE. Optimizing the building structure by creating an efficient thermal envelope, avoiding cold bridges, building location, using solar energy, etc.	9,962 t CO_2/year through two demo projects.	Project
Assistance in the development of construction of energy efficient rural housing in Uzbekistan	– Development of the regulatory framework/financial products ("green mortgages") for large-scale low-carbon housing construction.	Ongoing 2017-2023	– Development, piloting and development of a mechanism for "green" mortgage lending	Undefined	Project

Title	Goals/tasks	Status	Progress indicators Baseline (BL)	Estimated reduction of GHG emissions	Notes
Mitigation measures: Introduction of energy-saving technologies in heat power engineering					
Central Heating (CH) Energy Efficiency Project	– Implementation of a modern CH model; – Improvement of the legal and regulatory framework.	Ongoing 2018-2024	– Improving energy efficiency and quality of heating and hot water supply services for more than 240 thousand residents of apartment houses in 5 cities	by 2024 765 thousand tons CO_2	Project
Centralized heat supply of the city of Tashkent - TASHTEPLOCENTRAL project	– Increase in EE by installing new cogeneration turbines, additional gas turbines and gas piston units at CHPP-4 on existing boilers.	Planned	– Energy savings ≈100 GWh/year – Reducing water consumption	55 thousand tons CO_2/year	Project
Central heating Tashkent - TASHTEPLOENERGO project	Increase in EE heat consumption of heat supply as a result of: – replacement of pipes, modernization and replacement of pumping equipment of the CH network; – installation of a number of separate heating units; – installation of heat meters and solar energy systems, with a generation of ≈12 GWh/year.	Planned	– Reduction of gas consumption by 38 mln m3/year – Reducing water consumption	86 thousand tons CO_2/year	Project
– Mitigation Measures: Implementation of Energy Saving Technologies in Industry					
Improving energy efficiency of industrial enterprises in Uzbekistan. Phase 1, 2	– Implementation of 82 investment projects at 32 enterprises for the introduction of EE equipment and technologies with a target indicator of e/saving at the level of 20%	Completed 2018	– Savings per year 505 mln kWh of electricity and 187.7 mln m3 of natural gas	627 thousand tons of CO_2/year	Project
Improving the energy efficiency of industrial enterprises. Phase 3	– Credit lines to industrial enterprises are available for the introduction of energy efficient equipment –	Ongoing 2018-2023	– Target: energy savings of 20%	Undefined	Project (IBRD WB)

Title	Goals/tasks	Status	Progress indicators Baseline (BL)	Estimated reduction of GHG emissions	Notes
Modernization and increase of energy efficiency of technological equipment of grain processing enterprises of JSC "Uzdonmakhsulot"	– Technical re-equipment due to the installation of EE equipment at the mills of 20 flour mills	Completed 2015-2019	– Saving energy consumption 13.3 mln kWh	7 thousand tons of CO_2/year	Resolution PKM No.2343 of 05.05.2015
Green Economy Financing Mechanism in Uzbekistan - Ipak Yuli	– Loan funds will be used for investments in the development of a green economy.	Ongoing 2018	– Provision of a first priority loan to 13 projects		Project
On additional measures to reduce the dependence of economic sectors on fuel and energy products by increasing the energy efficiency of the economy and using available resources	– Approved target parameters for saving fuel and energy resources at 25 large energy-intensive enterprises of economic sectors	Ongoing 2020-2022	– by 2022 saving 3.3 billion kWh of electricity/energy, 2.6 bcm of natural gas, 6.5 thousand tons of oil products	6,776.3 thousand t CO_2/year	Resolution PP No.4779 of 10.07.2020
Mitigation measures: Introduction of energy-saving technologies in water management, Modernization and improvement of technical condition and pumping stations, reduction of energy consumption for water delivery					
Project "Thorough renovation of Karshi cascade of pumping stations. Phase III"	– Improving the water supply of irrigated lands on an area of 402 thousand hectares	2017-2019	– Energy saving 90 mln kWh	47.880 thousand tons CO_2-eq/year	Project PP No.2977 of 19.05.2017 PP No.4170 of 9.02.2019
Projects for the reconstruction of 8 pumping stations in Navoi and Andijan regions and the construction of a station in Kashkadarya region	– Improving the water supply of irrigated lands on an area of 59.2 thousand hectares	2012-2019	– Energy saving 2640 thousand kWh	1.4 thousand tons CO_2-eq/year	Projects
2 projects for the construction and rehabilitation of pumping stations in Bukhara region	– Improving the water supply of irrigated lands on an area of 75.33 thousand hectares	2010-2013	– Energy saving 5.7 mln kWh	3.3 thousand tons of CO_2-eq/year	Projects

Title	Goals/tasks	Status	Progress indicators Baseline (BL)	Estimated reduction of GHG emissions	Notes
South Karakalpakstan Water Management Improvement Project	– Modernization of irrigated agricultural production and irrigation network - restoration of irrigated areas by 89 thousand hectares by 2021.	Ongoing 2014-2021	– from 2016 to 2021 – reduction of annual government expenditures and WCA costs for pumps by 80%. – power consumption by 60 thousand MWh	31.92 thousand tons CO_2-eq/year	Project PP No.2324 of 24.03.2015
Amu Bukhara Irrigation System Rehabilitation Project	– Provision of sustainable and reliable water supply on the territory of 250 thousand hectares and provision of drinking water to 725 thousand people.	Ongoing 2013-2020	– Construction of 1 new pumping station. Modernization and rehabilitation of 4 existing ones	178.1 thousand CO_2-eq/year	Project PP No.2396 of 25 August 2015
Rehabilitation of the main irrigation canals of the Tashsakinsky system of Khorezm region		Ongoing 2013-2019			Project
Introduction of energy efficient pumps and electric motors in pumping stations of water management organizations of the Ministry of Water Resources of the Republic of Uzbekistan	– Replacement of 879 pumps and 1523 electric motors is envisaged	Ongoing 2017-2021	– Energy savings 807.3 mln kWh	429.5 thousand tons	Resolution PP No.3012 of 26.05.2017
Mitigation measure: Limiting emissions and reducing energy consumption in transport					
Reducing GHG emissions by transferring 74 thousand vehicles to gas fuel (LNG and LPG)		Completed		18 thousand tons of CO_2/year	Environmental Protection Program 2013-2017
Railway Efficiency Improvement Project	– Supply of 24 modern electric locomotives, modernization of the locomotive depot in Tashkent	Ongoing 2019-2025		900 thousand tons of CO_2/year	Project

Title	Goals/tasks	Status	Progress indicators Baseline (BL)	Estimated reduction of GHG emissions	Notes
Mitigation measure: Improved solid waste management (SWM)					
Solid Waste Management Improvement Project	– SWM system rehabilitated and expanded in Tashkent – Enhanced operational capacity – National SWM Strategy	Ongoing 2013-2019 (revised until 2021)	– Modernization of the SWM system in Tashkent. – Disposal of 3 mln tons of SW in accordance with international standards, with a production capacity of 1,950 t/day	undefined	Project
Sustainable Solid Waste Management Project	– Updating the SWM legal framework – Strengthening Clean Area's (Toza Hudud) asset base and improving collection services through the provision of vehicles, equipment and physical infrastructure	2020-2025	By 2024 from BL: 2019 – an increase by 6 mln consumers; – increasing the collection of solid waste in 13 regions from 5,000 tons/day to 7,500 t/day; – customer satisfaction from 63% to 80%	undefined	Project
Mitigation measure: Expanding forest areas and improving land fertility					
Sustainable management of forests and pastures in dryland ecosystems in Uzbekistan	– Demonstration of LDN approach and scaling up SLM/SFM practices in Bukhara-Navoi landscape	2020 - 2025	Quantity (ha) under SLM meeting LDN criteria: – 25 thousand hectares of irrigated agricultural land; – 100 thousand hectares of forest land; – 100 thousand hectares of pastures – 13 thousand hectares of reclaimed land – 1000 beneficiaries received direct benefits	Carbon sequestration - 5.1 mln t CO_2-eq	Project
Sustainable forest management in mountain and valley regions of Uzbekistan	– Development of an information management system for SFM. – Multifunctional forest management	2018-2023	SFM will be deployed in 4 demonstration sites, delivering sustainable benefits such as carbon sequestration and improved livelihoods for at least 500 local households	Sequestration 4.1 Mt CO_2-eq over 20 years or 206.021 t CO_2-eq/year Mitigateion potential - 2.4 t CO_2-eq/ha per year	Project

Table 3.8 Measures to reduce GHG emissions on power generation side ("AMBITIOUS" scenario)

Goal: Increasing the share of RES in the structure of electricity generation; improving energy efficiency, reducing leaks in the oil and gas industry			
Description of mitigation measures	**Period**	**Reducing emissions mln t CO_2-eq/year**	
Implementation of - 6 projects for the construction of new TPPs (3.8 thousand MW) - 6 projects to expand existing TPPs through the construction of CCGT, GTU with an increase in capacity by 4.1 thousand MW. Saving natural gas - 4.1 billion m^3, fuel oil - 154 thousand tons	2020-2030	8.5	"Concept of providing the Republic of Uzbekistan with electric energy for 2020-2030"
Construction of 35 HPPs with a total capacity of 1,537 MW and modernization of 27 existing hydropower plants with a capacity increase of 186 MW. Additional generation of 6.6 billion kWh	2020-2030	1.9	
Construction of solar PVPPs with a total capacity of 5 GW with a production of 9.9 billion kWh/year	2020-2030	5.2	
Construction of wind power plants (WPP) with a total capacity of 3 GW, with an output of 8.6 billion kWh per year	2020-2030	4.6	
NPP construction - 2.4 thousand MW Production 18.0 billion kWh/year, natural gas savings 3.7 billion m^3	2022-2028	7.1	
Reducing fugitive emissions in the oil and gas sector	2021-2030	1.0	Expert estimates
Total emission reduction potential		**28.3 mln t CO_2-eq**	

Table 3.9 Measures to reduce GHG emissions on power consumption side ("AMBITIOUS" scenario)

Description of mitigation measures	Years	Goals	Methodologies/assumptions	Reduction of GHG emissions t CO_2-eq	Notes
Industrial processes					
Reducing nitrous oxide emissions from nitric acid production	2020-2030			2 mln	Within NACAG
Introduction of dry cement production lines	2020-2025		Emission reductions have been estimated taking into account energy savings of natural gas and electricity	2 mln	Draft Concept for the development of the building materials industry for the period up to 2025
Transport					
Transport	2020-2030			2.5 mln	Expert assessments
Water and agriculture					
Modernization and reconstruction of pumping stations	2020-2030	Replacement of outdated pumps and electric motors with energy-saving ones; The use of RES at pumping stations.	Reducing the annual electricity consumption of pumping stations by 2 billion kWh	1.1 mln	Concept for the development of water management for 2020-2030
Reducing emissions in agriculture	2020-2030	Reduction of GHG emissions in agriculture by 50% from the level of 2016	Improving the structure of the fleet of specialized equipment and the efficiency of its use; the use of EE technologies in greenhouses	7.8 thousand	Agriculture Development Strategy of the Republic of Uzbekistan for 2020-2030

Description of mitigation measures	Years	Goals	Methodologies/assumptions	Reduction of GHG emissions t CO_2-eq	Notes
Energy efficiency in buildings					
Buildings: Introduction of new building codes in public buildings	2020-2030	Introduction of new building codes in public buildings	Reducing energy consumption	155.7 thousand	Evaluations of the "Energy Efficiency in Public Buildings" project
Buildings: Transfer of a part of multi-storey buildings to a closed heat supply system and to local boiler houses	2020-2030	Reduction of heat energy losses		0.7 mln	UNDP "Towards Sustainable Energy. Low-carbon development strategy of the Republic of Uzbekistan", 2015.
Energy efficient lighting in the residential sector	2020-2030	As of 01.01.2017, the use of incandescent power over 40 W is prohibited on the territory of the country.	As a result of replacing 2 lamps with EE lamps by 5.5 mln consumers. Energy savings will amount to 1.9 billion kWh per year	1.0 mln	Expert assessments
Improving energy efficiency of household electrical appliances	2020-2030	As of 01.01.2016, new EE requirements for household electrical appliances sold in the country have been introduced.	Annual energy savings potential per household: TV - 100-110 kWh/year, refrigerators - 130 to 170 kWh/year The total potential is 1,500 GWh/year.	800 thousand	
Total emission reduction potential excluding sequestration				**10.1 ml t CO_2-eq**	

Description of mitigation measures	Years	Goals	Methodologies/assumptions	Reduction of GHG emissions t CO_2-eq	Notes
Forestry					
Creation of forest plantations on the drained bed of the Aral Sea	2017-2020	On an area of 20 thousand hectares	Carbon sequestration	65.4 thousand	State program for the development of the Aral Sea region for 2017-2021
Increase in the area of protective belts and forest plantations on the lands of the forest fund	2020-2024	By 2024, the creation of 558,993 hectares of forest plantations on the lands of the forest fund in various regions of the country; 12,020 hectares of plantations for protection from water and wind erosion of agricultural land and reclamation structures	Carbon sequestration	1,962.5 thousand	Forestry development program for 2020-2024
Creation of forest plantations on an area of 1.2 mln hectares of the drained bed of the Aral Sea.	2018		Carbon sequestration	3,921.9 thousand	State program to eliminate the consequences of the drying up of the Aral Sea
Total potential for absorption of emissions by forest areas				**5.9 mln t CO_2-eq**	

3.5 GREENHOUSE GAS EMISSIONS FORECASTS UNTIL 2030

For assessment of GHG emissions in perspective up to 2030, three scenarios were developed using the target indicators of sectoral programs and strategies, development trends of the main sectors of the country's economy, international and national expert forecasts of macroeconomic indicators:

1. "Inertial". Accepted assumptions: the growth rate of GHG emissions remains at the current level, energy consumption in the sectors of the economy grows in proportion to the growth of GDP and population. This option does not imply the implementation of additional measures to reduce greenhouse gas emissions.
2. "Realistic". Accepted assumptions: involves the implementation of mitigation measures included in sectoral programs or priority projects that are under implementation or planned for the near future and secured with funding. The growth rates of GHG emissions are decreasing due to the diversification of the fuel consumption structure, reduction of natural gas consumption and an increase in the share of renewable energy sources in energy generation.
3. "Ambitious". Accepted assumptions: a decrease in the growth rate of GHG emissions can be achieved as a result of the development of a "green economy", increasing energy efficiency, and realizing the maximum potential for reducing greenhouse gas emissions in the production, distribution and consumption of energy. This option can be implemented with significant financial support from IFIs.

Methodology. For the calculations, the GHG Abatement Cost Model (GACMO) [67] was used, which makes it possible to estimate the projected GHG emissions by the main sectors and categories of the IPCC, adapted to national conditions.

Model calculations of GHG emissions were carried out on the basis of:

- the results of the GHG inventory (1990-2017);
- data on current and projected consumption of fuel and electricity in key sectors of the economy;
- macroeconomic indicators (GDP and population growth).

The scenarios use the following assumptions about the growth rates of the main macroeconomic indicators for the period 2017-2030. The projected GDP growth rates are selected based on the analysis of strategic documents and the Action Program of the Cabinet of Ministers for the short and long term. [68] The forecast for the annual population growth was adopted in accordance with the report of the UN Department of Economic and Social Affairs "Prospects for the world population for 2019" (UN projection variant "Above 80%").

According to the recommendations for using the GACMO model, 2017 was adopted as the base year - the last year of the current GHG inventory.

Capacity assessment. For key sectors of the economy, estimates of the potential for reducing GHG emissions were made, which were used to calculate projections of GHG emissions under the "Realistic" and "Ambitious" scenarios.

For the "Realistic" scenario, the potential emission reductions were estimated as a result of the completion of activities with guaranteed funding, which are in the process of implementation or are priority projects and are planned for the near future.

Based on the analysis of development programs and a portfolio of investment projects, consultations with national experts, a list of projects was formed, the implementation of which will reduce GHG emissions, and estimates of emission reductions were made. The results are presented in tables 3.6, 3.7.

[67] The Greenhouse Gas Abatement Cost Model has been developed through more than 20 years of research through a partnership between UNEP and the Danish Technical University (DTU) and is used by a number of countries to calculate emission projections https://unepdtu.org

[68] Speech by Prime Minister A. Aripov at a joint meeting of the Legislative Chamber and the Senate of the Oliy Majlis of Uzbekistan https://www.gazeta.uz/ru/2020/01/21/prime-minister/ (21.01.2020)

According to the estimates obtained, in the Energy sector, the implementation of projects for the construction of modern energy-efficient CCGT and GTU will lead to savings in natural gas and will reduce 8.1 mln t CO_2/year. Implementation of projects for the development and implementation of renewable energy sources - modernization and rehabilitation of existing hydroelectric power plants, construction of new hydroelectric power plants, solar power plants, wind power plants and biogas plants - will increase the share of "clean" energy generation, which will reduce GHG emissions by 1.84 mln t CO_2/year.

The potential of measures to improve the energy efficiency of heat supply is estimated at 0.9 mln t CO_2/year, measures to save fuel and energy resources in the main sectors of the economy - 6.8 mln t CO_2.

In the water sector, modernization and improvement of the technical condition of pumping stations will reduce energy consumption for water delivery and will reduce 0.6 mln t CO_2/year. In the transport sector, within the framework of the project to improve the efficiency of railways, emissions will be reduced by 0.9 mln t CO_2/year.

The use of LDN approaches and sustainable forest and pasture management practices in dryland ecosystems in mountainous and valley areas will lead to carbon sequestration. The potential for CO_2 sequestration by 2030 is estimated at 2.7 mln t CO_2/year.

According to the results of estimates, the total potential for reducing GHG emissions is 21.4 mln t CO_2-eq.

For the "Ambitious" scenario, the potential assessments were carried out based on the target indicators of strategies and concepts for the development of backbone sectors of the economy[69], that is, mitigation measures and actions with a relatively high degree of uncertainty for implementation, which are planned for the future, but have not yet been funded (Tables 3.8, 3.9).

Electricity production. The Ministry of Energy, together with the relevant ministries and agencies, as well as with the technical assistance of the IFIs (World Bank, Asian Development Bank), has developed[70] a "Concept for providing Uzbekistan with electricity for 2020-2030." [71] According to the document, it is planned to change the structure of generating capacities and almost double the generation of electricity by 2030.

The concept provides for the modernization and reconstruction of existing power plants, construction of new ones using energy efficient technologies, improvement of electricity metering systems; construction of the first nuclear power plant (NPP) in the republic; development of RES, especially solar energy, as well as legal reforms to improve tariff policy and ensure the transition to the wholesale market.

Oil and gas industry. Currently, the Concept for the Development of the Oil and Gas Industry of the Republic of Uzbekistan until 2030[72], is being developed jointly with international consulting companies and financial institutions. The priority tasks for the development of the industry in perspective are assumed to be:

- an increase in the production of hydrocarbon raw materials, including natural gas - up to 42.3 billion m^3 and liquefied gas - up to 1.5 mln t in 2024, ensuring full satisfaction of the needs of economic sectors and the population, as well as the company's profitability;
- development of the transit potential of the gas transmission system through the construction and reconstruction of gas pipelines and compressor stations, increasing the storage of natural gas in underground gas storage facilities;

[69] The concept of providing the Republic of Uzbekistan with electric energy for 2020-2030. https://minenergy.uz/ru/lists/view/77 (approved by the Government in May, 2020)

[70] PP No.4249 of 27.03.2019 "On the Strategy for the Further Development and Reform of the Electricity Industry of the Republic of Uzbekistan".

[71] https://minenergy.uz/ru/news/view/534

[72] PP No.4388 of 9 July 2019 "On measures for the stable provision of the economy and the population with energy resources, financial recovery and improvement of the oil and gas industry management system".

- introduction of a monitoring and control system for natural gas flows (SCADA) and automated control systems at high-pressure gas distribution stations;
- reduction of losses of natural gas during its supply to consumers through the modernization and reconstruction of existing gas distribution points and networks;
- introduction of an automated system for monitoring and accounting for natural gas for all categories of consumers until 2022;
- stage-by-stage transfer of gas supply facilities to private operators for the implementation of functions for the operation of gas distribution networks and associated equipment, as well as the sale of natural gas to consumers on the basis of a public-private partnership;
- implementation of international standards and reporting systems in the management of the industry.

Given that a number of measures were implemented in the industry, which led to a significant reduction in leaks during gas transportation, the potential for reducing fugitive emissions in the future, according to experts, is 1 mln t CO_2-eq.

Industrial processes. One of the target indicators of the "Strategy for the transition to a green economy" is energy savings in the most energy-intensive industries, for example, in the mining, chemical, mechanical engineering, production of building materials, can be about 20%, due to the modernization of production, the introduction of modern technologies and other measures for increasing energy efficiency and energy saving.

In terms of reducing greenhouse gas emissions, the most significant are the building materials industry and the chemical industry.

In the meantime, the "Concept for the development of the building materials industry for the period until 2025"[73] has been developed, the implementation of which will allow by 2022 to completely abandon the lines of the "wet" method and bring the capacity of the "dry" method to 100% of the total capacity that has been achieved about 20 mln t. This measure will provide a relative gas savings of 35-40% per ton of cement from the current level of consumption and reduce emissions in the industry by 2 mln t CO_2.

In the chemical industry in Uzbekistan, the total capacity for the production of nitric acid is 1.2 mln t/year. Nitrous oxide emissions from this sector account for 16% of the industry's emissions. Uzbekistan's joining the Nitric Acid Climate Action Group (NACAG) Initiative will reduce nitrous oxide emissions by 2 mln t CO_2 eq[74] .

Transport. Further development of the economy of Uzbekistan involves the growth of the transport sector, and the introduction of advanced, innovative technologies:

- production of motor fuel, automobile and other equipment that meet the environmental classes "Euro-3", "Euro-4" and "Euro-5";
- transition to the transportation of up to 50% of goods by rail on electric traction;
- use up to 40-50% of hybrid, electric and other vehicles.

On the one hand, the development of the sector involves an increase in the number of vehicles, on the other, the implementation of the above measures will allow, according to expert estimates, to restrain the growth of GHG emissions and achieve their reduction by 2.5 mln t CO_2-eq.

Buildings. The Buildings sector is one of the largest energy consumers in Uzbekistan. It should be noted that in recent years, as a result of the strengthening of the state energy-saving policy, energy consumption in buildings has

[73] https://regulation.gov.uz/ru/document/4086
[74] GIZ assessments.

decreased by 5-10%. According to UNDP / GEF project estimates, the introduction of new building codes, taking into account energy efficiency, will lead to an indirect reduction in emissions of 155.8 thousand tons of CO_2/year[75]. Transfer of a part of multi-storey buildings to a closed heating system and to local boiler houses will reduce GHG emissions by 0.7 mln t CO_2 eq[76].

As of 01/01/2017, the use of incandescent lamps with a power of more than 40 W is prohibited in the country and the sale has been discontinued. (PKM No.299, 2015 "On measures to expand the domestic production of energy-saving lamps"). According to calculations, the reduction of CO_2 emissions will amount to about 1 mln t CO_2.

As of 01.01.2016, new requirements have been introduced for labeling the energy efficiency of household electrical appliances sold in the country. The situation in Uzbekistan is characterized by a high level of provision of households with the most energy-intensive electrical appliances: televisions, refrigerators and washing machines. The largest shares in imports are occupied by air conditioners, refrigerators, televisions and electric heating devices. Their imports and volumes of local production also showed a noticeable increase. As the calculations show, in Uzbekistan, the energy-saving potential in the case of using the best available technologies for refrigerators and televisions is about 1,500 GWh/year, the estimated reduction in CO_2 emissions is 800 thousand tons/year.

Agriculture. The potential for energy saving and reduction of GHG emissions in agriculture is associated with:

- improving the structure of the fleet of specialized agricultural machinery, increasing the efficiency of its use;
- with the expansion of the use of lightweight machines and mechanisms for individual use;
- using modern technologies in the greenhouse industry.

According to the "Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030"[77] by 2030, it is planned to reduce greenhouse gas emissions of agricultural origin by 50% from the level of 2016 and will amount to 15.7 thousand tons of CO_2-eq., i.e., it will decrease by 7.8 thousand tons of CO_2-eq.

Water resources. The main technical measures to reduce GHG emissions are associated with the renewal of obsolete equipment and the reduction of energy consumption at pumping stations for pumping irrigation through the use of energy-efficient pumps.

The Concept for the Development of Water Resources for 2020-2030 provides for a reduction in the annual electricity consumption of pumping stations by 2 billion kWh by 2030. At the same time, the possible reduction of GHG emissions is estimated at 1.13 mln t CO_2-eq.

Forestry. Afforestation and reforestation are some of the most effective climate change mitigation measures, as forests are the main sink for GHGs. Within the framework of the Forestry Development Program for 2020-2024, it is planned to create 558,993 hectares of new forests on the lands of the state forest fund, including in the territories of deserts and steppes in various regions of the country; restoration of 12,020 hectares of protective plantations to protect agricultural land and reclamation structures from water and wind erosion. Since December 2018, the State Program has been implemented to eliminate the consequences of the drying up of the Aral Sea. During this time, protective forest plantations with an area of 1.2 mln hectares have been created on the dried bottom of the Aral Sea.

The reproduction of forests, the rational use of forest lands, the organization of protective plantations will allow increasing the potential for CO_2 sequestration by 5.9 mln t CO_2 by 2030.

Thus, the maximum potential for reducing GHG emissions is 38.4 mln t CO_2-eq, excluding the absorption of CO_2 by forest plantations.

[75] GEF/UNDP. Improving Energy Efficiency of Buildings in Uzbekistan: Reform Directions and Expected Effects. - Tashkent, 2014.
[76] UNDP "Towards Sustainable Energy. Low-carbon development strategy of the Republic of Uzbekistan", 2015.
[77] UP No.5853 of 23.10.2019 "On approval of the strategy for the development of agriculture of the Republic of Uzbekistan for 2020 - 2030".

Estimates under the Realistic Scenario demonstrate a decrease in total GHG emissions by 2030 by about 16% relative to the Inertial Scenario.

The ambitious scenario allows containing GHG emissions (growth by 2030 is predicted to be about 18% relative to 2017), subject to the realization of the maximum potential for reducing GHG emissions, laid down in the approved and considered strategies, long-term programs and projects. Emission reductions in comparison with the Business-as-usual scenario in 2025 and 2030 could be 10% and 24%, respectively.

The upward trend in GHG emissions by 2030 under all scenarios is explained by the following factors:

- further development of energy-intensive sectors of the economy (transport, industry, construction);
- an increase in the population and an increase in the level of its well-being;
- increasing agricultural production, strengthening export potential and ensuring food security;
- an increase in the production and processing of fossil fuels (natural gas, coal, oil).

The relatively small values of the projected increase in total emissions indicate that the country pays great attention to the issues of energy efficiency and energy conservation, which is reflected in the implemented and developed state and sectoral strategies, programs and projects.

Thus, all considered scenarios assume an increase in total GHG emissions relative to the 2017 level by 15-20% by 2025 and by 18-42% by 2030. The calculation results for all three scenarios are summarized in Tables 3.10-3.12 and Fig. 3.2.

Table 3.10 Forecast of total GHG emissions for the period up to 2030.

Forecast scenario	GHG emissions, mln t CO_2-eq.				Change in GHG emissions, % to 2017.		
	2017	2020	2025	2030	2020	2025	2030
Inertial	189.8	207.5	237.4	269.6	9%	25%	42%
Realistic		205.5	225.7	248.1	8%	19%	31%
Ambitious		204.0	218.5	223.1	7%	15%	18%

Source: expert assessments

Table 3.11 Forecast of GHG emissions by sector, mln t CO_2-eq

Scenarios, sectors	2017	2020	2025	2030
Inertial				
Energy	145.0	159.4	182.7	207.1
Industrial processes and product use	8.5	8.9	9.6	10.4
Agriculture, forestry and other types of land use*	33.7	36.6	42.0	48.4
Waste	2.7	2.7	3.0	3.6
Amount excluding forestry and other types of land use	189.8	207.5	237.4	269.6

Tabl 3.11 cont.

Scenarios, sectors	2017	2020	2025	2030
Realistic				
Energy	145.0	157.4	171.0	185.6
Industrial processes and product use	8.5	8.9	9.6	10.4
Agriculture, forestry and other types of land use *	33.7	36.6	42.0	48.4
Waste	2.7	2.7	3.0	3.6
Amount excluding forestry and other types of land use	189.8	205.5	225.7	248.1
Ambitious				
Energy	145.0	155.8	163.9	160.6
Industrial processes and product use	8.5	8.9	9.6	10.4
Agriculture, forestry and other types of land use *	33.7	36.6	42.0	48.4
Waste	2.7	2.7	3.0	3.6
Amount excluding forestry and other types of land use	189.8	204.0	218.5	223.1

* excluding forestry and other types of land use

Table 3.12 Forecast of GHG emissions by gases*, years

Scenarios, gases	2017	2020	2025	2030
Inertial				
CO_2	103.4	115.1	133.6	152.7
CH_4	75.2	80.5	90.4	101.9
N_2O	11.2	12.0	13.4	15.0
Amount excluding forestry and other types of land use	189.8	207.5	237.4	269.6
Realistic				
CO_2	103.4	113.1	121.9	131.2
CH_4	75.2	80.5	90.4	101.9
N_2O	11.2	12.0	13.4	15.0
Amount excluding forestry and other types of land use	189.8	205.5	225.7	248.1
Ambitious				
CO_2	103.4	114.8	123.9	121.8
CH_4	75.2	77.2	81.2	86.3
N_2O	11.2	12.0	13.4	15.0
Amount excluding forestry and other types of land use	**189.8**	**204.0**	**218.5**	**223.1**

* excluding forestry and other types of land use

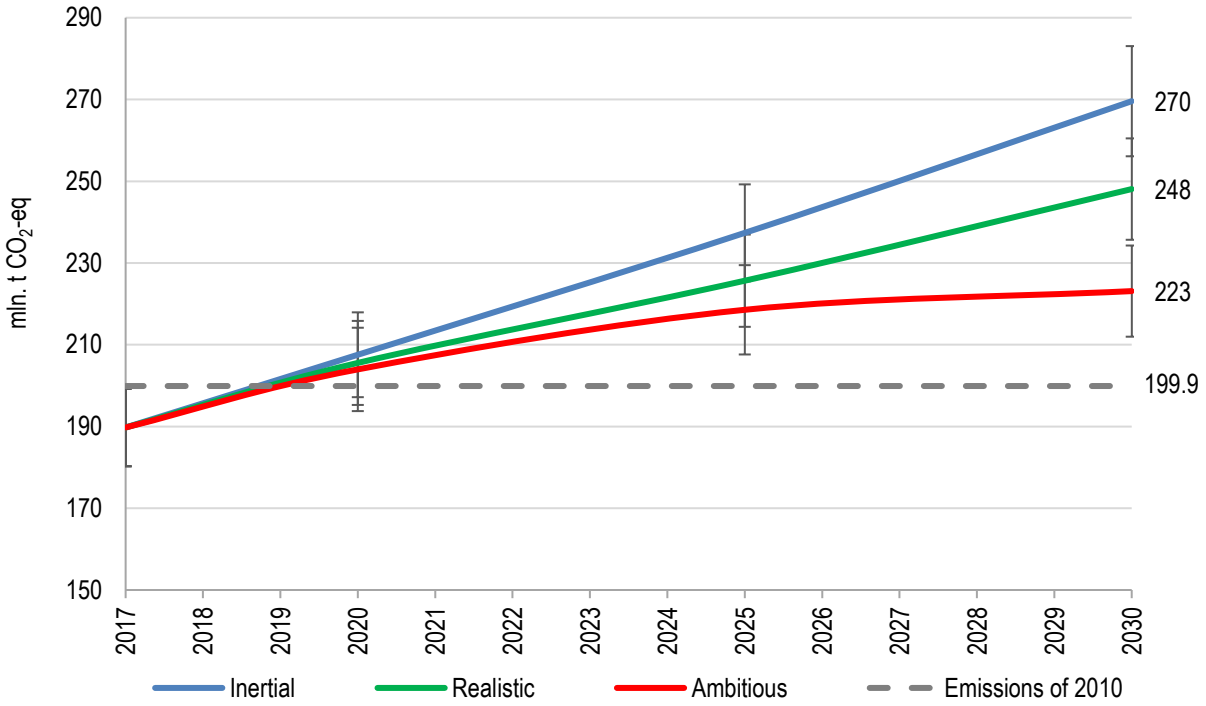

Figure 3.2 *Forecast of GHG emissions until 2030*

4 FINANCIAL RESOURCES AND TECHNICAL SUPPORT, TECHNOLOGY TRANSFER, CAPACITY BUILDING

4.1 INFORMATION ON RECEIVED FINANCIAL AND TECHNICAL SUPPORT

Achieving the long-term goal of Uzbekistan on the PA assumes support from international organizations and financial institutions, ensuring access to advanced energy-saving and environmentally friendly technologies, resources for climate finance. Financial support for activities related to climate change directly depends on the investment conditions of the country. Since 2017, the government of Uzbekistan has been implementing reforms aimed at removing barriers and improving the investment environment. As a result, there is a significant increase in the inflow of financing, which indicates an improvement in the characteristics of the investment climate, as well as the development of interest in the economy of Uzbekistan by investors. International development organizations are seeking to restore or expand their presence in Uzbekistan. This is evidenced by the return to the country of the European Bank for Reconstruction and Development (EBRD) in 2017.

According to the review presented in the Joint Report on Multilateral Development Banks' Climate Finance 2019, which includes an analysis of the activities of the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Islamic Development Bank (IsDB) and The World Bank Group (WBG), the volume of climate finance for the economy of Uzbekistan (overall financial support for mitigation and adaptation actions) has increased by about 4 times since 2017.

International institutions and foundations provide Uzbekistan with various types of financial or in-kind support in one or several areas: (i) scoping and project preparation, (ii) creating an enabling environment and building institutional capacity, (iii) implementing a project or program, (iv) compliance with the requirements of the UNFCCC. Financial instruments used include grants, loans, output-based credit lines.

Details of the support for mitigation received from bilateral and multilateral sources from 2015-2018 and the type of grants and loans are presented in Tables 4.5-4.6. The tables provide a list of projects active during this period and the corresponding data on donors/implementing agencies/local partners, financial resources, main results. The list of projects is not exhaustive, however, it contains information about the main sources of funding for the fight against climate change. As the process for assessing financing for the climate component is currently not agreed and formalized properly, Table 4.6 provides information on the total project cost and the total loan amount.

Grants received from international organizations are intended for capacity building, technical support, technology transfer (Table 4.1). Summarized information on donors and areas of project implementation is provided in Table 4.2. The total budget of projects on a grant basis is estimated at $ 69.4 mln. The main sources of funding are the Global Environment Facility (GEF), which operates through UN executive agencies, IDA funds, the World Bank Group's IBRD, Climate Change Fund and Clean Energy Fund under the Asian Development Bank's Clean Energy Partnership. They account for over 80% of the aid received. The main efforts were focused on promoting energy efficiency, developing clean energy, sustainable forest management, cross-sectoral synergy of mitigation measures with other development goals, for example, developing a sustainable rural housing market, etc.

Table 4.3 contains information on the main financial flows that were generated with the involvement of bank loans and loans from IFIs provided to the government on various concessional terms for the implementation of projects containing components directly aimed at reducing GHG emissions and mitigating the effects of climate change.

Table 4.1 *Information about grant support received from international organizations*

Donor	Energy EE	Energy Development of RES	Agriculture	Forestry	Inter-sectoral	Capacity building	Total (mln.USD)
GEF/UNDP/FAO/UNEP	3.3		2.5	21.9	5.4	1.5	34.6
WB Group					12.8	2.0	14.8
ADB	3.8	7.3					11.1
EU (EBRD, Germany)	0.6					0.3	0.9
UNFCCC AF			5.2				5.2
UNDP						1.2	1.2
Republic of Korea		0.7				0.6	1.3
IFAD			0,3				0,3
Total (mln USD)	**7.7**	**8**	**8**	**21.9**	**18.2**	**5.6**	**69.4**

Table 4.2 *Information on funding received from IFIs*

IFI	Energy, EE	Energy, Development of RES	Water resources	Agriculture	Waste	Transport	Inter-sectoral	Total (mln .USD)
ADB	1700.3		325.7		69.0	80.0		2,175.0
WB/IBRD + IDA	776.5		359.8	800.0		195.0	0	2,131.3
Eximbank (PRC)		364.2				350.0		714.2
CSDB (PRC)	220.0							220.0
Vnesheconombank (RF)	55.8	240.8						296.6
JICA (Japan)	292.0							292.0
NEDO (Japan)	49.6							49.6
EBRD	240.0							240.0
IFAD				46,2				46.2
SFD							43.2	43.2
Slovakia	69.0							69.0
Total (mln USD)	**3,403.2**	**605**	**685.5**	**846.2**	**69**	**625**	**57.2**	**6,277.1**

Table 4.3 *Participation of Uzbekistan in regional projects on a grant basis*

Project	Years	Donor	Grant	Partners	Notes
Central Asia Hydrometeorological Services Modernization Project (PMHMS CA)	2012-2018	WB		EC IFAS, NHMS CA	Modernization of the WMO Regional Meteorological Center (RMC) to improve information exchange capabilities between the CA NMHS communication centers
Central Asia Sustainable Energy Program (CASEP) Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	2013-2016	EC	€ 332 thoussand	GIZ GFA State Ecology Committee	Identification of policy documents of priority sectors for the promotion of RES and improvement of EE; Capacity building for the use of best practices on EE and RES.
Capacity Building and Strategic Framework Development to Support Low Carbon Development in Central Asian Countries Tajikistan, Turkmenistan, Uzbekistan	2015	UNEP	$ 52,4 thousand	Republic of Korea IIEC Ministry of Energy of Thailand China Quality Mark Certification Group Product Certification Co., Ltd UNDP RK UNESCAP	Regional Study "Evaluation of EE of Household Electrical Appliances in Central Asia and Policy in the Field of Energy Consumption Standards and Labeling" Capacity building in energy labeling and standards
Central Asia Dialogue on Harnessing Multisectoral Finance Opportunities by Building Water-Energy-Food Nexus - Phase I Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	2016-2019	EC	€1.3 mln	CAREC IUCN EC IFAS	support for cross-border and multisectoral planning in CA; promoting climate resilient investments in CA
Climate Change Adaptation and Mitigation Program for the Aral Sea Basin (CAMP4ASB) Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	2016-2021	WB/ IDA	$ 15 mln	CAREC EC IFAS	

During the review period, the key partners were the World Bank and the Asian Development Bank, which account for 69% of financial resources. The World Bank helps the economic development of Uzbekistan by supporting a number of projects worth $ 2.1 billion. Projects cover the energy sector, agriculture, water resources management, transport,

and urban planning. ADB is supporting the construction of combined cycle plants and the improvement of power transmission lines in the energy sector. It is also supporting the national electricity company to improve its financial strength by installing automated metering systems. ADB supports public-private partnerships, including solar energy projects, district heating upgrades, and financing road and rail development projects along the Central Asia Regional Economic Cooperation (CAREC) corridors.

The main borrowed funds (64%) are invested in the low-carbon development of the "Energy" sector - increasing energy efficiency and the development of the renewable energy sector, the rest are aimed at the development and implementation of climate-friendly technologies in agriculture and water management, industry, transport.

Uzbekistan takes an active part in regional projects that are implemented on a grant basis and provide assistance to the Central Asian countries in solving problems related to climate change (Table 4.4).

Financial support for the preparation of the First Biennial Report and the Fourth National Communication was received by Uzbekistan from the Global Environment Facility (GEF) through UNEP as the implementing agency. In 2018, GEF/UNEP approved $ 832,000 for the project. The contribution of the government of Uzbekistan to the implementation of the project amounted to an amount equivalent to $ 146,000. The financial support that Uzbekistan received was timely and sufficient to enable the country to meet its reporting obligation.

Table 4.4 *Funding received for activities related to climate change in the form of grant support*

Years	Project/Program title	Donor (s)/ Executing agency/ Local partners	Financial resources, USD	Support type			Project description/main outputs
				Capacity building	Technical support	Technology transfer	
2018	Conducting a comprehensive survey during preparation of the project and business plan "Central heating of the city of Tashkent -" TASHTEPLOENERGO project "(TC 1, TC 2)	EBRD/State Unitary Enterprise "Tashteploenergo"	500 thousand euro		x		Preparation of a feasibility study and business plan of the project
2018	Conducting a comprehensive survey during preparation of the project and business plan "Central heating of the city of Tashkent -" TASHTEPLOENERGO project "(TC 1, TC 2)	EBRD/SUE "Tashteplocentral"	500 thousand euro		x		Preparation of a feasibility study and business plan of the project
2008-2020	GEF Small Grants Program (SGP)	GEF/UNDP/local communities, farmers	599,000	x	x	x	Projects aimed at supporting the activities of NGOs and local civil society organizations for CC adaptation and mitigation. 6th replenishment period (GEF-6): 2015-2019.
2009-2016	Improving Energy Efficiency in Public Buildings in Uzbekistan	GEF/UNDP/Goskomarkhitekts troy RUz	UNDP: 350,000 GEF: 3,250,000	x	x	x	Reducing energy consumption and GHG emissions in public buildings by improving building codes and standards, demonstrating integrated building design approaches and developing the capacity of local professionals
2011-2015	Supporting Uzbekistan in transition to low-carbon development of the national economy	UNDP/Ministry of Economy of the Republic of Uzbekistan	1,186,600	x			A strategy for low-carbon development of the Republic of Uzbekistan and a Roadmap for the medium and long term perspectives have been developed.

Years	Project/Program title	Donor (s)/ Executing agency/ Local partners	Financial resources, USD	Support type			Project description/main outputs
				Capacity building	Technical support	Technology transfer	
2011-2016	Development of solar energy	ADB/Ministry of Finance of the Republic of Uzbekistan	2,250,000	x	x	x	A legislative base for the development of solar energy has been created; roadmap, NAMA, feasibility study for Samarkand solar power plant project was prepared.
2012-2016	Modernization of hydrometeorological services in Central Asia, regional	World bank/ Uzhydromet	2,000,000	x	x	x	Strengthening systems and techniques for early warning of disasters in the mountainous regions of Central Asia; provision with equipment for international transfer and interpretation of meteorological data, including using the COSMO model.
2013-2018	Sustainable agriculture and climate change mitigation	World Bank/ GEF/RRA	12,699,000 + 107,960	x		x	Promoting the introduction of RES and EE technologies relevant to agribusiness and farms.
2014	Construction of a solar PVPP with a capacity of 0.13 MW	Ministry of Energy of the Republic of Korea/Uzbekenergo	700,000				Construction of a solar PVPP with a capacity of 0.13 MW with connection to a unified power system (Pup district, Namangan region)
2014 -2016	Central Asia Regional Economic Cooperation Corridor 2 (Pup-Namangan-Andijan) Railway Electrification Project	ADB/ "Uzbekiston temir yullari" (Uzbekistan railways)	400,000		x		Preparation of a feasibility study and a business plan for the project
2014-2015	Improvement of hydrometeorological monitoring in Uzbekistan	German Foreign Affairs Ministry/Uzhydromet	260,000	x	x	x	Automatic stations were installed at the Maidantal and Kumbel m/s (Tashkent region); tracking system for the mass balance of the Pakhtakor glacier (Tashkent region); training workshops were held.

Years	Project/Program title	Donor (s)/ Executing agency/ Local partners	Financial resources, USD	Support type			Project description/main outputs
				Capacity building	Technical support	Technology transfer	
2014-2017	Project for the construction of a PTL in the North-West region	ADB/JSC Uzbekenergo	800,000	x	x	x	Construction of 364 km of 220 kV PTL construction/reconstruction of 3 substations. Support for institutional development and capacity building. Modernization of planning and automation of the dispatcher transmission system of Uzbekenergo JSC
2014-2018	Reducing the pressure on the use of natural resources as a result of the competing use of rain-fed drylands in the mountainous, semi-desert and desert landscapes of Uzbekistan	UNDP/GEF/ State Cadaster agency of the Republic of Uzbekistan	2,513,600	x	x		Implementation of best practices for sustainable pasture use and land management of the forestry sector. Improvement of vegetation cover on 6 thousand hectares of pastures and 1 thousand hectares of forests
2014-2020	Developing climate resilience of farming communities in the drought prone parts of Uzbekistan	UNFCCC AF, UNDP, Uzhydromet	5,998,448	x	x		Development of capacity for drought management; implementation of measures to introduce climate-resistant practices in farms of the Republic of Karakalpakstan
2015-2016	Large-scale development of the market for sustainable construction of rural housing in Uzbekistan. Phase 1	GEF/UNDP/State Architecture Committee, State Cadaster Committee, Ministry of Economy, Ministry of Finance	150,000	x			Transformation of the housing construction sector in rural areas, construction of low-carbon houses through the development, testing, dissemination of the mechanism of "green" mortgage lending.
2015-2016	Saving climate data in Uzbekistan	Government of the Republic of Korea (through WMO)/Uzhydromet	628,000	x	x		Conversion of the archival climatic data of Uzhydromet from paper to digital format was carried out; a unified climate database has been created

Years	Project/Program title	Donor (s)/ Executing agency/ Local partners	Financial resources, USD	Support type			Project description/main outputs
				Capacity building	Technical support	Technology transfer	
2015-2016	Uzbekistan: Developing an Intended Nationally Determined Contribution for the 2015 Global Climate Agreement.	GEF/UNEP/Uzhydromet	200,000	x	x		Development and preparation of the "Intended Nationally Determined Contribution of the Republic of Uzbekistan" document for the Paris Agreement in accordance with the objectives of the UNFCCC
2015-2017	Power Generation Efficiency Improvement Project	ADB/Uzbekenergo	2,400,000		x		Construction of 2 units of steam gas turbines with a capacity of 450 MW at Talimarjan TPP
2015-2023	Assistance in the development of construction of energy efficient rural housing in Uzbekistan	UNDP/GEF/State Architecture Committee of Uzbekistan	4,304,467	x	x	x	Shifting the rural housing construction sector to a more sustainable development path that reduces GHG emissions. Design, piloting and development of a mechanism for "green" mortgage lending
2016-2020	Sustainable Hydropower Project, Kashkadarya, Samarkand, Tashkent	ADB/Uzbekgidroenergo JSC, REN (Regional Electric Networks) JSC	5,000,000		x		Preparation of a feasibility study for the Hydropower Climate Resilience Project
2018- 2023	Sustainable forest management in mountain and valley regions of Uzbekistan	GEF/FAO/ State Forestry Committee of the Republic of Uzbekistan	21,853,174	x		x	Component 1: Information Management Systems for Sustainable Forest Management. Component 2: Multifunctional forest management leading to carbon sequestration, improvement of forest and wood resources, etc. Component 3: Enhancing sustainable forest management with carbon sequestration - by strengthening the enabling environment
2018-2020	Republic of Uzbekistan: Preparation of a	ADB / «Uztransgaz»	225,000		x		Preparation of a project on introduction of a SCADA

Years	Project/Program title	Donor (s)/ Executing agency/ Local partners	Financial resources, USD	Support type			Project description/main outputs
				Capacity building	Technical support	Technology transfer	
	project for modernization of a gas infrastructure in Uzbekistan						system in the gas sector of Uzbekistan
2018-2022	Preparation of the Fourth National Communication on Climate Change and the First Biennial Update Report of the Republic of Uzbekistan for the UNFCCC	GEF/UNEP/Uzhydromet	978,000	x	x		Preparation of the First Biennial Update Report (FBUR) and the Fourth National Communication on Climate Change (FNC) on the implementation of the obligations of the Republic of Uzbekistan under the UNFCCC
2018-2023	Diversification and modernization of agriculture	IFAS	300 000			x	1 - Development of inclusive value chains; 2 - Inclusive rural finance; 3 - Climate resilient rural infrastructure; 4 - Project management, monitoring, evaluation and audit

Table 4.5 *Financing support in the form of loans received for climate change-related activities*

Years	Project/program title	Donor (s)/Executing Agency/Local Partners	Loan amount, USD mln	Total project amount, USD mln	Support type			Project description/main results
					Capacity building	Technical support	Technological transfer	
2010-2017	Expansion of Talimarjan TPP (TPP-1)	ADB/JICA	350 / 290				x	construction of 2 CCGT units of 450 MW each
2011-2020	Implementation of an automated system for accounting and control of electricity consumption. The system of accounting for the consumption of electrical energy by consumers of 0.4 kW of Bukhara, Jizzakh and Samarkand regions of the Republic of Uzbekistan - AEMCS Phase 1	ADB	300	300			x	Increasing the financial stability of the electric power industry. Correctly regulated cost of electricity supply. Modernization of the accounting system in other regions and for all types of consumers.
2011-2016	Project for the construction of a transmission line from Talimarjan TPP	WB/IBRD	110	203.046	x		x	Construction of a new open switchgear 500/220 kV at Talimarjan TPP; about 216 km of power transmission line 500 kV t of Talimarjan TPP - SS Sogdiana; 500 kV transmission line from 500/220 kV open switchgear at Talimarjan TPP - Karakul-Guzar transmission line. Strengthening technical and fiduciary capacity. Identifying areas of wind energy potential.

Years	Project/program title	Donor (s)/Executing Agency/Local Partners	Loan amount, USD mln	Total project amount, USD mln	Support type			Project description/main results
					Capacity building	Technical support	Technological transfer	
2012-2017	Improved electricity metering project	WB/IBRD	180	246.1	x		x	Reducing commercial losses of 3 regional energy distribution companies in Tashkent city, Tashkent and Syrdarya regions by improving their accounting and billing infrastructure, as well as commercial management system.
2012-2015	Construction of a CCGT unit (370 MW) at the Tashkent TPP	CSDB/JICA/SYNES TA a.s. (Slovakia)					x	
2013-2018	Improving energy efficiency of industrial enterprises in Uzbekistan. Phase 1, 2	World Bank	150.2				x	Implementation of 82 investment projects at 32 enterprises for the introduction of energy-efficient equipment and energy-saving technologies
2013-2021	Uzbekistan: Solid Waste Management Improvement Project	ADB	69				x	Rehabilitated and expanded solid waste management system in Tashkent city. Operational capacity building National SWM strategy
2013-2022	Amu Bukhara Irrigation System Rehabilitation Project	ADB	325,7	406.29			x	Providing sustainable water supply for irrigated agriculture on an area of 250 thousand hectares and providing drinking water to 725 thousand people.

Years	Project/program title	Donor (s)/Executing Agency/Local Partners	Loan amount, USD mln	Total project amount, USD mln	Support type			Project description/main results
					Capacity building	Technical support	Technological transfer	
2014-2020	Construction of the Turakurgan TPP with a total capacity of 900 MW	JICA/FRDRU/state budget/JSC "TES"					x	
2014-2021	Construction of a combined cycle plant with a capacity of 230-250 MW at the Takhiatash TPP	ADB	0.300	0.430			x	Construction of 2 CCGT units (230-280 MW each)
2014-2021	South Karakalpakstan Water Management Improvement Project	World Bank/ MAWR of Uzbekistan	214.9	376.7	x			Irrigation network modernization - rehabilitation of irrigated areas in South Karakalpakstan in a cost-effective manner
2014-2023	Development of the horticultural sector in the Republic of Uzbekistan (taking into account additional funding)	WB/IBRD	650.0	989.12	x			Reducing poverty in the country by supporting horticulture farmers and increasing their income
2015-2020	Angren-Pap railway construction project	WB/MBRD; Eximbank (PRC)	195 / 350	1,633.75				Reduced transport costs and increased throughput and reliability of rail links
2015-2019	Expansion of the Navoi TPP with the construction of a 450 MW CCGT-2	JICA, FRDRU/JSC Uzbekenergo					x	construction of CCGT-2 with a capacity of 450 MW
2015-2020	Construction of two CCGT units with a capacity of 230-280 MW at the Takhiatash TPP	ADB/FRDRU/state budget/JSC «TES»	300				x	Construction of two CCGT units with a capacity of 230-280 MW at the Takhiatash TPP
2016-2022	Modernization and improvement of transmission substations	WB/IDB/IDA	92/58/46. 3	196.3			x	Improving the technical efficiency and reliability of electricity transmission networks in Uzbekistan. Rehabilitation of

Years	Project/program title	Donor (s)/Executing Agency/Local Partners	Loan amount, USD mln	Total project amount, USD mln	Support type			Project description/main results
					Capacity building	Technical support	Technological transfer	
								22 substations
2017-2023	Construction of Nizhnechatkal HPP (76 MW)	Vnesheconombank (RF)	185.0				x	
2017-2021	CA - regional economic cooperation - Corridor 2. Railway electrification project (Pup-Namangan-Andijan)	ADB	80.00	177.45			x	Development of Tashkent Economic Corridor of Fergana Valley. The electrified network of Angren-Pup (2016) will be expanded to large and small cities of Fergana Valley
2017 -2024	Construction of the Pskem HPP	Eximbank (PRC)/Uzbekhydroenergo	240	800				
2017-2020	Introduction of highly efficient cogeneration gas turbine technologies at Fergana CHPP and Fergana boiler house DBH-3	NEDO (Japan)/JSC "TES"	49.6	83.6				
2017-2020	Construction of 4 SHPPs and a cascade of Zarchob SHPPs	Eximbank (PRC)/Vnesheconombank (RF)	51.5					
2017-2020	Modernization of 4 hydroelectric power plants	Eximbank (PRC)	72.7					
2017-2021	Modernization of the Tupalang HPP	Vnesheconombank (RF)	55.8					

Years	Project/program title	Donor (s)/Executing Agency/Local Partners	Loan amount, USD mln	Total project amount, USD mln	Support type			Project description/main results
					Capacity building	Technical support	Technological transfer	
2017-2022	Thorough repair of the Karshi cascade of pumping stations. Phase III	SFD/FRDRU	43.2	105.3			x	
2017-2022	Development of the livestock sector in the Republic of Uzbekistan	WB/IBRD; IDA	30.0; 120.0	227.8			x	Component 1 "State Investment Program and Public Services" Component 2 "Modernization of Livestock Supply Chains" Component 3 - Project Coordination, Management, Monitoring and Evaluation
2017-2023	Construction of two 450 MW CCGT units at the Talimarjan TPP (TPP-2)	EBRD/ADB	240 / 450	1,063.0			x	Construction of two 450 MW CCGT units at the Talimarjan TPP (TPP-2)
2017-2024	Water resources management in the Fergana Valley. Phase-2	WB	144.9	228.2	x	x		
2018-2019	Access to Sustainable Energy - Distribution Modernization Program	ADB		0.75		x		Using a lending mechanism to (i) strengthen sector governance; (ii) increasing financial sustainability and reducing technical losses; (iii) ensuring a low-carbon transformation of the energy sector; (iv) modern electricity distribution system in rural areas; and (v) stimulating rural development
2018-2021	Modernization of UE "Farkhad HPP"	Vnesheconombank (RF)	55.8					

Years	Project/program title	Donor (s)/Executing Agency/Local Partners	Loan amount, USD mln	Total project amount, USD mln	Support type			Project description/main results
					Capacity building	Technical support	Technological transfer	
2018-2023	Diversification and modernization of agriculture	IFAS	46.2	84.777			x	1 - Development of inclusive (poor) value chains; 2 - Inclusive (inclusive) rural finance; 3 - Climate resilient rural infrastructure
2018-2024	Central Heating Energy Efficiency Project	WB/IDA/Ministry of Housing and Communal Services of the RUzb	140.00	232.00			x	Introduction of a modern model of central heating for the first time in Uzbekistan. Increasing infrastructure capacity and improving the regulatory framework

4.2 TECHNOLOGY TRANSFER

An important condition for the sustainable and dynamic development of the Republic of Uzbekistan is the phased introduction of modern and energy efficient technologies in all sectors of the economy. To activate this process, it is necessary to develop a legislative and institutional framework, create a favorable investment environment, and introduce financial and economic incentives.

In order to implement a unified state policy in the field of innovative and scientific and technical development, the Ministry of Innovative Development of the Republic of Uzbekistan was created in 2017, the main tasks of which are:

- introduction of modern technologies, taking into account long-term development scenarios of the country, aimed at developing the know-how;
- expansion of innovation and the market for competitive scientific and technical products.

At this stage in the country:

- a legislative and legal framework has been created and is functioning in the field of regulation and stimulation of the introduction of clean energy-saving technologies in all sectors of the economy - new laws have been adopted that determine legal, economic and organizational relations in the field of innovation and technology transfer, amendments and additions have been made to the existing legislative acts (Table4.6);
- the adopted strategic documents reflect the main directions and objectives of the development of technology transfer (Table 4.7);
- approved target parameters for the renewal of obsolete equipment at industrial enterprises and for the further development of renewable energy sources (Table 4.8);
- an off-budget intersectoral fund for energy conservation was created under the Ministry of Energy of the Republic of Uzbekistan to facilitate the transfer of clean technologies.

Table 4.6 *Legislation in the field of technology transfer*

Laws of the Republic of Uzbekistan	Content
"On the use of renewable energy sources" ZRU No.539 of 05.21.2019	The law envisages benefits and preferences in the field of introduction and use of renewable energy sources
On amendments and additions to the Law of the Republic of Uzbekistan "On the rational use of energy" ZRU No.628 от 14.07.2020 г.	The law "On the rational use of energy" has been revised; the legal regulation in the field of rational use of energy has been determined. The law is aimed at: – further rational and efficient use of electric and thermal energy, fuel and other non-traditional energy resources produced in the energy sectors, in the sectors of the economy and the social sphere; – ensuring the efficiency of energy consumption; – improving the legal framework for the provision of services for the introduction of modern energy-saving technologies. The law establishes a norm on compulsory certification of goods for compliance with energy efficiency indicators and the tasks of the responsible agencies to determine the procedure for state control of the rational use of energy and improving energy efficiency.

Table 4.6 cont.

Laws of the Republic of Uzbekistan	Content
"On innovation activity" ZRU No.630 of 07.24.2020	The law defines the main directions of state policy in the field of innovation, ways to support and stimulate the introduction of clean technologies, as well as regulation of technology transfer - directions, methods, mechanisms and conditions, in particular, the following transfer methods are determined: - obtaining technologies free of charge; – introduction of technologies through the creation of joint ventures; – introduction of technologies based on licensing agreements; – transfer of technological documentation; – full acquisition of technology. Transfer mechanisms: – analysis and assessment of technical characteristics, feasibility studies, instructions and other documents; – organization of training sessions with the involvement of experts from the party carrying out the technology transfer; – mastering the technical knowledge necessary for the construction and installation of equipment and their operation, facilitating the introduction of technologies.

Table 4.7 – *Strategic documents covering technology transfer issues*

Document	Content
"Strategy for innovative development of theRepublic of Uzbekistan for 2019 – 2021" UP No.5544 of 09.21.2018	The main tasks in the direction of technology transfer have been identified: – creation of effective mechanisms for the integration of education, science and entrepreneurship for the widespread introduction of the results of research, development and technological work; – increasing investment of public and private funds in innovation, research, development and technological work, the introduction of modern and effective forms of financing activities in these areas.
"Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period of 2019-2030". PP No.4477 of 04.10.2019	The directions for the development of the institutional framework for the introduction of "green" technologies were approved: – assessment of technological needs, identification of priorities and selection of key technologies, assistance in their development/transfer; – development of mechanisms for the commercialization of "green" technologies, creation of organizational structures to support innovation - technology transfer agencies, technology business incubators, technology parks, clusters.

The main channels for the dissemination of new technologies are investment projects that are implemented as part of government programs for the development and modernization of sectors of the economy (see Chapter 3). The most significant ones can be singled out from the list of energy-efficient and energy-saving technologies introduced into production:

In energy:
– Highly efficient combined cycle gas and gas turbine plants with power unit efficiency reaching about 60%.

In oil and gas sector:
– Technologies for the compression of associated petroleum gases at booster compressor stations (BCS) and supply to the general gas transmission system.
– Technologies for the generation of electrical energy by direct combustion of natural gas from low-pressure wells and associated petroleum gases using microturbines.
– Technology for processing/utilization of acidic process gases to obtain commercial sulfur.
– Technology for the production of synthetic liquid motor fuel (GTL) from purified methane.

Table 4.8 – *Technology transfer regulations*

Document	Content
Resolution of the President of the Republic of Uzbekistan "On additional measures to accelerate the renewal of physically worn out and obsolete equipment, as well as to reduce production costs of enterprises of industrial sectors" PP No.2692 of 22.12.2016	Target parameters for decommissioning and renewal of physically worn out and obsolete equipment of industrial enterprises for the period of 2021-2025 were approved with replacement with modern, applied at the world level.
Resolution of the President of the Republic of Uzbekistan "On accelerated measures to improve the energy efficiency of economic and social sectors, the introduction of energy-saving technologies and the development of renewable energy sources" PP No.4422 of 08.22.2019	Target parameters for the further development of renewable energy sources
Resolution of the Cabinet of Ministers of the Republic of Uzbekistan "On approval of the regulation on the off-budget intersectoral fund for energy conservation under the Ministry of Energy of the Republic of Uzbekistan" PCM No.640 of 09.10.2020	The main tasks of the fund are to help solve the problems of transfer of clean technologies: – co-financing of energy-saving projects with commercial banks or financial institutions of foreign countries; – concessional lending, as agreed with the bank, in production processes in sectors of the economy, as well as in the introduction of modern energy-saving technologies and renewable energy sources in social facilities and households; – providing financial assistance to manufacturers of energy-efficient and energy-saving technologies, equipment, and materials in various sectors of the economy; – concluding agreements with government agencies on the provision of energy services for the implementation of energy efficiency projects and the introduction of clean technologies and renewable energy sources.

Exhibitions, dialogue platforms, fora and conferences at the international and regional levels are the driving force and effective mechanisms for technology transfer, information transfer and exchange, decision-making and fundraising for the implementation of measures to combat climate change.

Every year Uzbekistan hosts major international exhibitions (Table 4.9), participation in which allows you to establish new partnerships, obtain first-hand information from government officials and sectoral ministries, get acquainted with priority investment projects, exchange experience and information on best practices of industries.

The Regional Environmental Center for Central Asia (CAREC) plays an important role in helping to solve both national and regional environmental problems to improve the well-being of the population. The platforms used by CAREC: the Central Asia International Environmental Forum (CAIEF), the Central Asia Climate Change Conference (CACCC) and the Central Asia Leadership Program on Environment for Sustainable Development (CALP) - serve to ensure regular dialogue and knowledge exchange between various stakeholder groups.

Table 4.9 – *Information about international exhibitions*

Title	Brief information
"OGU" Oil and gas of Uzbekistan	Representatives of ministries and government agencies, heads of leading international and regional oil and gas companies, international consultants and financial analysts annually gather at one platform to discuss the main challenges and urgent development problems facing the oil and gas sector of the economy. A regular event within the framework of the exhibition is the International Oil and Gas Conference, which discusses the priority development of the oil and gas industry in Uzbekistan, the best world practices, and promising directions for the development of the industry. More than 700 delegates from 27 countries of the world take part in the conference annually. More than 40 speakers - recognized experts of the oil and gas industry, representatives of government bodies, leading oil and gas companies, investment and financial institutions of Uzbekistan. Official support is provided by: - Ministry of Energy of the Republic of Uzbekistan. - Uzbekneftegaz JSC. At the moment, large-scale reforms in the fuel and energy sector are underway in Uzbekistan, which include the implementation of large projects with the involvement of foreign experience and investments. The event acts as an effective mechanism for interaction between the government of the Republic of Uzbekistan and business partners to address pressing issues in a changing industry. For many years, the OGU Exhibition and Conference has served as a platform for fruitful cooperation and discussions, where, with the support of the Government of Uzbekistan, the largest projects of the oil and gas industry are born.
"UzEnergyExpo" International specialized exhibition of energy	The largest energy exhibition in the country, brings together representatives of almost all major areas of the energy complex. The main thematic sections of the exhibition are energy, renewable energy, energy-saving, lighting, electrical engineering, cables, wires, fittings, thermal energy, gas supply. Participants of 180 companies from 15 countries.
"Power Uzbekistan" Energy, energy saving, nuclear energy, alternative energy sources	The exposition of the exhibition presents almost all the main directions of the energy complex in sections: energy, energy saving, electrical equipment, alternative and renewable energy sources, nuclear energy, power electronics, heat and power equipment. Presentation of experience and modern approaches from global manufacturers, business program, personal meetings with major customers. The exhibition is held with the support of the Ministry of Energy of the Republic of Uzbekistan, Uzatom Agency. An important tool for introducing new developments and advanced technologies, strengthening international relations and attracting new capital and investments. Participants of 300 companies from 23 countries.
"GETCA" (Green and Ecological Technologies Central Asia) Central Asian International Exhibition	An event uniting the exhibition and business forum with the participation of international experts and specialists in the field. The exhibition of green technologies held with the active support of key stakeholders (the State Committee for Ecology, the Ministry of Housing and Communal Services, the Ministry of Investments, the Chamber of Commerce and Industry of the Republic of Uzbekistan), represents national and foreign manufacturers and developers of equipment, technologies for collection, sorting, processing and disposal of waste, companies providing services and products with using resource-saving technologies, sources of alternative energy.

The Central Asian International Environmental Forum serves as a high-level platform uniting all interested partners in strengthening cooperation and developing joint measures aimed at realizing common goals in the field of sustainable development. The partners of the event are the Government of the Republic of Uzbekistan, the European Union, the World Bank, USAID. The event is held in response to the environmental challenges of the region associated with population growth, urbanization and changes in consumption habits, are becoming more and more complex (an increase in energy consumption, the rate of accumulation of solid waste, a decrease in biodiversity, intensifying desertification processes).

The Second Central Asian International Environmental Forum (CAIEF 2018) with the topic "Strengthening cooperation in the field of environment and sustainable development in Central Asia" (June 5-8, 2018, Tashkent, Uzbekistan) has become a high-level platform uniting partners interested in strengthening cooperation and developing joint measures aimed at implementing common goals in the field of sustainable development, discussing mutually beneficial solutions to protect ecosystems and promote green technologies. Participants: representatives of governments, ministries of the environment, UN structural agencies, leading international organizations and financial institutions, academia and public circles. During the forum, the first specialized international exhibition of environmentally friendly technologies Green Ecology Technologies Central Asia - GETCA 2018 and the Business Forum of environmentally friendly technologies were held.

Directions of CAIEF-2018:

- Renewable energy sources and energy efficiency;
- Integrated solid waste management;
- Conservation of biodiversity and development of a network of protected natural areas.

Within the framework of the "Program for Adaptation to Climate Change and Mitigation of its Consequences CAMP4ASB", one of the main components is the introduction of climate technologies, especially at the local level. The National Coordination Group in Uzbekistan works to promote climate finance for improved land use, water use and efficient use of natural resources, with the mandatory inclusion of low-carbon technologies and adaptation practices.

Within the framework of the CAMP4ASB project in Uzbekistan, the transfer of knowledge and technology is implemented in the context of several components:

a) In the area of improving climate observations and weather forecasts:

- 50 automated meteorological stations were purchased and installed;
- new tools for modeling water resources, long-term weather and climate forecasts have been developed, study tours have been organized to exchange experience;
- 50 training and educational events were organized;
- large greenhouses and farms have been created on an area of 340 hectares, the production of dried fruits has been established.

b) Improving the exchange of climate information:

- the Central Asian Climate Information Platform (CACIP) has been developed, the purpose of which is to provide stakeholders with access, analysis and visualization of data to support and raise awareness, assessment and decision-making. The information is based on quality databases from global, regional and local sources, supported by analytical tools and interfaces for visualization and interpretation;
- implemented pilot projects to introduce adaptation approaches and technologies;
- developed and tested methodologies and criteria for assessing climate investments (microloans);
- a number of farmers were supported in the development of crop production, animal husbandry, beekeeping, processing of dried fruits, horticulture, using energy-efficient technologies.

4.3 CAPACITY BUILDING

The first biennial report is a new type of reporting for Uzbekistan. Therefore, its preparation required an increase in the capacity of experts in all areas of activity.

Representatives of Uzbekistan took part in a series of International and regional workshops/webinars organized by the UNFCCC Expert Advisory Group, UNFCCC Secretariat, Technical Support Unit (TSU), IPCC Task Force on Greenhouse Gas Inventories (TFI) (Table 4.10).

To improve the assessment of GHG emissions in the oil and gas sector, which is one of the main sources of GHG emissions in Uzbekistan, the Norwegian consulting firm Carbon Limits, with the support of ADB, conducted a series of workshops and webinars for specialists from Uzhydromet, the oil and gas industry and environmental authorities. During the events, issues of monitoring methane emissions in the oil and gas industry and possible mitigation measures were considered.

Table 4.10 *Strengthening the capacity of experts for preparation of the First Biennial Update and GHG Inventory Report*

Event title	Event date/venue	Organizers
Workshops		
Workshop on the preparation of Biennial Update Reports for non-Annex I Parties to the Climate Change Convention	16-18.09.2013 Bonn, Germany	UNFCCC AEG
Regional workshops on preparation of Biennial Update Reports for non-Annex I Parties (Asia-Pacific and Eastern Europe)	8-10.09.2014 Yerevan, Armenia 4-6.04.2016 Colombo, Sri Lanka	UNFCCC AEG
Workshop on Sustainable Management Systems for National Greenhouse Gas Inventories and the Use of the 2006 IPCC Guidelines for the Preparation of Greenhouse Gas Inventories for the Asia-Pacific and Eastern European Regions	5-9.09.2016 Incheon, Republic of Korea 22-26.09.2019 Male, Maldives	UNFCCC AEG
Regional Workshop for Asia Pacific on Nationally Appropriate Mitigation Actions (NAMA)	22-25.04.2014 Vientiane, Laos	UNFCCC Secretariat
Meeting of UNFCCC experts on the compilation of the Emission Factor Database (EFBD) and the use of the updated version of the Software for the inventory of greenhouse gases	17-19.03.2015, Okinawa, Japan	UNFCCC Secretariat, TSU, TFI
IPCC Expert Meeting on Technical Assessment of the "Guidelines for Conducting National Greenhouse Gas Inventories" for the Agriculture, Forestry and Land Use (AFOLU) Sector	13-16.07.2015 Sao Paulo, Brazil	UNFCCC Secretariat, TSU, TFI
Workshop "Monitoring and Reduction of Greenhouse Gas Emissions in the Oil and Gas Sector"	21-22.09.2019 Tashkent	ADB, Carbon Limits (Norway)
Regional Workshop "Monitoring, Reporting and Verification (MRV) and Transparency Framework in Central Asia"	12-13.09.2019 Almaty, Kazakhstan	UNFCCC Secretariat, UNDP, GIZ, SDG, International Greenhouse Gas Management Institute

Table 4.10 cont.

Event title	Event date/venue	Organizers
Webinars		
Evaluation of mitigation measures for non-Annex I countries	21.06.2016	UNFCCC AEG
MRV System and Enhanced Transparency Framework (ETF) in Central Asia: From Theory to Practice	15.07.2020	SDG, International Greenhouse Gas Management Institute
Training on existing MRV mechanisms and an expanded framework for transparency in Asia and the Eastern European region	17-19.10.2020	UNFCCC AEG and Secretariat,
Synergy in data collection at the national level for reporting under MRV/ETF, SDGs and other international instruments	12.11.2020	UNFCCC AEG and Secretariat,
Virtual climate dialogues	23.11-4.12.2020	UNFCCC Secretariat
Regional Meeting of the Central Asia Network on MRV and Transparency: Key Achievements in 2020 and Prospects for 2021	3.12.2020	SDG

National experts participated in the Asia-Pacific Regional Workshop on Nationally Appropriate Mitigation Actions (NAMA), as well as a webinar on the assessment of mitigation measures for non-Annex I countries. The knowledge gained from the workshops was used to prepare the relevant sections of FBUR.

The participation of specialists in workshops and webinars organized on a regular basis by the UNFCCC Secretariat, UNDP in cooperation with the GIZ, the UNDP/UNEP National Communications Support Program (SDG), the International Institute for Greenhouse Gas Management improved understanding of the key principles and provisions of MRV, contributed to the development of the concept of a national MRV.

During the preparation of the FBUR, the consulting firm Carbon Limits provided technical support in the form of a preliminary expert assessment of the results of the inventory of greenhouse gases in the oil and gas sector (January-June 2020). This technical support was carried out on the basis of the Memorandum of Cooperation concluded between Uzhydromet and Carbon Limits. As a result of the joint work, inaccuracies in the calculations were eliminated and recommendations were obtained for further improving the estimates of emissions in this inventory category. Funding for the event was carried out from funds received by Carbon Limits from various philanthropic foundations.

5 NATIONAL MRV SYSTEM

In Uzbekistan, one of the priority areas of the Strategy for the transition to a "green" economy is "... the creation of a monitoring, reporting and verification (MRV) system on greenhouse gas emissions, taking into account national circumstances, to continuously track the implementation of the country's quantitative obligations under the Paris Agreement and ensure reporting on greenhouse gas emissions".

The development and implementation of an effective national MRV system will help build capacity and create an enabling environment in the country, and will also allow:

- to stimulate decision-making in the design and implementation of policies and measures for low-carbon development and, if necessary, adjust the policy;
- to improve coordination and information exchange between different sectors of the economy;
- to track progress towards the declared Nationally Determined Contributions (NDC);
- to meet the requirements of the Enhanced Transparency Framework.

The republic has accumulated valuable experience in the implementation of MRV for CDM projects in the oil and gas and chemical industries. Within the framework of the project of the Ministry of Economy of the Republic of Uzbekistan/UNDP "Supporting Uzbekistan in transition to low-carbon development of the national economy" (2011-2015), "Guidelines for the development of NAMAs, including a monitoring, reporting and verification system (MRV)" (2014) was developed. This document presented the general elements of the MRV structure proposed for selected sectors of the Uzbek economy (electricity, heating, and buildings), including the creation of an institutional structure; the functions of the coordinating body have been defined; methodological issues of MRV for NAMAs reviewed.

Since 2017, reforms are underway in the national statistical system to ensure the accuracy, reliability and openness of information. Practical steps have been taken to generate and monitor relevant statistics to measure progress towards achieving national Sustainable Development Goals. The State Statistics Committee and UNDP in Uzbekistan have developed a national website (nsdg.stat.uz). The website is a platform for monitoring and reporting on the implementation of national SDGs and is accessible to a wide range of users. To date, it contains data on about 100 indicators. Actions related to reducing greenhouse gas emissions or removing these gases from the atmosphere are integrated into the targets of seven NSDGs (SDG2- Hunger, SDG7- "Sustainable and reliable energy", SDG9- "Infrastructure" and SDG11- "Sustainable cities", SDG12- Sustainable Consumption and Production Patterns SDG13 - Climate Change SDG15 - Ecosystems".

From the lessons learned during the preparation of National Inventories and the implementation of CDM projects, it follows that an effective MRV system involves:

- the necessary level of political support;
- well-organized information flows between participating institutions.

The success of the MRV system depends to a large extent on institutional mechanisms aimed at coordinating actions related to the preparation of National Communications and Biennial Reports (BURs), including standardizing the data collection system, identifying common approaches to evaluating policies and mitigation measures, and quality control procedures (QC/QA), and database creation.

Currently, there is a stable institutional system that makes it possible to carry out an inventory of GHG emissions on an ongoing basis (see Chapter 2) in Uzbekistan, on the basis of the Center for Hydrometeorological Service under the Republic of Uzbekistan. The Department for Monitoring Climate Change was created in Uzhydromet in order to improve the existing structure.

Within the preparation of the FBUR, a concept for the development of MRV was developed, in which, taking into account the requirements of the UNFCCC, based on an analysis of international experience, as well as in accordance with national conditions, the main problems and tasks for the development of institutional mechanisms, methodological base, data processing procedures and a plan for the implementation of the national MRV systems were formulated.

The internal MRV system is expected to make the most of existing systems and processes for data collection, including QC/QA procedures, and will consist of the following components:

- MRV inventory of GHG emissions;
- MRV mitigation actions;
- M&E adaptation actions;
- MRV support (required and provided).

5.1 MRV OF GHG EMISSION INVENTORY

Inventory MRV aims to estimate and monitor GHG emissions.

GHG inventory is carried out within the framework of projects for the preparation of National Communications or Biennial Update Reports funded by the GEF. The project builds a group of technical experts on inventory, led by a team leader. Experts from key ministries and agencies, organizations and industrial companies, research institutes are engaged to carry out certain tasks. The core of the team is quite stable, if necessary, additional specialists are invited.

Technical experts are involved in the preparation of necessary information, spreadsheets of a specific format, calculations, development of national emission factors and writing reports.

Quality assurance/quality control (QA/QC) procedures for the preparation of the inventory are implemented in accordance with the requirements of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

5.2 MRV MITIGATION ACTION

The aim of the MRV on mitigation actions is to quantify the reduction of GHG emissions from the implementation of individual policies/strategies/programs/projects.

In the process of preparing the FBUR, steps were taken to assess and analyze mitigation measures, and experience was gained in analyzing and processing this information, which will be used to develop reporting and monitoring procedures.

The design of the MRV mitigation action involves the following steps:

- identification of institutional arrangements;
- determination of the methodological framework required to assess the impact of policies and mitigation measures on reducing GHG emissions;
- identification of data sources (statistic departments, ministries, organizations, private companies) related to the assessment of policies and mitigation measures;
- defining reporting obligations;
- defining approaches to verification.

5.3 M&E ADAPTATION ACTION

The MRV of adaptation actions is planned to be developed as part of the preparation of the National Adaptation Plan of the Republic of Uzbekistan in 2021-2022, since one of the mandatory components in the development of national adaptation plans is the creation of a monitoring and evaluation system (M&E), including: impact assessment, vulnerabilities and risks. The challenge is to develop indicators for assessing the implementation of adaptation measures, since there is no universal approach and common indicators for assessing risks, vulnerability and impacts of adaptation measures. Since Countries have different climatic risks, vulnerabilities and effects from adaptation measures are local/regional and do not have a significant impact on global processes.

5.4 MRV SUPPORT IN UZBEKISTAN

MRV support is under development. Some elements of the system were implemented during the preparation of the FBUR, in particular, assessments were carried out on:

- financial assistance from donor countries,
- investments in low-emission technologies,
- received support for capacity building (technical assistance, participation in seminars, and training).

With the further development of the MRV support system, it is assumed to:

- define a clear assignment of responsibilities and legal status of departmental / agency or private sector organizations according to their experience;
- identify the organizations involved in this MRV subsystem;
- identify indicators to quantify support provided/received (including technology transfer and capacity building), including in-kind financial assistance, e.g. technical advice on the development of a national energy efficiency strategy.

5.5 NATIONAL MRV IMPLEMENTATION PLAN

Introducing a national MRV system is a complex process that requires time and resources. In addition to creating working institutional mechanisms, an appropriate legal framework is needed that defines the functions and tasks of the parties involved in the implementation of the national MRV system. The adoption of the relevant document by the Government will allow, in the prescribed manner, to receive on a regular basis the information necessary for conducting an inventory, quantifying policies/measures for mitigation and adaptation, as well as introducing a system for monitoring GHG emissions at the level of ministries and agencies. As a result, these actions will ensure the stability of the functioning of the internal MRV system.

Currently, Uzhydromet, together with FAO, within the framework of the Transparency Initiative (CBIT), prepared and submitted to the GEF-7 a project proposal (PIF) to support the implementation of the project "Strengthening the capacity of national institutions to move from existing MRV mechanisms to an expanded transparency framework in accordance with the Paris Agreement", which aims to develop and support existing reporting tools and institutional arrangements, and build capacity for transparency-related activities in line with country priorities.

6 LIMITATIONS AND GAPS AND RELATED NEEDS

As a result of the experience gained in the preparation of the FBUR, the needs were identified, the implementation of which will contribute to capacity building for more effective implementation of the country's obligations under the UNFCCC and the Paris Agreement.

In the area of strengthening the national GHG inventory system:

- In order to develop the internal MRV system, the regulatory document should reflect the issues regulating the GHG inventory and providing a stable and permanent institutional framework, including (i) a description of mechanisms for interagency interaction, (ii) special reporting formats for the ministries/agencies involved, (iii) timing of the preparation of GHG inventory information.
- Further improvement of the estimation of the uncertainty of GHG emissions and removals, including for the Agriculture, Forestry and other land use sectors.
- Development of national emission factors and application of modern IPCC methodologies of a higher level in key inventory categories.
- Reducing inventory uncertainty by improving data quality and using national emission factors.

In the field of reducing GHG emissions:

- Formation of a national reporting system for assessing the reduction of greenhouse gas emissions as a result of the implementation of policies/measures/projects.
- Definition/identification of a set of methodologies for assessing GHG emission reductions in economic sectors/for various technological areas in the field of CC mitigation.
- Development of a set of indicators for assessment of the progress of mitigation measures
- Development of a data collection system for climate finance in line with international criteria.
- Development of an integrated national measurement, reporting and verification (MRV) system for economy-wide GHG reduction activities.

In the area of capacity building - mobilization of human and technological resources:

- Increase the capacity of national experts for assessment and prioritization of mitigation measures based on cost-benefit analysis through their implementation.
- Creation of a system for increasing the capacity of officials, personnel of ministries/agencies involved in the preparation of all types of reporting for the UNFCCC.
- Development of curricula on climate change in accordance with the requirements of the Paris Agreement for the system of higher and secondary education in the country.
- Strengthening and developing the technical capacity of institutions and experts at the national level for preparation of national GHG inventories on an ongoing basis, especially in the main sectors - GHG emitters.

In the field of technology transfer:

- Conduct an up-to-date Technology Needs Assessment (TNA) as a separate project to develop a sustainable technology transfer mechanism.
- Strengthened engagement with the UNFCCC Climate Technology Center and Network (CTCN) to effectively transfer environmentally sound technologies for low carbon and sustainable development.

Financial needs

- Support the preparation of National Communications and Biennial Reports in the context of implementing the country's commitments under the Paris Agreement, including improving the transparency framework
- Support the development of a national measurement, reporting and verification (MRV) system for activities on reduction of GHG emissions

7 ANNEXES

ANNEX 1

Institutional framework for addressing climate change issues

№	Ministries/agencies	Role in fulfilling obligations under the UNFCCC
National ministries and agencies		
1.	Hydrometeorological Service Center (Uzhydromet)	– Coordination of activities on CC issues, implementation of the UNFCCC and the Paris Agreement. – Preparation of National Communications and Biennial Reports with updated data under the UNFCCC (Article 13 of the Paris Agreement). – Estimation of emissions and preparation of inventory of greenhouse gases. – Preparation and updating of NDC in accordance with the requirements of the Paris Agreement (Article 4 of the Paris Agreement). – Preparation of the National Adaptation Plan. – Development of sectoral guidelines for conducting an inventory of greenhouse gas emissions. – Carrying out scientific research of CC processes, assessing the impact of their consequences on the natural environment, sectors of the economy and the population. – Development of a climate monitoring system, including forecasts, data exchange, etc. – Improvement of the environmental pollution monitoring system.
2.	Ministry of Economic Development and Poverty Reduction	– Authorized body for the promotion and implementation of the "green" economy. – Responsible for reducing the carbon intensity of GDP, modernizing the infrastructure of industrial enterprises using clean and environmentally friendly technologies and industrial processes. – Ensuring that environmental aspects are taken into account in all sectors of the economy. – Coordination of implementation of projects on reduction of greenhouse gas emissions in the industrial sector.
3.	Ministry of Energy	– Carrying out state policy in the field of energy-saving and reducing the energy intensity of the economy, stimulating the introduction of advanced resource and energy-saving technologies in the sectors of the economy and the household sector, developing renewable energy sources, expanding the production and use of motor fuel with improved environmental characteristics, ensuring access to modern, inexpensive and reliable energy supply. – Providing information on the "energy" sector for estimating greenhouse gas emissions, for assessing mitigation measures, updating NDC. – Implementation of projects aimed at improving the energy efficiency of the economy, the development of renewable energy sources.
4.	State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection	– Coordination of work on ecology and environmental protection, ensuring interagency cooperation in the development and implementation of a unified environmental and resource-saving policy. – Prevention of offenses in the field of environmental protection, rational use of natural resources and waste management. – Monitoring compliance with legislation in the field of waste management, implementation of measures included in the Roadmap of the Strategy for solid waste management. – Reducing the negative impact on the environment of hazardous waste. – Reducing the volume of emissions of pollutants into the air from stationary and mobile sources. – Providing information on the relevant sector for estimating greenhouse gas emissions, updating NDC. – Improvement of the system of ecological monitoring of the natural environment.
5.	Ministry of Innovative Development	– Introduction of green economy technologies. – Implementation of innovations in the systems of environmental protection and nature management, agriculture.

№	Ministries/agencies	Role in fulfilling obligations under the UNFCCC
6.	Ministry of Investment and Foreign Trade	– Attraction of foreign investments, as well as loans and grants from international financial institutions, foreign government financial organizations and other foreign donors for the implementation of the activities specified in the Strategy of the Republic of Uzbekistan for the transition to a "green" economy. – Mobilizing financial resources through climate finance. – Ensuring coordination of the development and effective implementation of state development programs, and investment programs and projects.
7.	Ministry of Agriculture	– Increase in yield and average productivity of production of basic types of food agricultural products – Achieve a neutral balance of land degradation. – Introduction of modern resource-saving agricultural technologies. – Reducing the negative impact of the agro-technical complex on the environment. – Providing information on agriculture for estimating greenhouse gas emissions, updating NDC. – Development and implementation of projects for the application of climate-resistant and water-saving technologies in agriculture.
8.	Ministry of Water Resources	– Improving water use efficiency. – Improvement of methods for monitoring reclamation lands. – Providing information on water management for estimating greenhouse gas emissions, updating NDC. – Development and implementation of projects for the introduction of climate-resistant and water-saving technologies in water management.
9.	State Forestry Committee	– Development and implementation of measures to prevent desertification, reforestation, protective afforestation and afforestation of the dried bottom of the Aral Sea. – Providing information on forestry for estimating greenhouse gas emissions and updating NDC. – Implementation of projects to prevent desertification, reforestation and protective afforestation.
10	Ministry of Housing and Communal Services	– Introduction of resource and energy-saving technologies and equipment into the system of housing and communal services, including equipping housing and communal services with modern metering and control devices. – Introduction of decentralized heat supply systems for multi-apartment housing stock, social and other facilities. – Introduction of energy-efficient technologies for heat energy generation, incl. using renewable energy sources. – Improving the efficiency of wastewater treatment. – Providing information on the housing and communal services sector for estimating greenhouse gas emissions and updating the NDC. – Implementation of projects on the introduction of resource and energy-saving technologies and equipment into the housing and communal services system.
11	Ministry of Transport	– Revision of standards for air emissions from road transport, taking into account international standards (transition to environmentally friendly fuel in accordance with Euro-4 and higher standards). – Expansion of production and use of vehicles with improved characteristics of energy efficiency and environmental friendliness in accordance with Euro-4 and higher standards, electric vehicles, cars with hybrid engines, gas-fueled. – Gradual transfer of public transport to natural gas fuel and electric traction. – Promotion of cycling in large cities and towns of the country. – Providing information on the transport sector for estimating greenhouse gas emissions and updating NDC. – Implementation of projects on the transition to environmentally friendly fuel in accordance with Euro-4 and higher standards.

№	Ministries/agencies	Role in fulfilling obligations under the UNFCCC
12	Ministry of Construction	– Development of a methodology for assessing the energy efficiency of buildings and structures. – Providing information on the construction sector for estimating greenhouse gas emissions and updating the NDC. – Implementation of energy-efficient and energy-saving innovative projects and solutions in construction.
13	Ministry of Finance	– Development of financial mechanisms to support the "green" economy. – Mobilizing financial resources through climate finance. – Providing information on climate finance to Uzhydromet.
14	State Statistics Committee	– Publication of statistical information on socio-economic phenomena, processes and their results for assessing greenhouse gas emissions and updating NDC.
17	JSC "Uzbekgidroenergo"	– Implementation of projects in the field of hydropower. – Providing data for preparing GHG inventory and updating NDC.
21	JSC "Uzkimyosanoat"	– Providing information on the chemical industry for estimating greenhouse gas emissions and updating NDCs. – Implementation of a project on introduction of technologies to reduce nitrous oxide emissions (at the plants of "Uzkimyosanoat" JSC).
22	JSC "Uzbekugol"	– Providing information on the coal industry for estimating greenhouse gas emissions and updating NDC.
23	JSC "Uzpromstroymaterialy"	– Providing information on the production of building materials for estimating greenhouse gas emissions and updating NDC.
National research institutions		
26	Center for Economic Research and Reforms under the Administration of the President of the Republic of Uzbekistan	– Providing analytical reviews and reports in the field of economics and ecology. – Providing research and analytical information to update NDC.
27	Research Hydrometeorological Institute (NIGMI) at the Center for Hydrometeorological Service (Uzhydromet)	– Climate change research – Assessment of the impact of natural and anthropogenic factors on the state of water and agroclimatic resources. – Provision of climate monitoring data for preparation of national communications and NDC updates.
28	Research Institute of Ecology and Environmental Protection under the State Committee for Ecology	– Conducting research on the reduction of industrial emissions, pollution of surface and groundwater, wastewater treatment and waste management. – Provision of research data for and updating NDC.
29	LLC "UZGIP"	– Conducting research for assessment of vulnerability to climate change – Implementation of projects on adaptation to climate change – Providing information for the preparation of National Communications and updating the NDC.
30	Research Institute of Forestry	– Conducting research on the impact of climate change on forestry. – Assessment/monitoring of forests and forest areas. – Providing information for the preparation of National Communications and updating the NDC.
31	Research Institute of Soil Science and Agrochemistry	– Providing information for the preparation of National Communications and updating the NDC.
32	Research Institute of Livestock, Poultry and Fish Farming	– Providing information for the preparation of National Communications and updating the NDC.
33	Physicotechnical Institute NGO "Physics-Sun" of the Academy of Sciences	– Development of state standards and regulations in the field of solar energy and renewable energy.
Non-governmental organizations, private sector		
34	Ecological movement of Uzbekistan	– Increasing civic engagement of the population in addressing issues related to the environment, including through legislative, public and educational activities
35	Ecological resource center "Ekomaktab"	– Development of environmental education and the formation of environmental culture of the population.

№	Ministries/agencies	Role in fulfilling obligations under the UNFCCC
		– Raising public awareness in the field of environmental protection.
International organizations providing support/assistance in the implementation of NDCs		
37	UNDP in Uzbekistan	– Provision of advisory and technical support for the implementation of projects in the field of CC, environmental protection
38	UN Environment (UNEP)	– Providing advisory and technical support for the implementation of projects in the field of CC, environmental protection (Preparation of National Communications (NC) and Biennial Update Reports (FBUR) for the United Nations Framework Convention on Climate Change (UNFCCC))
39	Green Climate Fund (GCF)	– Provision of financial and technical support for the implementation of projects in the field of CC.
40	Adaptation Fund (AF)	– Provision of financial and technical support for the implementation of projects in the field of CC.
41	Global Environment Facility (GEF)	– Providing advisory and technical support for the implementation of projects in the field of CC, environmental protection (Preparation of National Communications (NC) and Biennial Update Reports (FBUR) for the United Nations Framework Convention on Climate Change (UNFCCC).
42	Food and Agriculture Organization (FAO)	– Providing assistance in the following directions: diversification of crop production systems and sustainable intensification of production; conservation agriculture and efficient agricultural production methods; livestock production, rational use of natural resources.
43	French Development Agency (AFD)	– Providing financial support in the field of state policy "Energy and Climate", in reforming the "Energy" sector for the transition to a low-carbon economy, as well as providing technical assistance to fulfill the country's obligations to mitigate and adapt to CC.
44	German Society for International Cooperation (GIZ)	– The NACAG initiative provides financial support and technical assistance for the implementation of technologies to reduce nitrous oxide emissions from the production of nitric acid, as well as direct financial assistance for the installation of technologies to reduce greenhouse gases (at the plants of "Uzkimyosanoat" JSC).
45	World Bank	– Providing financial support for the implementation of projects in the areas of climate change, environmental protection, modernization of agriculture and water supply, etc..
46	Asian Development Bank	– ADB promotes Uzbekistan's economic advancement, industrial development, agricultural diversification through technical assistance and loans.
47	European Bank for Reconstruction and Development	– Providing financial support for the implementation of projects in the field of climate change and environmental protection.
48	Islamic Development Bank	– Providing financial support for the implementation of energy-saving projects, etc.
49	International Renewable Energy Agency (IRENA)	– Provision of advisory support for the implementation of projects in the field of climate change, as well as for analysis and support of the implementation of NDC.

ANNEX 2

Summary information on the methodologies used, activity data and emission factors

Category	CO_2			CH_4			N_2O		
	Methodological tier	EF	AD	Methodological tier	EF	AD	Methodological tier	EF	AD
1. Energy									
Fuel combustion:									
Energy industry	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
Industry and construction	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
Transport	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
Commercial sector	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
Residential sector	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
Agriculture	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
Fugitive emissions from fuels:									
Coal	T1	D	State Statistics Committee , JSC "Uzbekugol"	T1	D	State Statistics Committee , JSC "Uzbekugol"			
Oil	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo

Category	CO_2			CH_4			N_2O		
	Methodological tier	EF	AD	Methodological tier	EF	AD	Methodological tier	EF	AD
Natural gas	T1	D	State Statistics Committee , Ministry of Energyo	T2	CS	State Statistics Committee , Ministry of Energyo	T1	D	State Statistics Committee , Ministry of Energyo
2. Industrial processes and product use									
Mineral Industry	T2	CS	State Statistics Committee , JSC "Uzpromstroymaterialy"						
Chemical Industry	T2	CS	State Statistics Committee , JSC "Uzkimyosanoat"				T2	CS	State Statistics Committee , JSC "Uzkimyosanoat"
Metal Industry	T1	D	State Statistics Committee						
Lubricants Use	T1	D	State Statistics Committee						
3. Agriculture									
Enteric Fermentation				T2	D	State Statistics Committee , Ministry of Agriculture			
Manure Management				T2	D	State Statistics Committee , Ministry of Agriculture	T2	D	State Statistics Committee , Ministry of Agriculture
Burning Biomass	T1	D	State Statistics Committee , Ministry of Agriculture	T1	D	State Statistics Committee , Ministry of Agriculture	T1	D	State Statistics Committee , Ministry of Agriculture
N_2O emissions from managed soils							T1	D	State Statistics Committee , Ministry of Agriculture
Rice cultivation				T1	D	State Statistics Committee , Ministry of Agriculture			
4. Forestry and other land use									
Forest land	T1	D	State Forestry Committee, Research Institute of Forestry, Cadastral Agency under the State Tax Committee of the RUz						

Category	CO_2			CH_4			N_2O		
	Methodological tier	EF	AD	Methodological tier	EF	AD	Methodological tier	EF	AD
Pastures	T1	D	State Statistics Committee , Cadastral Agency under the State Tax Committee of the RUz						
Cropland	T1	D	State Statistics Committee						
5. Waste									
Solid waste landfills				T2	CS	State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection			
Industrial wastewater				T1	D	State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection, State Statistics Committee			
Domestic wastewater				T1	D	State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection	T1	D	State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection

T1 – IPCC Tier 1

T2 - IPCC Tier 2

D – IPCC default

CS – Country Specific

Summary table of the national greenhouse gas inventory, 1990

Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
Total National Emissions and Removals	97620,841	2251,063	31,675	NE	NE	NE	NE
1 - Energy	104887,875	1845,591	1,893				
1.A - Fuel Combustion Activities	104647,411	13,636	1,890				
1.A.1 - Energy Industries	53396,963	1,125	0,234				
1.A.2 - Manufacturing Industries and Construction	10200,978	0,296	0,042				
1.A.3 - Transport	17191,128	0,982	1,462				
1.A.4 - Other Sectors	23858,342	11,234	0,152				
1.A.5 - Non-Specified	NO	NO	NO				
1.B - Fugitive emissions from fuels	240,464	1831,955	0,003				
1.B.1 - Solid Fuels	NA	14,801	NA				
1.B.2 - Oil and Natural Gas	240,464	1817,154	0,003				
1.B.3 - Other emissions from Energy Production	NO	NO	NO				
1.C - Carbon dioxide Transport and Storage	NO	NO	NO				
1.C.1 - Transport of CO_2	NO						
1.C.2 - Injection and Storage	NO						
1.C.3 - Other	NO						
2 - Industrial Processes and Product Use	6797,166	0,003	6,722	NE	NE	NE	NE
2.A - Mineral Industry	2925,429	NO	NO				
2.A.1 - Cement production	2584,895						
2.A.2 - Lime production	335,925						
2.A.3 - Glass Production	0,000						
2.A.4 - Other Process Uses of Carbonates	4,609						
2.A.5 - Other (please specify)	NO	NO	NO				
2.B - Chemical Industry	3007,133	0,003	6,722	NO	NO	NO	NO

Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.B.1 - Ammonia Production	2992,173						
2.B.2 - Nitric Acid Production			6,722				
2.B.3 - Adipic Acid Production			NO				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				
2.B.5 - Carbide Production	NE	NE					
2.B.6 - Titanium Dioxide Production	NO						
2.B.7 - Carbonates Ash Production	NE						
2.B.8 - Petrochemical and Carbon Black Production	14,960	0,003					
2.B.9 - Fluorochemical Production				NE	NE	NE	NE
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	661,440	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	661,440	NE					
2.C.2 - Ferroalloys Production	NO	NO					
2.C.3 - Aluminium production	NO						
2.C.4 - Magnesium production	NO						
2.C.5 - Lead Production	NE						
2.C.6 - Zinc Production	NE						
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	203,164	NA	NA	NA	NA	NA	NA
2.D.1 - Lubricant Use	203,164						
2.D.2 - Paraffin Wax Use	NE						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	NO	NO	NO				
2.E - Electronics Industry	NO	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE
2.E.1 - Integrated Circuit or Semiconductor				NE	NE	NE	NE

Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.E.2 - TFT Flat Panel Display					NO	NO	NO
2.E.3 - Photovoltaics					NE		
2.E.4 - Heat Transfer Fluid					NO		
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	NE	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				NE			
2.F.2 - Foam Blowing Agents				NE			
2.F.3 - Fire Protection				NE	NO		
2.F.4 - Aerosols				NE			
2.F.5 - Solvents				NE	NO		
2.F.6 - Other Applications (please specify)				NE	NO		
2.G - Other Product Manufacture and Use	NO	NO	NE,NO	NO	NE,NO	NE, NO	NO
2.G.1 - Electrical Equipment					NE	NE	
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE	
2.G.3 - N2O from Product Uses			NE				
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO, NE	NO	NO	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NE	NO					
2.H.2 - Food and Beverages Industry	NO	NO					
2.H.3 - Other (please specify)	NO	NO	NO				
3 - Agriculture, Forestry, and Other Land Use	-14064,199	332,749	22,887	NA	NA	NA	NA
3.A - Livestock	NO	317,925	1,879	NA	NA	NA	NA
3.A.1 - Enteric Fermentation		292,475					
3.A.2 - Manure Management		25,450	1,879				
3.B - Land	-14064,199	NO	NO	NA	NA	NA	NA

Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
3.B.1 - Forest land	-3517,739						
3.B.2 - Cropland	-9207,260						
3.B.3 - Grassland	-1339,200						
3.B.4 - Wetlands	NE						
3.B.5 - Settlements	NE						
3.B.6 - Other Land	NE						
3.C - Aggregate sources and non-CO_2 emissions sources on land	NA	14,824	21,008	NA	NA	NA	NA
3.C.1 - Emissions from biomass burning		0,920	0,020				
3.C.2 - Liming	NA						
3.C.3 - Urea application	NE						
3.C.4 - Direct N_2O Emissions from managed soils			15,390				
3.C.5 - Indirect N_2O Emissions from managed soils			5,056				
3.C.6 - Indirect N_2O Emissions from manure management			0,542				
3.C.7 - Rice cultivation		13,904					
3.C.8 - Other (please specify)		NO	NO				
3.D - Other	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO						
3.D.2 - Other (please specify)	NO	NO	NO				
4 - Waste	NO	72,720	0,173	NA	NA	NA	NA
4.A - Solid Waste Disposal	NO	65,228	NO	NA	NA	NA	NA
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA
4.C - Incineration and Open Burning of Waste	NE	NE	NE	NA	NA	NA	NA
4.D - Wastewater Treatment and Discharge	NA	7,492	0,173	NA	NA	NA	NA
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA
5 - Other	NO	NO	NO	NA	NA	NA	NA

Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	NE	NA	NA	NA	NA	NA	NA
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)							
International Bunkers	2914,651	0,020	0,082	NA	NA	NA	NA
1.A.3.a.i - International Aviation (International Bunkers)	2914,651	0,020	0,082				
1.A.3.d.i - International water-borne navigation (International bunkers)	NE	NE	NE				
1.A.5.c - Multilateral Operations	NO	NO	NO	NO	NO	NO	NO

Summary table of the national greenhouse gas inventory, 2010

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
Total National Emissions and Removals	90486,074	3384,805	40,238	19,162	NE	NE	NE
1 - Energy	96691,137	2657,219	0,870				
1.A - Fuel Combustion Activities	96296,936	8,066	0,865				
1.A.1 - Energy Industries	31566,087	0,598	0,101				
1.A.2 - Manufacturing Industries and Construction	7570,681	0,160	0,018				
1.A.3 - Transport	13187,810	2,398	0,644				
1.A.4 - Other Sectors	43972,358	4,909	0,102				
1.A.5 - Non-Specified	NO	NO	NO				
1.B - Fugitive emissions from fuels	394,200	2649,153	0,006				
1.B.1 - Solid Fuels	NA	4,369	NA				
1.B.2 - Oil and Natural Gas	394,200	2644,784	0,006				
1.B.3 - Other emissions from Energy Production	NO	NO	NO				
1.C - Carbon dioxide Transport and Storage	NO	NO	NO				
1.C.1 - Transport of CO2	NO						
1.C.2 - Injection and Storage	NO						
1.C.3 - Other	NO						
2 - Industrial Processes and Product Use	6744,526	0,016	5,604	19,162	NE	NE	NE
2.A - Mineral Industry	3120,013	NO	NO				
2.A.1 - Cement production	2926,378						
2.A.2 - Lime production	167,7						
2.A.3 - Glass Production	0						
2.A.4 - Other Process Uses of Carbonates	25,935						

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.A.5 - Other (please specify)	NO	NO	NO				
2.B - Chemical Industry	2707,922	0,016	5,604	NO	NO	NO	NO
2.B.1 - Ammonia Production	2687,814						
2.B.2 - Nitric Acid Production			5,604				
2.B.3 - Adipic Acid Production			NO				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				
2.B.5 - Carbide Production	NE	NE					
2.B.6 - Titanium Dioxide Production	NO						
2.B.7 Carbonates Ash Production	NE						
2.B.8 - Petrochemical and Carbon Black Production	20,109	0,016					
2.B.9 - Fluorochemical Production				NE	NE	NE	NE
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	863,121	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	775,284	NE					
2.C.2 - Ferroalloys Production	NO	NO					
2.C.3 - Aluminium production	NO						
2.C.4 - Magnesium production	NO						
2.C.5 - Lead Production	NE						
2.C.6 - Zinc Production	87,837						
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	53,470	NA	NA	NA	NA	NA	NA
2.D.1 - Lubricant Use	53,470						
2.D.2 - Paraffin Wax Use	NE						
2.D.3 - Solvent Use							

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.D.4 - Other (please specify)	NO	NO	NO				
2.E - Electronics Industry	NO	NO	NO	NO, NE	NO, NE	NO, NE	NO, NE
2.E.1 - Integrated Circuit or Semiconductor				NE	NE	NE	NE
2.E.2 - TFT Flat Panel Display					NO	NO	NO
2.E.3 - Photovoltaics					NE		
2.E.4 - Heat Transfer Fluid					NO		
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	19,162	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				19,162			
2.F.2 - Foam Blowing Agents				NE			
2.F.3 - Fire Protection				NE	NO		
2.F.4 - Aerosols				NE			
2.F.5 - Solvents				NE	NO		
2.F.6 - Other Applications (please specify)				NE	NO		
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO	NO, NE	NO, NE	NO
2.G.1 - Electrical Equipment					NE	NE	
2.G.2 - SF_6 and PFCs from Other Product Uses					NE	NE	
2.G.3 - N_2O from Product Uses			NE				
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO	NO	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NE	NO					
2.H.2 - Food and Beverages Industry	NO	NO					
2.H.3 - Other (please specify)	NO	NO	NO				

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
3 - Agriculture, Forestry, and Other Land Use	-12949,589	627,548	33,545	NA	NA	NA	NA
3.A - Livestock	NO	620,998	3,613	NA	NA	NA	NA
3.A.1 - Enteric Fermentation		572,243					
3.A.2 - Manure Management		48,756	3,613				
3.B - Land	-12949,589	NO	NO	NA	NA	NA	NA
3.B.1 - Forest land	-22147,9						
3.B.2 - Cropland	-2002,1						
3.B.3 - Grassland	11200,4						
3.B.4 - Wetlands	NE						
3.B.5 - Settlements	NE						
3.B.6 - Other Land	NE						
3.C - Aggregate sources and non-CO_2 emissions sources on land	NA	6,55	29,932	NA	NA	NA	NA
3.C.1 - Emissions from biomass burning		NO	NO				
3.C.2 - Liming	NO						
3.C.3 - Urea application	NE						
3.C.4 - Direct N_2O Emissions from managed soils			21,744				
3.C.5 - Indirect N_2O Emissions from managed soils			7,103				
3.C.6 - Indirect N_2O Emissions from manure management			1,085				
3.C.7 - Rice cultivation		6,55					
3.C.8 - Other (please specify)		NO	NO				
3.D - Other	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO						
3.D.2 - Other (please specify)	NO	NO	NO				
4 - Waste	NO	100,022	0,218	NA	NA	NA	NA

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
4.A - Solid Waste Disposal	NO	91,296	NO	NA	NA	NA	NA
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA
4.C - Incineration and Open Burning of Waste	NE	NE	NE	NA	NA	NA	NA
4.D - Wastewater Treatment and Discharge	NA	8,726	0,218	NA	NA	NA	NA
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA
5 - Other	NO	NO	NO	NA	NA	NA	NA
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	NE	NA	NA	NA	NA	NA	NA
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)							
International Bunkers	993,569	0,007	0,028	NA	NA	NA	NA
1.A.3.a.i - International Aviation (International Bunkers)	993,569	0,007	0,028				
1.A.3.d.i - International water-borne navigation (International bunkers)	NE	NE	NE				
1.A.5.c - Multilateral Operations	NO	NO	NO	NO	NO	NO	NO

Summary table of the national greenhouse gas inventory, 2017

Categories	Emissions (Gg)			Emissions CO_2 equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
Total National Emissions and Removals	92803,926	2925,031	48,242	269,734	NE	NE	NE
1 - Energy	94631,874	1979,155	0,997				
1.A - Fuel Combustion Activities	94331,781	16,394	0,993				
1.A.1 - Energy Industries	31886,970	0,546	0,110				
1.A.2 - Manufacturing Industries and Construction	21191,739	0,411	0,043				
1.A.3 - Transport	15641,789	9,080	0,757				
1.A.4 - Other Sectors	25611,283	6,357	0,084				
1.A.5 - Non-Specified	NO	NO	NO				
1.B - Fugitive emissions from fuels	300,093	1962,761	0,004				
1.B.1 - Solid Fuels	NA	5,106	NA				
1.B.2 - Oil and Natural Gas	300,093	1957,655	0,004				
1.B.3 - Other emissions from Energy Production	NO	NO	NO				
1.C - Carbon dioxide Transport and Storage	NO	NO	NO				
1.C.1 - Transport of CO2	NO						
1.C.2 - Injection and Storage	NO						
1.C.3 - Other	NO						
2 - Industrial Processes and Product Use	6804,292	0,016	4,677	269,734	NE	NE	NE
2.A - Mineral Industry	3455,538	NO	NO				
2.A.1 - Cement production	3173,358						
2.A.2 - Lime production	239,298						
2.A.3 - Glass Production	0,000						

Categories	Emissions (Gg)			Emissions CO_2 equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.A.4 - Other Process Uses of Carbonates	42,883						
2.A.5 - Other (please specify)	NO	NO	NO				
2.B - Chemical Industry	2223,555	0,016	4,677	0	0	0	0
2.B.1 - Ammonia Production	2217,253						
2.B.2 - Nitric Acid Production			4,677				
2.B.3 - Adipic Acid Production			NO				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				
2.B.5 - Carbide Production	NE	NE					
2.B.6 - Titanium Dioxide Production	NO						
2.B.7 - Carbonates Ash Production	NE						
2.B.8 - Petrochemical and Carbon Black Production	6,302	0,016					
2.B.9 - Fluorochemical Production				NE	NE	NE	NE
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	1040,989	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	908,314	NE					
2.C.2 - Ferroalloys Production	NO	NO					
2.C.3 - Aluminium production	NO				NO		
2.C.4 - Magnesium production	NO					NO	
2.C.5 - Lead Production	NO						
2.C.6 - Zinc Production	132,675						
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	84,210	NA	NA	NA	NA	NA	NA
2.D.1 - Lubricant Use	84,210						

Categories	Emissions (Gg)			Emissions CO_2 equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.D.2 - Paraffin Wax Use	NE						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	NO	NO	NO				
2.E - Electronics Industry	NO	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE
2.E.1 - Integrated Circuit or Semiconductor				NE	NE	NE	NE
2.E.2 - TFT Flat Panel Display					NO	NO	NO
2.E.3 - Photovoltaics					NE		
2.E.4 - Heat Transfer Fluid					NO		
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	269,734	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				269,734			
2.F.2 - Foam Blowing Agents				NE			
2.F.3 - Fire Protection				NE	NO		
2.F.4 - Aerosols				NE			
2.F.5 - Solvents				NE	NO		
2.F.6 - Other Applications (please specify)				NE	NO		
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO	NO, NE	NO, NE	NO
2.G.1 - Electrical Equipment					NE	NE	
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE	
2.G.3 - N2O from Product Uses			NE				
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO	NO	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NE	NO					

Categories	Emissions (Gg)			Emissions CO_2 equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
2.H.2 - Food and Beverages Industry	NO	NO					
2.H.3 - Other (please specify)	NO	NO	NO				
3 - Agriculture, Forestry, and Other Land Use	-8632,240	844,224	42,103	NA	NA	NA	NA
3.A - Livestock	NO	837,473	5,380	NA	NA	NA	NA
3.A.1 - Enteric Fermentation		777,852					
3.A.2 - Manure Management		59,621	5,380				
3.B - Land	-8632,240	NO	NO	NA	NA	NA	NA
3.B.1 - Forest land	-12207,720						
3.B.2 - Cropland	-1448,720						
3.B.3 - Grassland	5024,200						
3.B.4 - Wetlands	NE						
3.B.5 - Settlements	NE						
3.B.6 - Other Land	NE						
3.C - Aggregate sources and non-CO_2 emissions sources on land	NA	6,751	36,723	NA	NA	NA	NA
3.C.1 - Emissions from biomass burning		NO	NO				
3.C.2 - Liming	NO						
3.C.3 - Urea application	NE						
3.C.4 - Direct N_2O Emissions from managed soils			26,671				
3.C.5 - Indirect N_2O Emissions from managed soils			8,607				
3.C.6 - Indirect N_2O Emissions from manure management			1,444				
3.C.7 - Rice cultivation		6,751					
3.C.8 - Other (please specify)		NO	NO				
3.D - Other	NO	NO	NO	NO	NO	NO	NO

Categories	Emissions (Gg)			Emissions CO_2 equivalents (Gg)			
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)
3.D.1 - Harvested Wood Products	NO						
3.D.2 - Other (please specify)	NO	NO	NO				
4 - Waste	NO	101,635	0,465	NA	NA	NA	NA
4.A - Solid Waste Disposal	NO	86,839	NO	NA	NA	NA	NA
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA
4.C - Incineration and Open Burning of Waste	NE	NE	NE	NA	NA	NA	NA
4.D - Wastewater Treatment and Discharge	NA	14,797	0,465	NA	NA	NA	NA
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA
5 - Other	NO	NO	NO	NA	NA	NA	NA
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	NE	NA	NA	NA	NA	NA	NA
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)							
International Bunkers	400,700	0,003	0,011	NA	NA	NA	NA
1.A.3.a.i - International Aviation (International Bunkers)	400,700	0,003	0,011				
1.A.3.d.i - International water-borne navigation (International bunkers)	NE	NE	NE				
1.A.5.c - Multilateral Operations	0,000	0,000	0,000	NO	NO	NO	NO

Note:
NE - no evaluation
NA - not applicable
NO - not observed

ANNEX 3

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