FOURTH NATIONAL COMMUNICATION

TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

REPUBLIC OF AZERBAIJAN

BAKU - 2021

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Ministry of Ecology and Natural Resources
Republic of Azerbaijan

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FOREWORD

Climate change is one of the most severe challenges our planet is facing in 21st century. Regardless of the level of development, no country is insured against the effects of climate change. This is clearly shown by the anomalous natural phenomena that are taking place.

The Republic of Azerbaijan joined the international efforts to mitigate the negative effects of global climate change by ratifying the UN Framework Convention on Climate Change in 1995, the Kyoto Protocol to the Convention in 2000, and the Paris Agreement in 2016.

With a population of around 10 million people, Azerbaijan contributes only 0.15% of total global Greenhouse gasses emissions. However, the physical and geographical characteristics of Azerbaijan make it a highly sensitive country to the effects of climate change. These effects are observed, especially in increase in the number of droughts, thermal stresses, floods, and other dangerous natural phenomena.

As a result of climate change, our water resources have decreased by 15% over recent decades. A growing water shortage cause high vulnerability in different sectors: water resources, human health, agriculture, and forestry. In order to ensure resilience to the hazardous hydrometeorological events, we have established modern system of early warning.

Azerbaijan has submitted an ambitious commitment in NDC to reduce 35% of Greenhouse Gas emissions by 2030. Energy, industry, agriculture, land use and forestry, and waste management are the priority sectors.

The liberation of occupied territories after almost 30 years provides new opportunities for mitigation and reducing the impact of climate change. The rehabilitation of liberated territories includes the application of "smart city" and "smart village" approaches, as well as the creation of "green energy zone" will directly contribute to mitigation initiatives.

In 2019, by the initiative of the First Vice President of the Republic of Azerbaijan, 650,000 trees were planted throughout the country in one day to mark the 650th birthday anniversary of the great Azerbaijani poet and thinker Imadeddin Nasimi.

In general, the greening activities such as the establishment of modern agro-forest massifs are being implemented. In its turn, these activities contribute to the diversification of the national economy and the reduction of carbon dioxide emissions. Azerbaijan has also joined the Bonn Challenge with the commitment of bringing 270 thousand hectares' forest land into restoration by 2030.

Coherent work on local level plays significant role in reaching environmental targets. In this regard, State Commission on Climate Change ensures smooth coordination between all stakeholders in the field of climate change on the national level and contributes to implementation of obligations under the United Nations Framework Convention on Climate Change.

Azerbaijan set the target to increase the share of renewable energy in power generation up to 30% by 2030 despite long the history of oil and gas industry development.

The only way to achieve positive results in reducing the impact on environment is consolidation of efforts of each and every country to ensure safe and resilient future. No country on this planet will be able to act alone. We should use every opportunity which may lead to development of regional interaction.

Ministry of Ecology and Natural Resources

LIST OF ACRONYMS

MENR	Ministry of Environment and Natural Resources
SOCAR	State Oil Company of the Republic of Azerbaijan
SSC	State Statistics Committee
SAARES	State Agency for Alternative and Renewable Energy Sources
UNFCCC	UN Framework Convention on Climate Change
EU	European Union
UNDP	United Nations Development Program
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
OSCE	Organization for Security and Co-operation in Europe
IEA	International Energy Agency
EBRD	European Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change (IPCC)
GUAM	Georgia, Ukraine, Azerbaijan, and Moldova
GIZ	German Organization for International Cooperation
KfW	German Development Bank
NGO	Non-Governmental Organization
AZN	Azerbaijani manat
GHGs	Greenhouse gasses
TPP	Thermal Power Plant
HPP	Hydroelectric Power Plant
AFOLU	Agriculture, Forestry and Other Land Use
NC	National Communication
MRV	Measurement, Reporting and Verification
NDC	Nationally Determined Contributions
CJSC	Closed Joint-Stock Company
OJSC	Open Joint Stock Company
IPPU	Industrial Processes and Product Use
FS	Feasibility Study
CDM	Clean Development Mechanism
GDP	Gross Domestic Product

EXECUTIVE SUMMARY

ES.1.1. The role of the Republic of Azerbaijan in global climate change

The share of the Republic of Azerbaijan in global warming has historically been negligible. In 2016, the amount of GHG emissions in the Republic of Azerbaijan was estimated at 61.257 Mt of CO_2 equivalent, and net emissions, taking into account the removals, were estimated at 54.033 Mt of CO_2 equivalent, which is only 0.15% of the estimated emissions worldwide in 2016.

Per capita emissions in Azerbaijan amounted to 6.3 tons of CO_2 equivalent, and net emissions, taking into account the removals, amounted to 5.6 tons of CO_2 equivalent. For comparison, in 2016, the world average per capita emissions (absorption) were 6 tons of CO_2 equivalent, but in developed countries such as Germany and Austria, for example, these figures were 9.79 tons and 7.74 tons of CO_2 equivalent, respectively. According to the GHG inventory for 1990-2016, in 2016 Azerbaijan achieved a 31.6% reduction in emissions compared to the base year (1990).

ES.1.2. Institutional framework for GHG inventory

Following the ratification of the UN Framework Convention on Climate Change by the Republic of Azerbaijan in 1995, one of the commitments made to the Convention is to provide GHG institutional framework for assessing anthropogenic emissions and removals and to report to the Secretariat of the Convention on an ongoing basis.

The Action Plan between Azerbaijan and the European Union within the framework of the European Neighborhood Policy for European Integration, adopted by the Government of Azerbaijan on November 14, 2006, pays special attention to the development of statistics in Azerbaijan. The Action Plan sets objectives for the period up to 2011 to improve legislation in accordance with the recommendations of the Statistical Office of the European Communities, elaborate a short and medium term development strategy for harmonization with European standards in the relevant statistical areas, take steps to restructure the statistical services to ensure an optimal balance between available resources and data quality needs, improve the conformity with EU standards on national classification systems and statistical methodology, accelerate work to fully apply ESA 95 (European System of Accounts), modernization of information and communication technologies in the national statistical system, and improve the quality and coverage of the business register. As a result of these measures, the integration of the statistics of Azerbaijan into European statistics has been successfully implemented. Following this harmonization, the current structure of the submission of relevant information on the Energy and IPPU sectors in the statistical collection “Energy of Azerbaijan” fully meets the requirements of the GHG Calculation Guidelines. It should be emphasized that due to the lack of any improvements in the data structure for 1990-2010, there were difficulties in recalculations for that period.

Climate Change Center has been established within the MENR to coordinate the national GHG inventory. The Center is responsible for collecting data from relevant government agencies as part of GHG inventory coordination, obtaining relevant opinions and suggestions on GHG inventory reports, and archiving data.

In 2014, the annual official statistical report #2-TG (air) “On protection of ambient air” was complemented with GHG inventory section at the suggestion of the MENR in order to improve the Monitoring, Reporting and Verification (MRV) system for the GHG inventory in the country for obtaining direct data from industrial enterprises. These reports are submitted online by industrial enterprises to the State Statistics Committee once a year upon the MENR’s approval.

GHG inventory process was carried out in Azerbaijan first in 1998-2000 under “First National Communication report of The Republic of Azerbaijan for UN Framework Convention on Climate Change” project. GHG Inventory of the report covered 1990-1994 years. GHG inventory process for the following years was carried out under subsequent National Communication reports.

Regional Project on GHG inventory quality improvement was implemented with the assistance of UNDP-GEF in 2003-2006 years. This Project considered inventory quality improvement in transportation and fugitive waste category of energy sector, internal fermentation and manure categories of agricultural sector and solid municipal wastes of waste sector. GHG inventory was carried out under this project, GHG emissions as of 1990-1994 were compared to those calculated, uncertainties related to wastes were calculated, issues related to quality assurance, quality control and documentation were reviewed.

ES.1.3. Methodological approach

The information on these sections was developed in accordance with "UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention adopted in 17th Session of The Conference of the Parties and listed in Annex III to The Decision 2/CP.17. In addition, the opinions of international Team of Technical Experts (TTE) were considered while preparing this report.

The report includes detailed information on greenhouse gas emitted into atmosphere in 2011-2013 years and emission trends for 1990-2013 years. Besides the information obtained from the State Committee of Statistics, this report includes data provided by SOCAR, the Ministry of Energy, "Azerenergy" OJSC, "Azerbaijan Railways" CJSC, the Ministry of Transportation, Communications and High Technologies and other agencies and companies, which resulted in elimination of many uncertainties. In response to the opinions of UNFCCC TTE, national calorific values (NCVs) for each fuel type used in the calculations are shown in the Table ES-1 below. These coefficients were determined based on analyses carried out by ANSA Petrochemical Process Institute and included in statistical yearbook "Energy of Azerbaijan".

Energy products	Low heat value	Energy products	Low heat value
Crude oil	43.094	Sub-Bituminous coal	18.9 (D,İPCC)
Motor gasoline	43.197	Coke oven coke	28.2 (D,İPCC)
Aviation gasoline	43.375	Petroleum coke	31.556
Jet kerosene	43.174	LPG	47.425
Gas/Diesel oil	42.656	Lubricants	40.193
White spirit	43.430	Refinery Gas	49.5 (D,İPCC)
Naphtha	41.005	Refinery Feedstock	43.0 (D,İPCC)
Other kerosene	43.057	Other petroleum products	42.496
Residual fuel oil	42.480	Natural gas (dry)	38.938
Oil bitumen	40.948	Municipal Wastes (non-biomass fraction)	6.0

Table ES-1. National low heat capacity (TJ/kt)

It is to note that the report was developed in accordance with 2006 IPCC Guidelines, Tier 1 approach and default emission factors for developing countries not included in Annex I to the Convention were used in the calculation. Emissions for the 4.A. Solid Waste Disposal category in the waste sector were calculated in accordance with Tier 2 using the model provided by the IPCC.

Global Warming Potentials (GWPs) used in the report are the potentials determined for 100-year perspective in the IPCC Second Assessment Report (SAR).

The report provides information about hydrofluorocarbons, perfluorocarbons, SO_2 and SF_6, precursors (CO, NOx and NMVOC) along with GHG emissions of main gases, such as CO_2, CH_4 and N_2O. To develop precursors, EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019 was used. All calculations were made in accordance with Tier 2.

It is to note that, Greenhouse Gas Inventory Software (IPCC inventory software Ver.2.54) does not provide tools to calculate precursors and indirect emissions. This makes it difficult to prepare the report.

ES.1.4. Main Categories Analysis

Based on the recommendations set out in the 2006 IPCC Guidelines, key categories have been identified to prioritize efforts to improve overall inventory quality.

By applying the Tier 1 methodological approach, 16 categories on Level (L) were identified in 2016, excluding LULUCF.

	IPCC Category code	IPCC Category	Greenhouse gas	2016 Ex,t (Gg CO_2 Eq)
1	1.A.1	Energy Industries - Gaseous Fuels	Carbon Dioxide (CO_2)	12914.726
2	1.A.4	Other Sectors - Gaseous Fuels	Carbon Dioxide (CO_2)	7478.5676
3	1.A.3.b	Road Transportation	Carbon Dioxide (CO_2)	5689.2627
4	3.A.1	Enteric Fermentation	Methane (CH_4)	5170.62
5	1.B.2.b	Natural Gas	Methane (CH_4)	5168.9711
6	1.B.2.a	Oil	Carbon Dioxide (CO_2)	5145.3171
7	1.A.1	Energy Industries - Liquid Fuels	Carbon Dioxide (CO_2)	3368.1317
8	1.B.2.a	Oil	Methane (CH_4)	2963.5414
9	1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	Carbon Dioxide (CO_2)	2646.1753
10	3.C.7	Rice cultivation	Methane (CH_4)	1961.61
11	4.A	Solid Waste Disposal	Methane (CH_4)	1233.33
12	2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	1206.66
13	1.A.4	Other Sectors - Liquid Fuels	Carbon Dioxide (CO_2)	1007.0343
14	3.A.2	Manure Management	Nitrous Oxide (N_2O)	871.1
15	1.A.3.a	Civil Aviation	Carbon Dioxide (CO_2)	697.96155
16	2.A.1	Cement production	Carbon Dioxide (CO_2)	666.796

Table ES-2. Main Categories Analysis (kt CO2 eq.)

ES.1.5. Quality control and quality assurance

The data provided by the State Statistics Committee (SSC) of the Republic of Azerbaijan on annual basis were mainly used in the report. The internal procedures used to verify the data quality in the SSC meet the standards of the International Energy Agency (IEA). The data received from other agencies was obtained on the basis of inquiries sent by MENR or taken from the official websites of these agencies. In addition, in order to check the quality of the developed report, the data used in the calculations were checked by an expert who was contracted by the UNDP and who was not directly involved in the inventory. As a result of the implemented QA/QC measures, it was found that in 2011-2013, emissions from waste incineration for the purpose of obtaining energy were calculated twice for both the Energy Sector and the Waste Sector. Furthermore, in the calculation of volatile emissions in the oil and gas industry, the total production volumes were used instead of the commercial production volumes of natural gas. It is to note that in recent years there has been a significant increase in the volume of natural and associated gas used in the gas-lift system in order to increase productivity in crude oil production. This process is carried out in completely closed circumstances and only the technological loss in the compressors is considered.

ES.1.6. Recalculation

In order to ensure the consistency of the methodological approaches used in the GHG inventory, the emissions from the Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Types of Land Use (AFOLU) and Waste sectors for 1990-2010 were recalculated in accordance with the 2006 IPCC Guidelines requirements.

Compared to the Second Biennial Report, the current inventory shows a significant increase in the emissions calculated for 1990 and 1995. This increase was due to the fact that the statistical bulletins published by the SSC for 2002-2003 took into account the actual losses in pipelines during the transportation and distribution of natural gas.

ES.1.7. Assessments of uncertainties

The GHG emissions in the Republic of Azerbaijan have been assessed with the highest possible accuracy. However, the results obtained are somewhat uncertain. Calculation of some emissions, such as CO_2 emissions from the gaseous fuels combustion in the energy industry, or CH_4 and CO_2 emissions from the petrochemical industry, have minimal uncertainty. For other sources, uncertainty is high due to poor performance data, the use of average emission factors, and a limited understanding of the waste generation process. The general uncertainty of the 1990-2016 inventory was assessed based on the Tier 1 methodological approach.

The uncertainties of the data obtained in the inventory process and the emission factors used were analyzed and evaluated. The analysis of each sector reflects the degree of accuracy of the GHGs calculated in that sector.

Energy sector

The most uncertainties in the energy sector are in oil and gas production, energy consumption, especially in the population category.

Generation of methane gas, which is released into the atmosphere in the oil industry, occurs in extraction, processing, transportation, and storage of oil. The volumes of methane emissions from these sources are unclear. Thus, in most cases, there are no measurement tools for the gas released from sources. As the tools are quite expensive, their installation is not economically viable for the company. For this reason, uncertainties arise in the data, as the methane gas extracted with the oil cannot be measured.

In some cases, uncertainties in the residential sector come from the lack of control and measuring instruments. In this case, electricity, gas consumption is calculated according to regulations. Natural gas used by the population is released into the air as the result of leakages. And it is difficult to know the exact amount of it. Therefore, for the reduction of the percentages of uncertainties in the inventory of the sector, there is need for further studies.

The uncertainties of the data provided by the Statistics Committee in the 2006-2010 energy balances were compared with the statistical differences provided by it for each year, and it was determined that the uncertainties in the data did not exceed 3.2%.

In the emission rates, liquid fuels uncertainties do not exceed 5%. The uncertainty of natural gas is 17.5% compared to the emission coefficient in 2006. Thus, the low thermal coefficient used in the National coefficient is different from the coefficient adopted the methodology.

Methane gas uncertainty has been calculated by using the 2003 - Positive Experience document. An uncertainty of 34.7% has been estimated.

Industrial processes

The uncertainty in the calculation of the emissions in a timeframe, i.e., for the base year, has also been high for the calculation of F-gases. Thus, due to lack of information about the sources of these gases for the years of 1990-1999, their quantities have not been calculated for the mentioned years.

Agriculture

It has been found out that the uncertainties concerning the CH_4 released from internal fermentation and manure by the best practices method in the Agricultural sector are approximately 19.5%. In reality, the figure could be much higher. Thus, accurate data on the number of cattle in the households are not provided in any source. Studies are needed to reduce uncertainties.

Land Use, Land Use Change and Forestry

In the forestry sector, there are very huge uncertainties. This is due to the fact that unlike other forests, the sorts of trees in the country's forests are wide range. Therefore, the selection of an average rate for the emission factors creates large uncertainty. In-depth research is needed to get rate closer to exact one.

Wastes

In the waste sector, the percentage of uncertainty for solid wastes of households CH4 emissions is lower than the percentage of the CH4 emissions from wastewaters. In total, the uncertainty for CO2 emissions is nearly 17%.

ES.1.8. Integrity assessment

In general, the national inventory of the Republic of Azerbaijan is a complete record of the following direct greenhouse gases - CO_2, CH_4, N_2O, HFC, PFC and SF_6. In addition, the national inventory also covers the following indirect greenhouse gases: CO, NOx, NMVOC and SO_2. Despite efforts to cover existing sources of emissions/removals, there are still gaps in the inventory. Most of the gaps are due to the incompleteness of the activity data required to assess GHG emissions and removals.

ES.1.9. Direct GHG emissions report

Carbon dioxide emissions continue to play an important role in total GHG emissions. Emissions from the energy sector dominate in total emissions. The GHG emissions calculated for the country are 63% carbon dioxide and 31.6% methane. Compared to 1990, there was a 4.6% decrease in carbon dioxide and a 3.5% increase in methane gas. More detailed information on sectors is provided in the relevant sections of the report.

Categories	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Total National Emissions and Removals	34011.92	17110.228	1236.858	1206.66	467.46	NE
1 - Energy	39786.222	8208.6838	133.25796	NO	NO	NE
2 - Industrial Processes and Product Use	1449.5875	12.936952	NO	1206.66	467.46	NE
3 - Agriculture, Forestry, and Other Land Use	-7223.89	7562.31	1103.6	NO	NO	NO
4 - Waste	İE	1326.297	İE	NO	NO	NO

Table ES-3. Calculation of direct GHGs for the country in 2016 (in CO_2 equivalent).

CHAPTER 1: NATIONAL CIRCUMSTANCES

1.1. Physical context

1.1.1. Geographical location

Azerbaijan located between 38°25'-41°55' North Latitude and 44°50' - 50°51' East Longitude in the eastern part of the South Caucasus, on the western shore of the Caspian Sea. It stretches 400 km from north to south and 500 km from west to east. Remote points are located on Gutan Mountain in the north, Astarachay in the south, Sadarak region in the west, the Absheron Peninsula in the east (Shah-Dili), and Neft-Dashlari in the islands.

The territory of Azerbaijan is 86.6 thousand km. The territory of the country is divided into five geographical regions: four of them (Greater Caucasus, Lesser Caucasus, Nakhchivan AR, Lankaran) are mountainous, and one (Kur-Araz or Central Aran) is lowland.

Azerbaijan shares borders with 5 countries. With a total border of 390 km to the north with Russia, 480 km to the northwest with Georgia, 1007 km to the west with Armenia, 15 km to the southwest with Turkey, and 765 km to the south with Iran, Azerbaijan border with Russia, Kazakhstan, Turkmenistan and Iran in the Caspian Sea. The territory of Azerbaijan is 86.6 thousand km^2 including Pirallahi, Chilov, Boyuk Zira, Garasu, Sangi Mughan, Neft Dashlari, and other islands in the Caspian Sea.

The Caspian Sea is the largest inland body of water in the world It is subject to water-level fluctuations (10-20%) and on average covers an area of 370 thousand km^2. The main role in the water balance of the Caspian Sea is played by about 130 rivers flowing into the sea.

The capital of Azerbaijan is Baku. Baku is the largest port on the Caspian Sea and an invaluable flagship of the oil industry. This city is a major industrial, scientific and cultural center of the Caucasus.

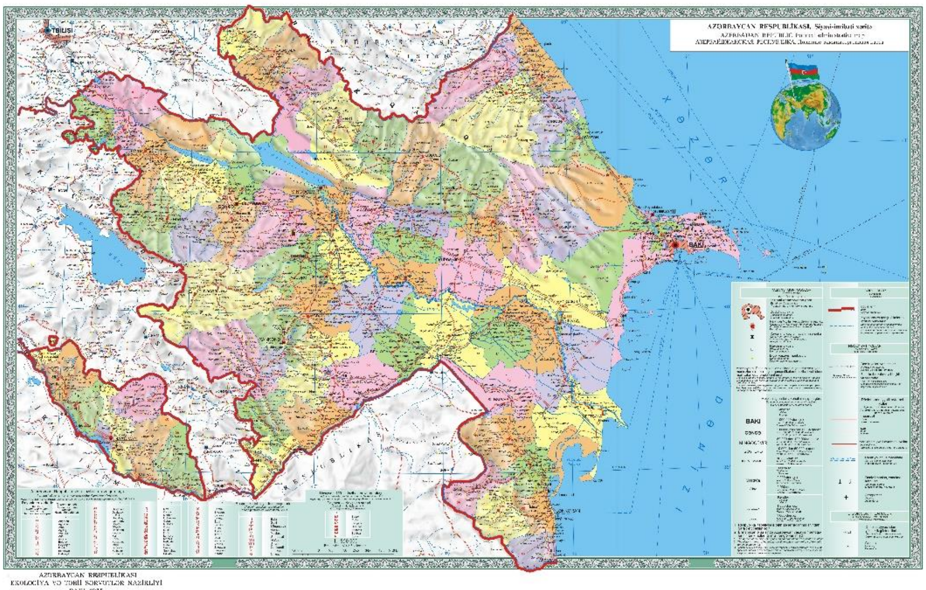


Figure 1-1. Political map of the Republic of Azerbaijan

1.1.2. Relief

The relief of the Republic of Azerbaijan is very diverse. Two main forms of relief dominate in this area - plains and mountains.

About 60 percent of Azerbaijan's territory is mountainous. The main geomorphological units of the republic, the Greater Caucasus, the Lesser Caucasus (along with the Karabakh plateau), and the Talysh

Mountains surround the Kura-Araz lowland from the north, west, and southeast. The Nakhchivan Autonomous Republic is located around the middle reaches of the Araz River and surrounded by Zangazur and Daralayaz mountains.

The average height of the territory of the republic is up to 400 meters. However, while the Caspian lowland is below sea level (currently -26.5 m), the highest point Bazarduzu is 4,466 meters high.

The south-eastern part of the Greater Caucasus belongs to Azerbaijan. Two mountain ranges are distinguished in the area: Head or Watershed with the mountain peak Bazarduzu (4466 m), the Side range with the mountain peak Shahdag (4243 m). To the south-east, the ridges gradually descend to an altitude of 1000-700 m. The ranges of the Greater Caucasus are surrounded by foothills: a steppe plateau to the north-west, Gobustan to the south-east, Alazan-Ayrichay plain to the south-west, and Gusar sloping plain to the north-east.

The mountains are mainly composed of Jurassic and Cretaceous sedimentary rocks that are relatively easily denudated. Bedlands (Jeyranchol, Ajinohur plain) and mud volcanos (Gobustan, Absheron) are characteristic for the foothills. Gusar plain and Alazan-Hefteran valley are composed of a thick layer of quaternary gravel sediments.

The Lesser Caucasus is a complex mountainous area composed of a number of ranges and plateaus with relatively low altitudes, occupying the south-western and western parts of the republic. The main mountain ranges are Murovdagh, Shahdag, and Zangazur. The Garabagh plateau, extending from the south of Murovdagh towards the river Araz, lies on the cones of extinct volcanos and quaternary lava. The Lesser Caucasus is composed of Jurassic-Cretaceous volcanic and sedimentary rocks.

The Talysh Mountains occupy the south-eastern part of the country. They are mainly composed of tertiary sediments. The Talysh Mountains are the range of transition from the Lesser Caucasus to Elbrus Mountains in Iran and are composed of three mountain ranges, with a height of 2477 meters and a number of their branches.

The Kura-Araz lowland covers the area between the Greater Caucasus, Lesser Caucasus, and Talysh mountains. Being the largest intermontane lowland in the Caucasus, it occupies the central part of the republic. The lowland is divided into five plains by the Kura and Araz rivers: Shirvan, Karabakh, Mil, Mughan, and Salyan plains.

The Samur-Davachi lowland, resting on Gusar sloping plain on the shore of the Caspian Sea, stretches from the Absheron peninsula to the north. The narrow strip of the Lankaran lowland stretches south from the Absheron Peninsula along the foothills of the Talysh Mountains. Most of the Kura-Araz, Samur-Davachi, Lankaran lowlands, and the Absheron Peninsula lie below sea level.

1.1.3. Climate

The climate of Azerbaijan is strongly influenced by the country’s geographical position, relief, and the Caspian Sea. Semi-desert and arid (steppe), subtropical, temperate, and cold climate are common in this area. 8 of the 11 climate types on Earth (according to V.V. Keppen) were identified in this area. The dry subtropical climate is typical for this area.

In plains summers are hot, winters are mild, while in mountains summers are cooler and temperatures are negative. While the absolute maximum is +46°C, the absolute minimum drops to -32°C. Humidity is low and varies across the country. Annual precipitation in the western part of the Absheron Peninsula is 150-200 mm, while in the foothills of the Talysh Mountains it reaches 1,600-1,700 mm. Annual precipitation is less than 400 mm in 65% of the country. Snow cover in the plains does not persist for a long time and in some years, it is not even observed. The snowiest areas of the Republic are the southern slopes of the Greater Caucasus. The highest peaks of the Greater Caucasus are always covered with snow.

Prevailing winds blow from the north (Absheron peninsula), south-west (Kur-Araz lowland), and west (Lankaran lowland). The average annual wind flow speed in the country is up to 5 m/s. However, it varies between 6-8 m/s in the coastal areas of Absheron Island.

1.2. Natural resources

1.2.1. Land resources

Vertical soil zonality predominates in the territory of the republic. There are 25 types and 60 subtypes of soils in the country.

Chestnut soils (gray-brown) are widespread in the Republic at altitudes of 400-800 m. The amount of humus in these soils is 2.5-3.5%. In the Greater and Lesser Caucasus Mountains, Ganja-Gazakh and Mil-Karabakh plains, in the low mountainous areas of Ajinohur and Jeyranchol, these lands rise up to 600 m, and in Nakhchivan to more than 1000 m.

Mountain-forest soils occur in the mountains at an altitude of 700-2000 m. Brown mountain-forest soils are widespread in the lower zones and relatively arid areas. The amount of humus in these soils with sparse forests and shrubs is 5-7%. Brown mountain-forest soils occur in the upper parts. Due to heavy rainfall, brown mountain-forest soils are widespread in the Lankaran region. Nakhchivan does not have this type of soil due to the arid climate.

Mountain-black soils occur in the south-east of the Greater Caucasus, and in the north of the Karabakh and Murovdagh ranges. Humus in these soils is 6~6.5%. Yellow and red soils are found in the lower parts of the Talysh Mountains and Lankaran lowland. These soils with a humus content of 8-12% are rich in iron oxide.

The Alazan-Ayrichay valley, Samur-Davachi lowland, and Shollar plain are covered with meadow-forest soils. Alluvial-meadow soils occur in the northern foothills of the Talysh Mountains, on the shores of the Gizilaghaj Bay, along the Kura River and the Main Shirvan Collector.

The lands of the Republic of Azerbaijan are divided into the following categories depending on their purpose and legal regime:

- agricultural lands;
- lands of settlements (cities, settlements, and rural settlements);
- Lands for industrial, transport, communications, defense, and other use;
- lands of specially protected areas;
- lands of forest fund;
- lands of water fund;
- lands of the reserve fund.

The plots of land intended for agricultural purposes under the territorial planning of land use are considered agricultural lands. Agricultural land includes agricultural areas, lands under forest strips, on-farm roads, communications, swamps, ponds, and buildings and structures required for conducting agricultural activities. Agricultural areas (arable lands) include lands sown with grains, perennial crops, derelict lands, meadows, pastures, and grazing fields.

The total land fund in the country is more than 8.641 million hectares. 4.78 million hectares or 55% of this are agricultural lands, including 1.45 million hectares of irrigated land. About 2.06 million hectares of agricultural land are arable lands. 3.88 million hectares of the country's lands are non-agricultural. Azerbaijan is one of the countries having limited land resources. The agricultural land per capita in the country is equal to 0.47 hectares, including 0.2 hectares of crop field. The per capita area of pastures and hayfields is limited. Except for foothills and the south-eastern part of the country, for most of the agricultural land's irrigation water is a very important means of agricultural production. This is due to the specifics of arid and semi-arid climates.

Distribution of the total land fund by purpose of use (as of the end of year, thousand ha)												
	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Agricultural lands-total	4740.4	4758.6	4766.8	4768.7	4768.3	4769.8	4769.7	4769.8	4772.9	4777.5	4779.5	4779.7
among them:												
perennial plantings	236.8	221,5	227.4	227.2	230.9	230.3	233.5	237.0	241.1	246.8	255.0	260.3
mowing and grazing areas	2678.0	2693.9	2655.3	2655.8	2640.6	2614.2	2609.7	2595.1	2532.9	2436.2	2426.6	2423.4
Non-agricultural lands - total	3919.6	3901.4	3893.2	3891.3	3891.7	3890.2	3890.3	3890.2	3887.1	3882.5	3880.5	3880.3
including:												
forest areas	1037.4	1037.8	1040.7	1040.8	1040.8	1040.2	1040.3	1040.3	1040.3	1040.3	1040.2	1040.3
Lands submerged in the water	399.5	394.1	394.5	394.2	394.2	394.1	393.7	394.5	393.0	393.8	394.6	394.6
other lands	2482.7	2469.5	2458.0	2456.3	2456.7	2455.9	2456.3	2455.4	2453.8	2448.4	2445.7	2445.4

Table 1-1. Distribution of the total land fund by the purpose of use (according to the State Statistics Committee)

The intensity and form of erosion processes vary depending on the natural conditions and anthropogenic impacts existing in different regions of Azerbaijan. Water erosion is widespread in mountainous areas, especially on the southern and partly northeastern slopes of the Greater Caucasus. Devastating floods are more common on slopes with sparse forest cover, especially in Shinchay, Kishchay, Girdimanchay, Pirsaat, and Gozluchay. The main factor driving the erosion process in the subalpine and alpine meadows above the forest zone is the increasing anthropogenic pressure exerted by cattle and sheep herds.

Wind erosion is most widespread on the Apsheron Peninsula, in Gobustan, the coastal zone of the Caspian Sea from the Samur River to the Gizilagaj Bay, on the Mil and Mughan plains, Jeyranchol, Achinohur Plain, and in the Bozdag system. The damage caused to farms by wind erosion is enormous.

Soil salinization is considered to be one of the biggest ecological and geographical challenges in Azerbaijan. The total area of saline lands in the country is more than 2 million hectares, 1.32 million hectares of it is in the Kura-Araz lowland.

1.2.2. Water resources

Variety of physical and geographical conditions of the territory of Azerbaijan, features of relief and climate, and human activity affect the development of hydrographic network (sum of rivers, lakes, glaciers, reservoirs, other permanent or temporary water basins and objects located in a certain area). The main water objects pertaining to the hydrographic network - rivers, lakes, and water reservoirs are unevenly distributed across various parts of the country.

Azerbaijan's water resources are limited compared to other countries in the South Caucasus and account for only 15 percent of the region's water resources. Sources of the country's surface water resources are rivers, lakes, reservoirs, and glaciers. Surface water resources are mainly concentrated within rivers. 67-70% of river water resources originate in the territory of neighboring countries.

The river net of the republic consists of more than 8350 rivers, 2 of them are rivers with a length of more than 500 km, while most rivers are smaller than 10 km long. The river system of Azerbaijan comprises the Kura River and its tributaries, and the rivers flowing directly into the Caspian Sea. The Kura River is the main water source, the artery of Azerbaijan. The river flows through the territory of Turkey, Georgia, and Azerbaijan. Its total catchment area is 188,000 km^2, and 258000 km^2, or 31% of it falls to the share of Azerbaijan. The Kura River passes through Mingachevir, Yevlakh, Shirvan cities, and a number of other regions of the country. The main transboundary rivers of Azerbaijan (21 rivers) are the Kura, Araz, Ganikh, Gabirri, Samur, Astara rivers and small rivers forming the tributaries of the Kura and Araz rivers.

The Araz River, which is the second largest river in the country and a right tributary of the Kura River, flows through Turkey and serves as the border between Turkey and Armenia, Turkey and Azerbaijan, and Iran and Azerbaijan. Its total catchment area is 102,000 km^2 and 18740 km^2 or 18% of it fall to the share of Azerbaijan.

Rivers	Flows into (which shore)	Length, km	Water catchment area, km^2		Altitude, meters
			source	mouth	
Kura River	Caspian Sea	1515	188000	2740	-27
Araz	Kura River (right)	1072	102000	2990	-11
Ganikh	Mingachevir Water Reservoir	413	16920	2560	75
Gabirri	Mingachevir Water Reservoir	389	4840	2560	51
Khrami	Kura River (right)	220	8340	2422	255
Aghstafachay	Kura River (right)	133	2586	3000	210
Kurekchay	Kura River (right)	186	2080	3100	18
Arpachay	Araz (left)	126	2630	2985	780
Hakarichay	Araz (left)	113	5540	3080	268
Samur	Caspian Sea	216	4430	3600	-27
Pirsaat	Caspian Sea	119	2280	2400	-11
Bolgarchay	Mahmudchala lake	163	2170	1710	-17

Table 1-2. Rivers

In Azerbaijan, there are about 450 lakes with a total area of 395 km^2, and 10 of these lakes have an area greater than 10 km^2. The largest lake of the Republic is the Sarysu Lake located in the Kura-Araz lowland (water surface area 65.7 km^2, volume 59.1 million m^3). Tufangol (area 0.01 km^2, volume 0.11 million m^3) is the highest mountain lake located in the basin of Demiraparanchay and at an altitude of 3277 meters. One of the most picturesque lakes of the Republic is the famous Goy-Gol Lake. The lake was formed in the middle reaches of the Aghsuchay after a strong earthquake in 1139.

Lakes	Location:	Water catchment area, km^2	Volume, million m^3
Sarısu	Kura-Araz lowland	65,7	59,1
Aghzibirchala	Shabran	13,8	10,0
Goygol	Kurekchay basin	0,79	24,0
Hajigabul	Kura-Araz lowland	8,4	12,1
Boyuk-Shor	Absheron peninsula	16,2	27,5
Aghgol	Kura-Araz lowland	56,2	44,7
Jandargol	The border of Georgia	10,6	51,0
Boyuk Alagol	Karabakh volcanic plateau	5,1	24,3
Ashig-Gara	Hakarichay river basin	1,76	10,2
Garachug	Nakhchivanchay river basin	0,45	2,53

Table 1-3. Lakes

140 water reservoirs and artificial reservoirs were built in Azerbaijan. Their total area is 982.84 km^2 and the total volume equal 21464 million m^3. In Azerbaijan, there are more than 60 reservoirs with a volume of over 1 million m^3. Water reservoirs are built both in the riverbed and outside it. Water reservoirs are also used for irrigation. Reservoirs and hydropower plants built on the Kura, Araz, and Tartar rivers - Shamkir, Mingachevir, Yenikand, Varvara, Araz, and Sarsang - are complex water facilities and used for energy, irrigation, water supply, etc. Mingachevir reservoir, which is the largest reservoir of the Republic, was put into operation in 1953.

Water reservoir	Water catchment area, km²	Volume, million³
Mingachevir	605	15730
Shamkir	116	2677
Yenikand	22,61	158,5
Varvara	22,5	60
Araz	145	1254
Sarsang	13,85	565
Jeyranbatan	13,89	186
Khanbulanchay	2,46	52
Sirab	1,54	12,7
Aghstafachay	6,38	120
Khachinchay	1,76	23

Table 1-4. Water reservoirs

Groundwater. Groundwater suitable for use in the territory of the Republic of Azerbaijan is limited and unevenly distributed. Moreover, the territory of the Republic of Azerbaijan is rich in highly mineralized thermal and hydromineral raw water, which has thermal energy and industrial importance and is distributed in deep horizons of the Earth's crust. Additionally, there are 16 medical-drinking and 14 mineral water sources of medical importance in the territory of the Republic of Azerbaijan. Iodine-bromine water deposits with proven industrial reserves have been operated for many years and have played an important role in the country's economy.

1.2.3. Biological resources

Flora. The country's flora includes 5,000 plant species in 176 families and 1,142 genera. In terms of the total number of species, the flora of Azerbaijan is much richer than in the other republics of the South Caucasus. Plant species found in the country account for 66% of the total number of plant species growing in the Caucasus. The Republic of Azerbaijan is rich in relict species rooting back to the tertiary period. There are over 240 endemic plant species in the country.

Broad-leaved forests are spread at an altitude of 600-1800 m above sea level in the mountainous areas of the Greater and Lesser Caucasus. Coniferous forests occur locally in the Eldar plain (Eldar pine), in the mountainous regions of the Greater and Lesser Caucasus, and around Goygol.

Fauna. The fauna of Azerbaijan includes 100 species of mammals, 360 species of birds, 61 species of reptiles, 10 species of amphibians, 100 species of fish, and more than 15,000 insects.

Invertebrates. About 25,000 species of invertebrates were found in Azerbaijan, 90% of them belong to the type of arthropods. 90% of them are insects (Insecta).

Cyclostomes The fauna of Azerbaijan includes one species of round-mouthed fish - the Caspian lamprey (Caspimyzon wagneri). It is included in the first edition of the Red Book of the Republic of Azerbaijan as a rare species.

Fish. 95 species of Azerbaijan's ichthyofauna are considered indigenous, and the rest are introduced species. Out of the bony fish (Osteichthyes), 101 species of fish pertaining to a total of 13 groups were recorded in the Azerbaijani section of the Caspian Sea (10 groups) and inland waters.

Amphibia. Amphibians in different landscapes vary according to species composition and distribution. Due to the warm climate and rich food, the species composition is relatively rich in the plains, semi-deserts, and foothills.

Reptiles. The modern vertebrate fauna of Azerbaijan includes 54 species of reptiles. Most species of reptiles live in semi-deserts.

Birds. Ornithofauna in Azerbaijan is very rich. 394 bird species from 60 families were recorded in this area. 40% of them are non-migrating and found in Azerbaijan all year round, 27% is wintering and more than 10% is recorded during migration. One of the largest migration routes in Eurasia passes through Azerbaijan. Every year, about 1.5 million waterfowl alone pass through the territory of Azerbaijan, using it as a stop for rest and feeding.

Mammals. 107 species of mammals are registered in Azerbaijan. The most common mammal species in Azerbaijan are water rat (Arvicola terrestris), brown rat (Rattus norvegicus), wolf (Canis lupus), jackal (C. aureus), fox (Vulpes vulpes), weasel (Mustela nivalis), badger (Meles) and wild boar (Sus scrofa).

Under the current legislation, rare and endangered species of animals and plants in their natural habitat within the country are under special protection and are included in the Red Book of the Republic of Azerbaijan. As an official document, the Red Book of the Republic of Azerbaijan contains information on the status, distribution, and protection of animal and plant species (subspecies, populations) throughout the territory of the Republic of Azerbaijan, including the part of the Caspian Sea belonging to the Republic of Azerbaijan.

The protection of flora and fauna in the country is enshrined both in the country's legislation and in the first edition of the Red Book of plants and animals of the Azerbaijan SSR, published in 1989. 140 species of flora and 108 species of fauna of Azerbaijan are included by scholars in this list of species requiring protection.

In the last (2013) edition of the Red Book of the Republic of Azerbaijan approved in 2000, the protection status of 300 species of plants (266 higher and 20 lower) and fungi (146 higher and 20 lower) and 223 species of animals (1 Oligochaeta species, 1 Crustacea species, 1 Mollusca species, 71 Insecta species, 6 Amphibia species, 14 Reptilia species, 9 Pisces species, 72 Aves species, and 42 Mammalia species) were re-assessed by experts in cooperation with the representatives of various organizations of the country.

1.2.4. Mineral resources

The mineral and raw material base of the republic is composed of mineral deposits and resources identified as a result of geological exploration. As a result of many years of geological exploration, deposits of ferrous, non-ferrous, and precious metal ores, non-metallic raw materials and construction materials, as well as fresh groundwater, mineral, thermal and iodine-bromine industrial waters sources were discovered in various regions of Azerbaijan. Gold, copper, lead-zinc, iron, molybdenum ores, various types of non-ore, deposits of construction materials have a special place among them.

Azerbaijan is rich in oil and gas fields. This fuel is mostly produced in Absheron on the shores of the Caspian Sea, in Baku, and the Absheron archipelago. Moreover, South-Eastern Shirvan, Central Aran (Muradkhanli and Mollakand), Gobustan, Jeyranchol, Ajinohur, and Siyazan (Devechi) are also rich in oil and gas.

Azerbaijan is also rich in ore deposits. The largest iron ore deposit is located in Dashkasan. There is a world-famous alunite deposit in Zaylik. Copper deposits are in Gadabay and Kalbajar.

Paraghachay and Gapichig molybdenum deposits are of industrial importance. They were also discovered in Batabat and Bichenak. Polymetal is extracted from the Gumushlu (Nakhchivan), Mehmana (Aghdara), and Filizchay (Balakan) deposits. Barite extracted from Chovdar village is used in the oil industry. The Nehram salt deposit in Nakhchivan has reserves of 1 billion ton Sulphur pyrite is the greatest wealth of the Lesser Caucasus.

Bentonite clay deposit in Gazakh region, Aghdag zeolite deposit in Tovuz region, Aghjakand gypsum deposit in Goranboy region, Gobustan, Absheron, Tovuz limestones, Shahtakhti (Nakhchivan) and Kalbajar travertine stones, Dashkasan marble, Hajivalli quartz sands are of great economic importance. More than 50 mercury deposits are discovered in the Lesser Caucasus and Nakhchivan. The Sorbulag, Aghyatag, and Lohchay fields are in Kalbajar.

Azerbaijan is a museum of mineral waters. It has more than 10 types of mineral water. In terms of quality, the "Isti su" spring of Kalbajar is superior to the famous Karlovy Vary mineral spring in the Czech Republic. Moreover, there are many thermal springs in Azerbaijan.

1.3. Territorial structure and administrative-territorial division, population and human development

1.3.1. Territorial structure and administrative-territorial division

The administrative-territorial structure of the country serves as the geographical basis for its territorial division. The establishment of settlements in Azerbaijan has gone through a complex historical period since ancient times. In each historical period, there have been processes of formation, rise, and decline of the settlement system, and a specific economic and political basis have led to this. In parallel to the change in the existing socio-economic relations, the administrative-territorial structure of the state has changed as well. The social structure of Azerbaijan has changed radically several times, consisting of states, emirates, khanates, sultanates, provinces, okrugs, mahals, and regions.

The first democratic parliamentary republic in the Muslim East, the Democratic Republic of Azerbaijan, was proclaimed on May 28, 1918. The life of the republic was short and on April 28, 1920, Azerbaijan was included in the USSR. Gaining its independence on October 18, 1991, Azerbaijan declared itself to be the political and legal successor of the Democratic Republic. As provided by the Constitution of the independent Republic of Azerbaijan, adopted by a national vote (referendum) on November 12, 1995, the state of Azerbaijan is a democratic, legal, secular, and unitary republic. The territory of the Republic of Azerbaijan is united, inviolable, and indivisible. Internal waters of the Republic of Azerbaijan, sector of the Caspian Sea (lake) belonging to the Republic of Azerbaijan, air space over the Republic of Azerbaijan are integral parts of the territory of the Republic of Azerbaijan.

The powers of state authorities and municipalities on the regulation of territorial structure and administrative division of the Republic of Azerbaijan, as well as the legal grounds for registration, delimitation, naming or renaming of territorial units, and other issues related to territorial structure and administrative division of the Azerbaijan Republic are governed by the Law on Territorial Structure and Administrative-territorial Division of the Republic of Azerbaijan.

The number of territorial units in Azerbaijan is as follows: 1 Autonomous Republic, 63 regions, 78 cities, 14 small towns, 261 settlements, 1726 rural districts, 4248 rural settlements.

Cities of republican subordination are Baku, Ganja, Sumgait, Mingachevir, Shirvan, Sheki, Khankendi, Yevlakh, Lankaran, and Naftalan.

Cities and regions of Nakhchivan Autonomous Republic: Nakhchivan city, Babek region, Julfa region, Kangarli region, Ordubad region, Sadarak region, Shahbuz region, and Sharur region.

The capital of the Republic of Azerbaijan is Baku city. The area of Baku is 2140 km, and the number of its population was 2,293,047 in 1999. Baku includes 12 administrative districts and 59 settlements. The coastal part of Baku is about 28 meters below sea level. Its climate is dry subtropical. The average temperature is 3-4 ° C in January and 25-26 ° C in July. Strong north wind - Khazri and south wind - Gilavar are typical for Baku.

1.3.2. Demographic situation

The modern demographic history of the Republic of Azerbaijan can be divided into periods of 1990-2002 and post 2003. In the early 1990s, the Republic of Azerbaijan, like many other former Soviet republics, underwent many changes in connection with the development of a market economy and democracy.

The socio-economic reforms carried out in the Republic of Azerbaijan since 2003, the achieved sustainable macroeconomic stability achieved, the strengthening of the social protection system, the reduction of poverty, and the improvement of living standards have also had a positive impact on demographic development. During this period, due to the measures taken to improve people's health, there was a decrease in mortality, especially infant mortality, and an increase in life expectancy at birth, and a decrease in migration flows out of the country, and a gradual transition to a positive migration balance.

As of 2020, the number of population in the Republic of Azerbaijan was 10,067,100 people. 52.8% of the population lives in urban areas and 47.2% in rural areas. Azerbaijan is one of the countries with the highest population density, which is 116 per 1 km^2, and it even exceeds the national level in Baku, Absheron, and Lankaran economic regions. As of the beginning of 2020, 49.9 percent of the population was men and 50.1 percent were women, and the ratio of females to males is 1,002 to 1,000 men.

Population change, thousand people (as of the beginning of the year)			
Years	Number of population-total	including:	
		urban areas	rural areas
1990	7131.9	3847.3	3284.6
1995	7643.5	4005.6	3637.9
2000	8032.8	4107.3	3925.5
2005	8447.4	4423.4	4024
2010	8997.6	4774.9	4222.7
2011	9111.1	4829.5	4281.6
2012	9235.1	4888.7	4346.4
2013	9356.5	4966.2	4390.3
2014	9477.1	5045.4	4431.7
2015	9593.0	5098.3	4494.7
2016	9705.6	5152.4	4553.2
2017	9810.0	5199.0	4611.0
2018	9898.1	5237.8	4660.3
2019	9981.5	5273.9	4707.6
2020	10067.1	5312.0	4755.1

Table 1-5. Population change

The birth rate of the population has historically been high in Azerbaijan. There were periods when the number of births was 40-50 per thousand people. However, in 1991- 2003, the figure declined, and as from 2003 it started rising and reached 14.2 in 2019. One of the factors influencing the decline in the birth rate is the growing tendency among families to move from having many children to having fewer. Consequently, the percentage of children born to families with three or more children has decreased. It should also be noted that higher levels of education, women's increased economic independence, and other factors are among the reasons accelerating the decline in the birth rate.

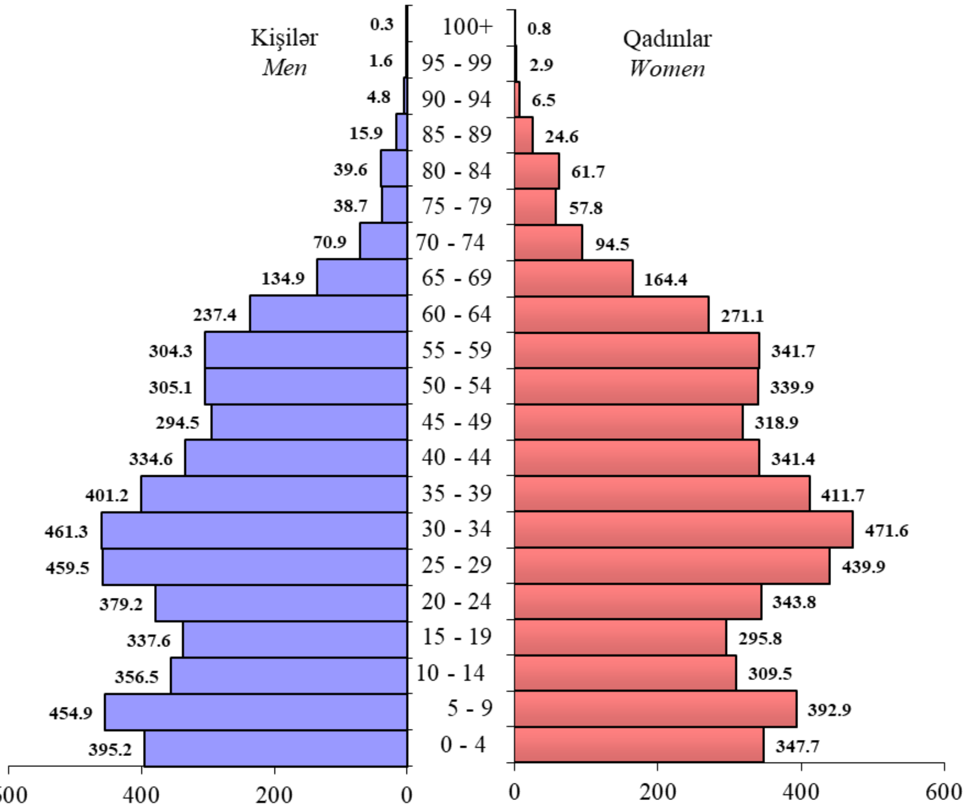


Chart 1-1. Gender and age structure of the population of the Republic of Azerbaijan at the beginning of 2020 (thousand people)

The second important demographic indicator after the birth rate is the mortality rate. The last sixty years are characterized by reduced mortality and increasing life expectancy. The decline in the country's mortality rate is mainly due to medical advances and improvements in the health care system in the second half of the twentieth century, including the use of antibiotics and other effective treatments, as well as the expansion of preventive measures.

Moreover, the country's demographic policy, including measures taken in the field of maternal and child protection has led to a transition from high infant and child mortality rates to lower rates. In 1990, the infant mortality rate under 1 was 23 per 1,000 live births, but in 2019 this figure dropped to 11. Positive trends in the decline of mortality lead to an increase in life expectancy at birth. I.e, in 1990 this indicator was equal to 71.1 years and constituted 67 years for men and 74.8 years for women. In 2019, life expectancy was 76.4 years, it constituted 74 years for men and 78.7 years for women.

Since the mid-1990s, as a result of political and macroeconomic stability in the country, there has been a gradual decrease in migration flows from the country. I.e., targeted measures are in progress to develop the country's regions, create opportunities for businesspersons, create new jobs, improve the social security of citizens, and improve the welfare of the population as a whole. Since 2008, the aforementioned factors have led to a positive migration balance and amounted to +0.4 thousand people in 2019.

Although 95 percent of Azerbaijan's population is Muslim, it is one of the most progressive countries in the world in terms of religious tolerance. The country has strong pillars of tolerance, rich traditions, deep historical and cultural roots, and tolerance is also implemented as a state policy. It is no coincidence that 2016 was declared the Year of Multiculturalism in the Republic of Azerbaijan, and a number of international conferences related to this area were held during the year. There are 793 registered religious organizations in the country, 765 of them are Islamic and 28 are non-Islamic (Christian - 17; Jewish - 8; Krishna - 1; Bahai - 2). There are 2,250 mosques, 14 churches, and 7 synagogues in the country.

Both in ancient and modern times, Azerbaijan has been mentioned in history as a region distinguished by its high tolerance. It is the birthplace of Zoroastrianism, the first cradle of Christianity in the Caucasus, a place where Islam is widespread, a place where different ethnic groups live in peace, a land where colorful cultures benefit each other and flourish.

Azerbaijan is distinguished by its ethnographic diversity. Along with Azerbaijanis, ethnic groups such as Mountain Jews, Tats, Talysh, Kurds, Molokans, Ingiloys, Tsakhurs, Avars, Lezgins, Khynalygs, Buduqlus, Grysz and other ethnic groups live in its territory. Although representatives of these ethnic groups consider themselves Azerbaijanis, each group has retained its own elements of different cultures. This culture manifests itself in everyday life, crafts, cuisine, and various ceremonies.

1.3.3. Healthcare

Consistent and purposeful work and reforms were implemented in the healthcare system. Firstly, several laws (Laws on Pharmaceutical Activity, on Private Medical Activity, and Medical Insurance, etc.) were adopted in order to improve the legal and regulatory framework of health care and raise it to the level of world standards. Like in all spheres of life within the country, the health care reforms complying with the new economic system, and the development and progress in this field have been gaining momentum since the beginning of the 21st century.

One of the key achievements of healthcare reform is the introduction of a private health care system. In this connection, a legal and regulatory framework was established, and the Law on Private Medical Activity of the Republic of Azerbaijan came to force. The Law of the Republic of Azerbaijan on Medical Insurance was adopted in 1999. Currently, about 10 voluntary health insurance companies are established and operating.

Over recent years, more than 400 health facilities were built or rebuilt in our country. During the last several years, the Ophthalmology Center, Urology Center, Thalassemia Center were built, and the Scientific Surgery Center was established in Baku. Perinatal centers are established in our country. Almost in all cities, hospitals are repaired and constructed. Treatment and diagnostic centers meeting the latest standards were built in 14 cities, and hemodialysis facilities were installed in these centers.

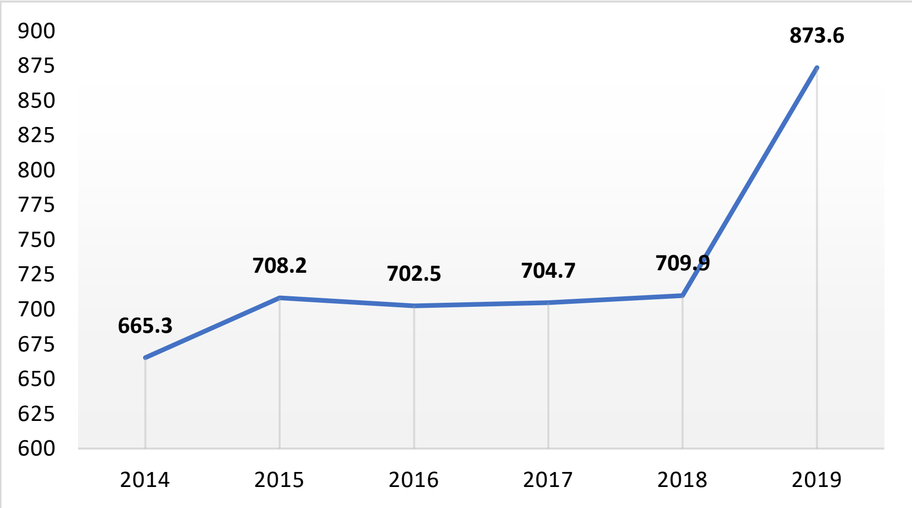


Chart 1-2. State budget spending on healthcare[1]

Currently, the implementation of socially oriented policy in Azerbaijan makes it possible to develop health care and solve public health problems. Hospitals, diagnostic centers, polyclinics equipped with modern equipment were constructed and commissioned in various regions of the country, and a number of medical institutions were reconstructed and restored as a result of the increase in the funds

[1] www.stat.gov.az/source/healthcare

allocated for healthcare from the state budget. As of the beginning of 2019, there were 563 hospitals, 1741 polyclinics, 79 ambulance stations, 130 women's consultation clinics, 248 children's polyclinics, outpatient clinics and outpatient departments employing 32.5 thousand doctors and 54.0 thousand nurses in the country, and 56 sanatoriums provided medical and preventive services to the population.

Key health indicators (as of the beginning of the year)										
	1991	1995	2000	2005	2010	2015	2016	2017	2018	2019
Number of doctors of all specialties, thousand people	27.5	28.8	28.5	30.1	32.8	32.8	32.5	32.2	31.9	32.5
per 10,000 people	38.7	38.3	36.0	36.1	36.9	34.6	33.9	33.2	32.6	32.9
Number of paramedical personnel, thousand people	68.0	68.8	60.6	59.7	62.9	56.1	54.9	54.5	52.8	54.0
per 10,000 people	95.8	91.4	76.7	71.7	70.9	59.3	57.3	56.2	54.0	54.8
Number of hospital facilities	731	773	739	732	756	566	559	569	566	563
the number of beds, thousand	70.9	74.4	71.0	68.4	67.4	46.4	44.9	45.3	44.1	44.0
per 10,000 people	99.9	98.9	89.7	82.1	76.0	49.0	46.9	46.7	45.1	44.7
Number of medical institutions providing outpatient care	1826	1767	1611	1,594	1,692	1746	1750	1758	1737	1741
Among them:										
number of women's consultation clinics and institutions with women's clinics	296	291	300	321	315	138	137	137	130	130
Capacity of outpatient clinics (number of visits per shift), thousand	108.9	107.3	103.4	105.3	102.7	106.3	107.0	106.9	105.2	104.9
per 10,000 people	153.4	142.6	130.7	126.5	115.7	112.2	111.6	110.4	107.6	106.4

Table 1-6. Key health indicators[2]

1.3.4. Education

The Ministry of Education implements adopted programs in various fields in accordance with the tasks set for the education system which is one of the main priorities of state policy. These programs cover updating the content of education, developing new programs, textbooks, and teaching aids, enhancing education management, strengthening the material and technical and educational bases of educational institutions, using information technology in the teaching process, staffing, renovating preschool education, improving vocational education, organizing the education of children with special needs, developing the creative potential of talented children and youth and other areas.

Significant progress is achieved in the field of informatization of education as a result of the implementation of two State Programs covering 2005-2007 and 2008-2013. General education schools of the country are supplied with ICT, and the ratio of one computer to 18 learners is achieved. 2,351 schools are provided with high-speed broadband Internet, and the percentage of schools connected to the Internet raised from 1.5 percent in 2004 to 52 percent in 2016.

The material and technical base of lyceums and gymnasiums was strengthened, a database of gifted children was established, the network of new types of educational institutions was expanded and a number of secondary and boarding schools were transformed into lyceums as a result of the implementation of 2006-2010 State Program on the Development of Creative Potential of Children (Youth) with Special Talents.

The restoration of the awarding of gold and silver medals to graduates of secondary schools, taking into account the achievements of pupils winning in international competitions in the student admission exams serves as incentives for the work of pupils.

[2] www.stat.gov.az/source/healthcare

A number of serious steps have been taken in recent years for the development of preschool education. As a part of the Program for Renovation of Preschool Education (2007-2010), significant work has been done to strengthen the material and technical base of institutions, improve management, involve 5-year-old children in compulsory preschool education, improve human resourcing, and develop a new curriculum.

The State Agency for Vocational Education under the Ministry of Education was established in 2016 in order to increase the effectiveness of vocational training in the field of basic vocational and special education and to ensure the training of competitive qualified personnel.

Secondary specialized education has a unique role in addressing issues related to the socio-economic development of the country, in meeting the needs of individuals and society in vocational education within the framework of market relations. According to Resolution no.30, dated February 3, 2016 of the Cabinet of Ministers, 14 colleges were merged into 7 and 3 of them were established as regional colleges. Three colleges were attached to higher education institutions in accordance with their profiles.

As a part of the State Program on Education of Azerbaijani Youth Abroad in 2007-2015, with the participation of specialists from the Ministry of Education, related government agencies, and higher education institutions, the youth were selected to study in the leading universities of the world in the specialties considered as a priority for our country and in total 3558 persons received the right to study under the program. Sixty percent of graduates with high academic performance work in the private sector and 40 percent in the public sector.

Maarifchi Student Loan Fund was established in 2016 at the initiative of the Ministry of Education. The fund was established by state higher education institutions. The main mission of the Fund is to create equal opportunities for students from low-income families to obtain higher education by providing long-term concessional loans.

Azerbaijan-French University (UFAZ) was established in the 2016-2017 academic year. Graduates of UFAZ which will train personnel in the four most popular specialties in Azerbaijan (chemistry, geophysics, oil and gas engineering, and computer science) will receive a double diploma (the University of Strasbourg and Azerbaijan State University of Oil and Industry). The opening ceremony of the Baku branch of the First Moscow State Medical University named after I.M. Sechenov was held in the 2016-2017 academic year.

According to the Global Competitiveness Report (2016) of the World Economic Forum, Azerbaijan ranks 78th among 144 countries in terms of the quality of higher education and training, 94th in terms of higher education engagement, 82nd in terms of staff training, and 91st for the quality of primary education.

Currently, as evidence of the importance given to education, educational institutions are continuously opened, and various programs are implemented in the field of education. As of the beginning of 2020, there were 1,840 pre-school, 4,400 general, 110 vocational, 59 secondary special, and 52 higher education institutions in Azerbaijan. A total of 1,622 schools have been constructed over the last 15 years. The state secures every citizen’s right to free compulsory general secondary education.

Education level	Per 1,000 people aged 15 and over				
	2015	2016	2017	2018	2019
The entire population aged 15 and over with higher and secondary (full and general) education	971	972	972	972	972
Including					
Higher	126	127	127	129	131
Secondary specialized	85	85	85	85	85
Full secondary	630	630	630	630	629
General secondary	130	130	130	128	127

Table 1-7. People's education level[3]

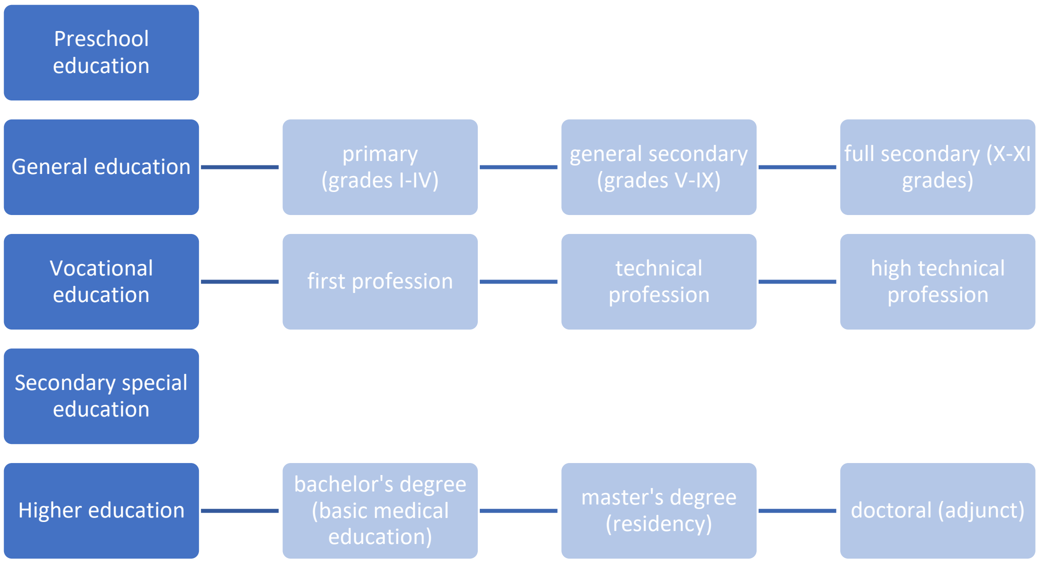


Figure 1-2. Stages and levels of education in Azerbaijan

Preschool education is the first stage of the system of continuing education in Azerbaijan. Preschool education lays the foundation for the development of children's mental, physical, creative capacity and cultural level, psychological stability, aesthetic education, mastery of simple work habits, sensitive and conscious attitude to the environment, personal health, the acquisition of necessary life skills and the molding of personality at an early age. The age of preschool education in the Republic of Azerbaijan covers children from 1 to 6 years old. Pre-school education is necessary for five-year-olds.

General education teaches the learners the basics of science, instills the necessary knowledge, skills, and habits, and ensures the preparation for life and work. General education is carried out on the basis of relevant educational programs. General education in the Republic of Azerbaijan comprises basic education, general secondary education, and senior secondary education.

Primary education. The main objectives of primary education are to promote the reading, writing, and calculation skills in learners, and develop the basic life skills on humans, society, and nature, as well as the elements of logical thinking, aesthetic, artistic taste, and other features Primary education in the Republic of Azerbaijan begins at the age of six.

General secondary education. The objectives of basic education are to further develop the learners' oral speech and writing abilities, communication skills, cognitive abilities, and logical thinking, to acquire the relevant knowledge ideas about the subjects included in the educational program, as well as the development of the human civilization, the skills to use modern information and communications technologies, and the ability to assess events and determine his/her future activities. General secondary education is compulsory in the Republic of Azerbaijan. A final assessment is carried out at the basic

[3] https://www.stat.gov.az/source/education/

education level and the students who complete their education receive a corresponding state document.

The orientation (offering of various courses) is provided at the **full secondary education** level (humanities, technical, science, etc.) The full secondary education constitutes the last stage of general education, and the final state attestation of the learners' knowledge assessment is carried out at this level. According to the results of attestation, the graduates are issued a standard state document, a certificate.

Vocational education - ensures preparation of qualified staff in various professions on the basis of general secondary education and full secondary education in accordance with the needs of the labor market. The levels of vocational education are as follows: -basic vocational education; -technical vocational education; - higher technical vocational education.

Secondary special education provides for the training of secondary education specialists in various fields of production in accordance with the demands of the society and labor market, on the basis of basic and general secondary education. Secondary vocational-professional education is mainly implemented at colleges and corresponding units established within the higher educational institutions and concludes with the issuance of a sub-bachelor vocational-professional degree. The graduates completing secondary vocational-professional education are accordingly issued a standard state document – a diploma.

Higher education. Highly specialized experts and scientific-pedagogic staff are trained in the higher education level taking into account the demands of the society and labor market. The training of specialists and scientific-pedagogic staff is carried out in three levels at the higher educational institutions of the Azerbaijan Republic: - Baccalaureate; - Master's degree; - Doctorate.

The following academic degrees are established in the Republic of Azerbaijan: - Doctor of Philosophy (with the indication of the fields of science); - Doctor of Science (with the indication of the fields of science).

1.4. Institutional arrangements

1.4.1. Institutions

The Republic of Azerbaijan declared its independence on October 18, 1991 and was recognized by the world community as an independent state. The Republic of Azerbaijan is a member of the United Nations, the OSCE, and the NATO Partnership for Peace, the Euro-Atlantic Partnership, the World Health Organization, GUAM, the Organization for Democracy and Economic Development, the Council of Europe, the International Monetary Fund, the Organization of the Islamic Conference and the Non-Aligned Movement. In 2011, Azerbaijan was elected a non-permanent member of the Security Council and represented the Eastern European Group in 2012-2013.

Like all modern political systems, Azerbaijan's political system is also characterized by pluralism, in other words by the existence of more than one political party.

In general, the structural formation of the political system of the Republic of Azerbaijan was basically complete on November 12, 1995, with the adoption of the new Constitution of the country. Under the Constitution, the state of Azerbaijan is a democratic, law-governed, secular, unitary republic. The form of state power execution in the political system of Azerbaijan corresponds to the parameters of the republic, based on the presidential government.

In line with the principle of separation of powers, the Republic of Azerbaijan has three branches of government, which are established and act independently: the legislative, executive, and judicial branches. The activities of each of these authorities are governed by the Constitution and legislative acts.

In the Republic of Azerbaijan, the Parliament exercises legislative power, the President exercises executive power, and the courts of the Republic of Azerbaijan exercise judicial power.

Executive power in the Republic of Azerbaijan is vested in the President of the Republic of Azerbaijan. According to the Constitution, the state of Azerbaijan is a presidential republic due to its form of administration. The President of the Republic of Azerbaijan is the Head of the state of Azerbaijan He/she represents the state of Azerbaijan both within the country and in its foreign relations. The President is the Commander-in-Chief of the Armed Forces of the state. The President of the Republic of Azerbaijan is the guarantor of independence and territorial integrity of the state of Azerbaijan. Moreover, the President, who is the head of the executive branch, is the guarantor of the state's compliance with the international agreements to which it is a party, and of the independence of the judiciary. The President of the Republic of Azerbaijan is elected for a 7-year term by way of universal, direct, and equal suffrage, by free, personal, and secret ballot.

The President of the Republic of Azerbaijan appoints the Cabinet of Ministers of the Republic of Azerbaijan to exercise executive power. The Cabinet of Ministers of the Republic of Azerbaijan is the higher executive body of the President, and subordinate and accountable to the President. The Cabinet of Ministers of the Republic of Azerbaijan consists of the Prime Minister of the Republic of Azerbaijan, his deputies, ministers, and heads of other central executive bodies. The Prime Minister and the Cabinet of Minister are appointed by the President and approved by Parliament. The Cabinet of Ministers deals with issues related to the state budget, finance, loans, and monetary/financial policy, and the implementation of state social programs. The Cabinet of Ministers includes the following bodies:

- Ministry of Internal Affairs
- Ministry of Ecology and Natural Resources
- Ministry of Energy
- Ministry of Justice
- Ministry of Labor and Social Protection of Population
- Ministry of Emergency Situations
- Ministry of Youth and Sports
- Ministry of Internal Affairs
- Ministry of Economy
- Ministry of Agriculture
- Ministry of Finance
- Ministry of Culture
- Ministry of Defense
- Ministry of Defense Industry
- Ministry of Transport, Communications and High Technologies
- State Service for Mobilization and Conscription
- Food Safety Agency
- State Tourism Agency
- Ministry of Health
- Ministry of Education
- State Committee for Family, Women and Children Affairs
- State Committee on Work with Diaspora
- State Committee on Religious Associations
- State Statistics Committee
- State Committee for Urban Planning and Architecture
- State Committee for Affairs of Refugees and Internally Displaced Persons
- State Migration Service
- State Border Service
- State Security Service
- Foreign Intelligence Service

State power in the Republic of Azerbaijan is based on the principle of separation of powers: According to Constitution, the executive power in the Republic of Azerbaijan is vested in the President of the Republic of Azerbaijan. Legislative power in the Republic of Azerbaijan is exercised by Milli Majlis of the Republic of Azerbaijan

The Parliament of the Republic of Azerbaijan is composed of 125 MPs. Deputies of Milli Majlis of the Republic of Azerbaijan are elected on the basis of a majoritarian electoral system and universal, equal, and direct suffrage by free, secret, and personal ballot. Elections for each convocation of Milli Majlis of the Republic of Azerbaijan are held every five years on the first Sunday of November.

Judicial power is exercised by the Constitutional Court, the Supreme Court, the courts of appeal, general courts, and other specialized courts of the Republic of Azerbaijan. Judicial power is exercised through constitutional, civil, and criminal proceedings, and through other means prescribed by law. The country has a three-tier judicial system -courts of the first instance, appeal, and cassation.

1.4.2. Institutional arrangements relevant for NCs, BURs and NIRs Preparation

The State Commission on Climate Change was established by Decree dated April 30, 1997, of the President of the Republic of Azerbaijan for ensuring the implementation of the commitments made by the Republic of Azerbaijan in accordance with the United Nations Framework Convention on Climate Change ratified by the Republic of Azerbaijan on January 10, 1995. The new composition of the State Commission was approved by Decree, dated March 11, 2020, of the President of the Republic of Azerbaijan.

The Chairman of the State Commission is the Deputy Prime Minister of the Republic of Azerbaijan. The Deputy Chairman of the Commission is the Minister of Ecology and Natural Resources of the Republic of Azerbaijan. Members of the State Commission are the Minister of Finance, Minister of Economy, Minister of Agriculture, Minister of Health, Deputy Minister of Foreign Affairs, Deputy Minister of Transport, Communications and High Technologies, President of the Azerbaijan National Academy of Sciences, President of the State Oil Company of Azerbaijan, President of “Azerenergy” OJSC and the Chairman of the Azerbaijan Amelioration and Water Management OJSC.

A working group composed of specialists from the relevant state bodies was established by taking into account the importance of the active role of the relevant state bodies in this process, the strengthening of interagency relations, and the significance of the recently approved State Commission in ensuring the implementation of the commitments of the Republic of Azerbaijan under the UN Framework Convention on Climate Change. The Action Plan of the Working Group is approved.

The Action Plan consists of 2 courses of action: 1. Developing Inventory and Monitoring, Reporting, and Verification (MRV) systems, 2. Evaluation of GHG emission reduction measures by sectors.

The Ministry of Ecology and Natural Resources is the National Designated Authority responsible for implementing the commitments arising from the UN Framework Convention on Climate Change. The Ministry has appointed a national coordinator for the Convention. At the same time, a working group is established to increase the efficiency and diversify activities in this area.

Climate Change Center was established under the National Hydrometeorological Department that is attached to the Ministry of Ecology and Natural Resources. The main purpose of the Center is to coordinate the country’s climate change activities and establish a relevant database.

In addition to the statistics provided by the State Statistics Committee of the Republic of Azerbaijan, the information provided by SOCAR, the Ministry of Energy, “Azerenergy” OJSC, Azerbaijan Railways, the Ministry of Transport, Communications and High Technologies, the Ministry of Agriculture and a number of other organizations and enterprises is also used in the estimation of emissions. This allows eliminating a number of uncertainties.

1.5. Economical context

1.5.1. Gross Domestic Product

The territory of the Republic of Azerbaijan has favorable natural-climatic conditions and rich natural resources. Oil and gas extraction and processing, chemistry and petrochemistry, metallurgy, mechanical engineering, textile, food, agriculture, grain growing, cotton-growing, viticulture, fruit growing, tobacco growing, tea growing, vegetable growing, and animal husbandry play a key role in the republic's industry.

In 1991 after gaining independence, one of the important challenges faced by the Republic of Azerbaijan was to establish a national economy based on market principles and effectively integrates into the modern world community.

Since 1995, Azerbaijan has pursued a market-oriented policy for the planned transition to a free market economy. For the first time since 1995, Azerbaijan's economy began to show signs of progress as a result of contracts signed with reputable international oil companies and named as the Contract of the Century, and economic reforms adopted by the state in partnership with local and international organizations. The following years saw economic stability, with economic growth increasing more than twice in 2005 compared to the previous year.

Between 2005 and 2015, the economy of Azerbaijan grew dynamically. However, since the end of 2014, the economy of Azerbaijan was negatively affected by the decline in oil prices in world markets for some time. Consequently, in 2016, GDP decreased by 3.1% and amounted to 60.4 billion AZN. In 2016, 37.1 percent of the GDP of the country fell to the share of industry, while agriculture, forestry, and hunting accounted for 5.6%, construction for 10.5%, transport and communication for 8.5%, other fields for 30.2%, and net taxes for 8.1% of GDP.

Economic reforms have been launched since 2016 in order to adapt to the new challenges posed by global processes and to minimize the impact of the current global economic crisis. "The main directions of the strategic roadmap for the national economy and the key sectors of the economy" were approved under the Decree dated March 16, 2016, of the President of the Republic of Azerbaijan in order to ensure the sustainability of the ongoing economic policy and reforms implemented in the country. Subject to this Decree, strategic roadmaps for the national economy and 11 sectors were developed and approved by the Decree dated December 6, 2016, of the President of the Republic of Azerbaijan. Strategic road maps reflect the economic development strategy and action plan for 2016-2020, long-term vision for the period until 2025, and the targets set for the post-2025 period.

Numerous important measures have been implemented in order to develop the economy, improve the investment and business environment, create favorable conditions for entrepreneurs, and strengthen the state support, increase non-oil export, and replace imports. i.e., important decisions were adopted to improve the business environment, reduce the number of activities requiring a license from 59 to 37, and reduce the number of permissions for entrepreneurial activities by almost 4 times from 330 to 87.

Subject to the Law of the Republic of Azerbaijan on Suspension of Inspections in the Field of Entrepreneurship, on November 1, 2015, inspections in the field of entrepreneurship were suspended for 2 years. In October 2017, the term for the suspension of inspections was extended until 2021.

The establishment of the Commission and Commission Secretariat under the Decree dated July 13, 2016 of the President of the Republic of Azerbaijan in order to ensure the sustainability of the rapid development achieved in recent years and raising competitiveness in the field of entrepreneurship and to further improve Azerbaijan's position in international rankings, and the establishment of the Financial Stability Board and the Financial Markets Supervisory Chamber, a legal entity of public law to further strengthen macroeconomic stability in the country and ensure financial sustainability in the country are of utmost importance.

The establishment of Azerbaijan Industrial Corporation OJSC, and Credit Guarantee Fund of the Republic of Azerbaijan in order to expand entrepreneurs' access to financial resources with the view of channeling natural and economic resources to the economic turnover, and for more effective management of the state-owned legal entities and the entities, the controlling stake of which is owned by the state is also part of the reforms.

The Food Safety Agency was established as a continuation of the reforms. The State Program for the Development of Cotton Growing in the Republic of Azerbaijan in 2017-2022; State Program on the Development of Tobacco Growing in the Republic of Azerbaijan in 2017-2021; State Program for the Development of Silkworm Breeding and Sericulture in the Republic of Azerbaijan in 2018-2025 were adopted in order to accelerate the progress in the field of agriculture.

As a positive result of the country's economic reforms and the implementation of strategic roadmaps, Azerbaijan ranked 35th out of 137 countries in the 2017-2018 Global Competitiveness Report of the World Economic Forum. At the same time, Azerbaijan moved up by 8 positions, rising from 65th to 57th place among 190 countries in the Doing Business 2018 report prepared by the World Bank. According to this report, Azerbaijan has risen by eight points and is one of the three most reformist countries in Europe and Central Asia.

Generally, the economic downturn was prevented, and stabilization was achieved as a result of the reforms implemented in the country. The signing of the Production Sharing Agreement on the development of the Azeri-Chirag-Guneshli block of oil fields in 2017, providing for the extension of the Production Sharing Agreement until 2050 was also characterized by the opening of the Baku-Tbilisi-Kars railway.

In 2019, compared to 2018, the Gross Domestic Product (GDP) increased by 2.2% in real terms (1.5% in the previous year) and amounted to 81.7 million AZN at current prices, GDP per capita increased by 1.4% and amounted to 8247.0 AZN or 4851.2 US dollars (4797.7 US dollars in the previous year).

In 2019, value-added production increased by 0.4% (0.6% in the previous year) in the oil sector and by 3.5% (2.0% in the previous year) in the non-oil sector. The share of oil and non-oil sectors in GDP was 38.3% and 61.7%, respectively.

Alongside construction, growth was also recorded in all other areas of the non-oil sector.

	Total			Per capita		
	in million AZN	in million USD	in million EUR	in AZN	in USD	in Euro
1990	0,3	2443,3	-	0,1	346,3	-
1995	2133,8	2415,2	-	282,1	310,3	-
2000	4718.1	5272.8	5687.2	593.2	662.9	715.1
2005	12522.5	13238.7	10603,3	1494.3	1579.8	1265.3
2010	42465,0	52909.3	39952,0	4753.0	5922.0	4471.7
2011	52082,0	65951.6	47377.4	5752.9	7285.0	5233.3
2012	54743.7	69683.9	54180.2	5966.1	7594.3	5904.7
2013	58182,0	74164,4	55826,1	6258,3	7977,4	6004,9
2014	59014,1	75234,7	56581,1	6268,0	7990,8	6009,6
2015	54380.0	52996.8	47785.6	5706.6	5561.5	5014.6
2016	60425.2	37862.8	34217.8	6269.6	3928.6	3550.4
2017	70337.8	40867.9	36213.7	7226.0	4198.5	3720.3
2018	80092.0	47112.9	39858.7	8156.2	4797.8	4059.0
2019	81681.0	48047.6	42906.4	8247.0	4851.2	4332.1

Table 1-8. Gross Domestic Product[4]

[4] https://www.stat.gov.az/source/system_nat_accounts/

	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Goss Domestic Product - total	4,718	12,523	42,465	52,082	54,744	58,182	59,014	54,380	60,425	70,338	80,092	81,681
including:												
oil and gas sector	1,371	5,521	20,410	25,830	24,487	23,778	21,405	15,382	19,553	25,005	32,232	30,091
Non-oil and gas sector	3,055	6,055	19,179	23,196	26,864	30,526	33,196	34,139	35,951	40,328	41,662	44,472
net taxes on production and imports	291	946.5	2,877	3,056	3,392	3,878	4,413	4,859	4,922	5,004	6,198	7,118

Table 1-9. Gross Domestic Product, in million AZN[5]

1.5.2. Inflation

Until 1994, the lack of at least one stable indicator of the money supply - the regular issuance of money to cover the budget deficit led to a sharp devaluation of the national currency.

Four-digit inflation peaked in 1994 and equaled 1,763.5 percent. Inflation started to fall beginning from 1995. Nevertheless, the inflation rate remained quite high at 511.8 percent. As a result of the tight monetary policy launched with the first of the development programs developed jointly with the International Monetary Fund, inflation has been contained and overall price stability has been achieved since 1996. Consequently, in 1997, inflation was already expressed in single digits.

As a result of the easing of monetary policy since the second half of 1999, the country experiencing deflation in 1998-1999, saw a resurgence in overall prices after 2000. In 2005, inflation reached a remarkable level of 12.49%.

Demand factors, a 30 percent increase in the material benefits of the population, and an increase in investment played a key role in the inflation seen in 2008. The role of cost increases was also significant. In the same year, a 10.9 percent increase was recorded in the production prices of industrial products.

In 2007, inflation was caused by traditional factors such as growing demand, reforms in the utility sector, and the global rise in market prices of some food products imported by Azerbaijan (sugar, wheat, etc.). Inflation in 2007 was 16.7%. In 2008, it constituted 15.4%.

In 2010 high food supply and price dynamics affected the level of inflation. This year, annual inflation was 7.9%, while the average annual inflation (inflation adjusted for changes in the prices of goods regulated by the state and seasonal factors) amounted to 5.7%.

Also in 2011, inflation was caused by external factors. This year inflation was 7.9%. This year, like last year, inflation was influenced by rising food prices. In general, over the past three years, the average annual inflation rate in Azerbaijan was lower than the rate of inflation in the CIS countries. In 2012, the average annual inflation was equal to 1.1%, and it was the lowest inflation rate of the last 3 years.

In 2016-2017, the key factors affecting price dynamics were changes in the aggregate supply and demand ratio, global food prices, and inflation expectations. Increased oil prices can be mentioned among the external factors affecting the overall level of prices. It is no coincidence that countries with successful foreign trade ties have seen a significant increase in the cost of goods imported from the Eurozone, as well as rising production costs and a strengthening of the Euro. Over these years, the average annual inflation grew by 8% and amounted to 12-13%.

In 2019, the level of inflation, which is the ultimate target of monetary policy, remained within the target range (4 ± 2%) (2.6%). Inflation in Azerbaijan was among the lowest among CIS and partner countries and remained within the target range.

[5] https://www.stat.gov.az/source/system_nat_accounts/

This year, a stable national currency has become the main anchor of macroeconomic and financial stability in the country. In 2019, supply exceeded demand in the home currency balance, and the AZN exchange rate was under pressure to appreciate. The foreign exchange supply was mainly supported by the surplus in the balance of payments, oil revenues used for fiscal purposes, and de-dollarization trends.

In 2019, the actual dynamics of inflation and the balance in the foreign exchange market kept inflation expectations at a minimum. Given the achieved macroeconomic stability, neutralization of a number of internal and external factors of inflation, the monetary situation was regulated both in terms of lowering the cost of money and increasing the money supply.

1.5.3. National currency exchange rate

In 2019, the Central Bank made a decision to gradually decrease the discount rate from 9.75% to 7.5%. In general, since the beginning of 2018, the discount rate has decreased by 2 times.

In 2019, the monetary base in AZN increased by 27.3%. The growth of the stock of money in AZN (M2 monetary aggregate) constituted 24.5%.

The easing of monetary conditions has a reducing effect on interest rates. In general, the average interest rate for new term deposits attracted in AZN since the beginning of 2018 has decreased by 1.8 percentage points, and the average interest rate on new loans in AZN has decreased by 4.9 percentage points.

De-dollarization continued in the context of low inflation and a balanced foreign exchange market. At the end of 2019, dollarization for the deposits of individuals fell to 52.2% from 62.5% recorded at the beginning of 2019. In 2019, the Central Bank's foreign exchange reserves increased by 11.2% and were close to 6.3 billion. USD.

In 2019, the official exchange rate of AZN against USD was determined based on the average rate for interbank transactions (including auctions and non-auction transactions on the Bloomberg platform). The average daily official exchange rate of AZN to USD was 1.7 AZN during the year. Although volatile, the foreign exchange rates set by the banks were close to the official exchange rate. During the year, the average daily buying rate at commercial banks was 1.6978 AZN, and the selling rate was 1.7022 AZN. The difference between the official exchange rate and the average daily purchase and sale rates of commercial banks was 0.1% (0.0022 AZN). This year, manat appreciated by 11% against the Turkish lira, 2.2% against the Euro, and depreciated by 11.8% against the Russian rouble. The dynamics of bilateral exchange rates also affected the dynamics of the multilateral exchange rate. During the year, the non-oil, trade-weighted nominal effective exchange rate of AZN increased by 0.4%, while its real effective exchange rate decreased by 2.1%. The depreciation of the real effective exchange rate is explained by the fact that inflation in Azerbaijan is significantly lower than the average inflation in trading partner countries.

Foreign Exchange	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1 USD	0.89	0.91	0.92	0.8	0.79	0.78	0.78	0.78	1.56	1.77	1.70	1.70	1.70
1 Euro	1.14	0.85 [1)]	1.09	1.06	1.02	1.03	1.08	0.95	1.70	1.86	2.03	1.95	1.90
1 Turkish lira	0.18	0.01 [2)]	0.68	0.51	0.41	0.44	0.36	0.34	0.54	0.50	0.45	0.32	0.29
Russian ruble	0.02	3.24	3.19	2.63	2.45	2.58	2.41	1.33	2.16	2.93	2.95	2.45	2.74

Table 1-10. Exchange rate of AZN in the Central Bank of the Republic of Azerbaijan (as of the end of the year, in national currency, manat)[6]

[6] https://www.stat.gov.az/source/finance/

1.5.4. Trade balance deficit

In 2019, the overall surplus of the trade balance deficit was generated due to both high oil prices ($64.4) and positive trends in the Current Operations Balance (COB). The surplus of the Current Operations Balance was about 4.4 billion USD. In 2019, the surplus of the balance of capital and cash flow was 116 million USD, and reserve assets raised to 5.1 billion USD.

The surplus in the oil and gas sector decreased by 10.7% (1.4 billion USD) compared to the previous year and) amounted to 11.5 billion USD, and the COB deficit of the non-oil sector increased by 4.5% (308 million. USD) and amounted to 7.1 billion USD. Consequently, the surplus of the oil and gas sector on the current account completely covered the deficit of the non-oil sector. The COB surplus was formed mainly due to the foreign trade surplus.

Foreign trade balance. In 2019, foreign trade turnover amounted to 31.2 billion USD, and the surplus in the amount of 16.1 billion USD in the oil and gas sector covered the deficit in the non-oil sector in the amount of 7.6 billion USD and leading to the surplus of 8.5 billion USD in the foreign trade balance (13.3% decrease). In 2019, Azerbaijan had trade relations with 184 countries. 14% of the foreign trade fall to the share of CIS member states, and 86% to the share of other foreign countries.

<u>Export of goods.</u> In 2019, merchandise exports were equal to 19.9 billion USD (decrease by 4.5%). During this period, the volume of exports in the oil and gas sector decreased by 6% and amounted to 18 billion USD (mainly due to the decrease of the price of crude oil on global markets by 8% to an annual average of $ 64 per barrel). In 2019, non-oil exports increased by 14.4% and amounted to 1.9 billion USD.

<u>Import of goods.</u> In 2019, imports of goods increased by 3.5% compared to the previous year and amounted to 11.3 billion USD, the total value of imports of consumer goods amounted to 5.3 billion USD and 1.7 billion of it fell to the share of food products. Imports in the non-oil sector increased by 2.7% and amounted to 9.5 billion USD. The share of passenger cars (34.1%), sugar (31.3%), railway vehicles (38.6%), cereals (55.8%), paper products (21.4%), vegetables (24.2%), stone and glass products (3.8%) and chemical products (28%) in non-oil imports have increased, while tobacco and tobacco products (29.3%), alcoholic and non-alcoholic beverages (19.5%), furniture products (2.7%), metals (14.1%) and wood products (4.1 %) imports have decreased. The share of machinery, equipment, and goods imported at the expense of foreign investment was 8% in the structure of imports and amounted to 849 million USD.

In general, the global business environment was favorable for Azerbaijan, the average oil price was higher than the forecasted in the state budget, and positive trends in the balance of payments were maintained.

The country’s international investment position assets (113.4 billion USD) prevail liabilities more than twice (55 billion USD). This evidences that Azerbaijan has high international solvency and acts as an international creditor.

1.5.5. Cash transfers and remittances

The progress made in non-cash payments, the expansion of electronic payment services, and the use of innovative payment technologies in the country are among the main priorities. In accordance with the State Program for the Development of Digital Payments for 2018-2020, work is underway to expand the non-cash payment environment between citizens, businesses, and government agencies in the country, as well as to reduce cash flow and cash turnover.

The main purpose of the payment system is to increase non-cash payments and limit cash payments. In 2019, the volume of payments through the national payment system increased by 10 percent, and their number increased by 41 percent. Also, the number of card payments increased by 29 percent, non-cash card payments by 57 percent, and payments through e-banking and e-commerce by 93 percent.

In 2019, the development of card infrastructure continued. The number of payment cards in the country reached 7.5 million. The number of ATMs increased to 2.6 thousand and the number of POS-terminals reached 65.2 thousand. 18.1% of payment cards are contactless. The number of ATMs increased by 2.2% and contactless POS-terminals by 35% compared to last year. The volume of non-cash payments by payment cards increased by 57%, including the increase in the volume of e-commerce transactions by 93%. The specific weight of non-cash card payments within the country has increased by 8% in the last five years and has reached 20%.

Money transfers in Azerbaijan are made through banks and the national postal operator. Currently, the regime of currency transactions of residents and non-residents through credit institutions of the Republic of Azerbaijan is governed by the Rules on the Regime of Currency Transactions of Residents and Non-residents in the Republic of Azerbaijan. According to these rules, funds can be freely deposited into foreign currency accounts of residents and non-residents of the Republic of Azerbaijan in authorized banks. Resident and non-resident individuals in our country can transfer foreign currency funds in the amount of up to $ 1,000 equivalent abroad through authorized banks without opening an account. Each resident and non-resident can make such a transfer within one business day within the established limit.

In 2019, the total amount of incoming remittances (bank transfers, humanitarian aid, grants, etc.) in the Republic of Azerbaijan was 934 million USD, while the total amount of outgoing remittances was 501 million USD.

1.5.6. Investments, international investment position, and total external debt

Investments. Attracting foreign investment to the country's economy is an important part of the economic development strategy established by the Azerbaijani state. Over recent years, political stability and economic development in the country have further increased the interest of foreign countries in long-term investment in the economy of Azerbaijan.

To date, a legislative framework is established in the country by the adoption of important laws in order to protect the rights and interests of investors, the inviolability of property, creating equal working conditions for local and foreign entrepreneurs, and the unimpeded use of profits. Currently, there are two laws governing investment activity in the Republic of Azerbaijan: the Law on Investment Activity of the Republic of Azerbaijan and the Law on the Protection of Foreign Investments of the Republic of Azerbaijan.

Moreover, the Government of Azerbaijan signed agreements with a number of foreign countries for the elimination of double taxation, investment promotion, and mutual protection.

In 2006, the Azerbaijan Investment Company was established to regulate the state policy to support the development of entrepreneurship from a single center and to ensure a further increase in the investment attractiveness of the country. The main task of the company is to promote investment in the country's economy and seek to eliminate the issues existing in this area. The purpose of the company's investment activity is mostly to realize term investments by acquiring shares in the authorized capital of joint-stock companies and other commercial organizations operating in the non-oil sectors of the economy.

The Azerbaijan Export and Investment Promotion Foundation (AZPROMO) was established in 2003 in order to increase the country's export capacity and encourage the attraction of investment with the development of local production. Serving as a bridge between investors, local producers, and the government, the fund plays an important role in the public-private dialogue. AZPROMO helps foreign investors to identify areas for their investment projects, fight local bureaucracy, and facilitate their arrival in Azerbaijan. Local businesses also benefit from AZPROMO's consulting services and foreign market research.

Currently, measures are in progress in the country in order to continue economic reforms, further improve the business environment, and develop the non-oil sector along with the oil sector. Currently, the government implements an open-door policy in order to attract investment to the economy of the Republic of Azerbaijan.

In 1995-2011 more than 60% that is about 63 billion of the 119 billion USD invested in the country's economy were foreign investments. In 1995-2002, the volume of foreign investment was equal to 9 billion USD, however, in 2003-2011 this figure increased six-fold and amounted to 54 billion USD. Between 2012 and 2019, this figure tripled to reach 159 billion USD.

	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Investments from all sources (including foreign investments):													
million AZN	481	1290	6733	14119	17049	20251	21448	21891	20057	22706	24463	25877	24987
million USD	544	1441	7119	17591	21589	25778	27340	27908	19547	14228	14213	15222	14698
Foreign investments:													
million AZN	331	830	4629	6620	6850	8103	8269	9176	10999	16216	15697	14002	12120
million USD	375	927	4893	8248	8674	10314	10541	11698	10719	10161	9121	8237	7129
Domestic investments:													
million AZN	149	460	2105	7499	10199	12148	13179	12715	9059	6490	8765	11875	12867
million USD	169	514	2225	9344	12915	15464	16799	16210	8828	4067	5093	6985	7569

Table 1-11. Investments in the economy[7]

Azerbaijan Investment Holding, a legal entity of public law was established by Presidential Decree No. 1120 of August 7, 2020, to manage state-owned companies and enterprises, as well as companies with state shares on common principles, improve their performance, increase transparency and economic efficiency of their investment programs, enhance competitiveness and improve their financial health and sustainability.

International investment position. The country's international investment position assets (111 billion USD) prevail liabilities more than twice (54 billion USD). This evidences that Azerbaijan has high international solvency and acts as an international creditor.

Total external debt. As of January 1, 2020, due to the loan agreements signed with various international financial institutions and foreign banks, the direct external debt of the Republic of Azerbaijan amounted to 8,320.0 million USD or 17.3 percent of the 2019 Gross Domestic Product (GDP), contingent liabilities under government guarantees for external loans attracted by state-owned enterprises amounted to 771.0 million USD or 1.6 percent of GDP, overall, total external debt amounted to 9.091.0 million USD or 18 percent of GDP. External public debt consists of loans from international financial institutions for infrastructure projects and financing programs, as well as government securities placed on international financial markets.

1.5.7. Social sphere

Over the recent years, important decisions have been adopted in order to diversify the economy, ensure higher growth in the non-oil sector, expand export opportunities, stimulate competitive production, encourage investment, strengthen state support for entrepreneurs and further improve the business environment.

The introduction of the development model that includes the development of human capital, innovative industrialization trends, the application of high technologies, inclusive approach, and the challenges of

[7] https://www.stat.gov.az/source/finance/

the time has laid the foundation for the modernization and strengthening of the country's economy at a qualitatively new level.

Therefore, 2019 can be considered the year of reforms; Reforms started in recent years for ensuring transparency and strengthening the fight against corruption have allowed for the implementation of a wide-range package of social reforms in 2019.

Tax reforms are aimed at the development of small and medium-sized enterprises, creating a liberal environment for investment, and social reforms provide a favorable social environment. Moreover, a 92% increase in retirement pensions and the minimum wage, as well as wage increases in general improved real income as an important macroeconomic indicator along with social well-being.

Important decisions were adopted in 2019 to increase social benefits and pensions by an average of 92%, the minimum pension by 72%, and the minimum wage by 92% in order to further strengthen the social protection of the country's population. Moreover, the salaries of employees of organizations financed from the state budget and receiving financial assistance from the state budget were increased by an average of 50%.

Electronic assignment systems for 21 types of social benefits were commissioned in 2019 alone. Sustainable and Operational Social Security (DOST) centers were established to provide 132 types of services in the field of social protection and security. It is envisaged to open DOST centers in 31 regions of the country in 2019-2025.

One of the most important events related to social policy was the finalization of preparations for the transition to compulsory health insurance. This can be considered a historic reform in the field of healthcare in Azerbaijan. The main goal of the transition to the system of compulsory health insurance is to organize the provision of reliable and high-quality medical services to the population and to ensure a more fair and effective distribution of costs. Compulsory health insurance has been introduced in stages in the country since January 1, 2020.

As of January 1, 2020, the number of the economically active population was 5190.1 thousand people, and 4938.5 thousand or 95.2% of them were employed. This year, the unemployment rate in the country was 4.8%.

In 2019, the nominal income of the country's population increased by 7.4 percent compared to the previous year and amounted to 57035 million AZN and the average per capita income was 5758.6 AZN.

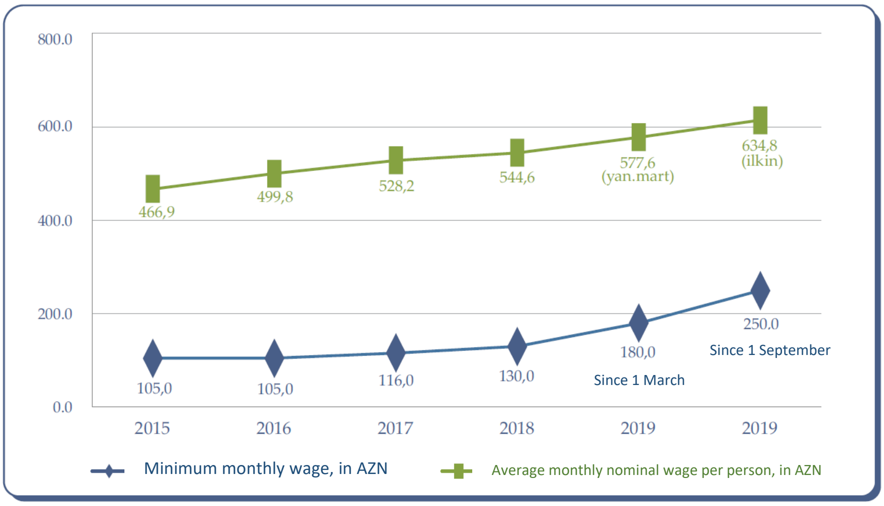


Chart 1-3. Minimum wage and average monthly nominal wage per person in 2015-2019[8]

As of January 1, 2020, the average monthly amount of retirement pensions raised from 227.8 AZN to 262 AZN, the average monthly amount of old-age pension from 256.5 to 295 AZN, the average monthly

[8] https://cabmin.gov.az/az/article/798/

amount of disability retirement increased from 185 AZN to 225 AZN and the average monthly amount of survivor retirement pension from 175.7 AZN to 201.1 AZN compared to January 1, 2019. The average monthly pension amount increased by 15.1% compared to the previous year.

As of January 1, 2020, 1278.0 thousand people, or 12.8% of the country's population receive retirement pensions.

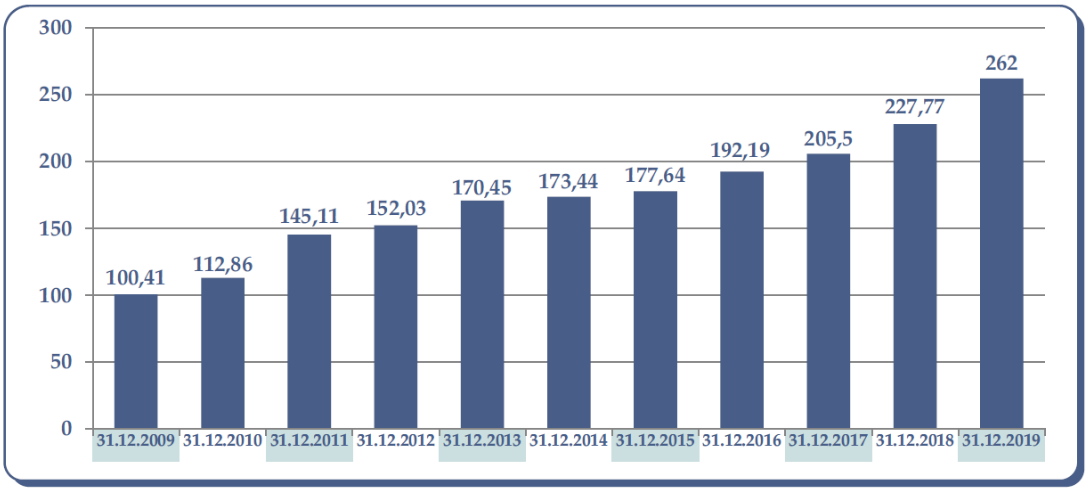


Chart 1-4. Information on the average monthly amount of retirement pension[9]

In 2019, the minimum amount of retirement pensions increased from 119 to 200 AZN, which in turn led to an increase in the pensions of 660,000 people. In general, in 2019, the minimum amount of retirement pension increased by 72%.

As of the end of 2019, the number of families receiving targeted state social assistance was 71.1 thousand (297 thousand family members), and it means an increase of 29.3 thousand families or 69% compared to the previous year. As of the end of 2019, the average monthly amount of the targeted state social assistance was 207.6 AZN per family.

Improving housing conditions of vulnerable groups of the population

In 2019, this group of the population (families of martyrs and disabled Karabakh war veterans, visually impaired) was provided with 934 apartments or private houses. This figure is 308 units more than the figure recorded in 2018.

1.6. Current state of the national economy

1.6.1. Industrial production

Industrial development is one of the major priorities of the economic policy of the country in terms of raising competitiveness and improving the structure of the economy. Industrialization is important not only economically, but also in terms of a range of social, scientific, and cultural aspects, such as employment, income levels, urbanization, skilled labor, research, and development.

Since 2004, the pace of industrialization in Azerbaijan has increased, improving the regional structure of the industry has been identified as a major priority, targeted measures have been taken to address the vital issues of energy supply for industrial production, the country has become an exporter of natural gas and electricity, and infrastructure support has improved significantly. Over the last period, in addition to infrastructure projects, state investments had been channeled into several production-oriented projects, the favorable business environment had been created in the country, projects

[9] https://cabmin.gov.az/az/article/798/

executed by the private sector had been financed by the state on concessional terms, and when necessary, government participated in these projects.

The implemented works have led the industry to a new stage of development, as the beginning of this stage, 2014 was declared the Year of Industry in the Republic of Azerbaijan. To ensure the transformation of Azerbaijan into a powerful industrial center of the region through more efficient use of the existing capacity at the new stage of industrialization, the State Program for the Development of Industry in the Republic of Azerbaijan for 2015-2020 was adopted taking into account the areas of activity specified in Development Concept Azerbaijan - 2020: outlook for the future. The State Program is aimed at strengthening the activities of existing industrial and technology parks, establishing new industrial parks and industrial areas, creating special economic zones, and improving the industrial capacity of the regions.

Moreover, the Strategic Roadmap for the Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan adopted in 2016 also provides for measures to develop the country’s industry in 2025 and after this period. Priority 1.2. of the Road Map sets the target to achieve optimal energy efficiency.

In 2019, 41.4% of GDP fell to the share of industry, production increased by 1.8% compared to the previous year (46.8 billion AZN).

75.7% of the manufactured product, that is 35.4 billion AZN fall to the share of the oil and gas industry, and 24.3%, i.e., 11.3 billion AZN to the non-oil industry. 88.6% of the total production was achieved at the account of industrial production and 11.4% at the account of industrial services.

69.9% of industrial output fell to the share of mining, 25.2% to the share of processing, 4.2% of electricity, gas, and steam generation, distribution, and supply, and 0.7% of water supply, waste treatment, and recycling.

In 2019, 8628.8 million AZN were invested in the industrial sector, 5489.5 million of which fell to the share of the oil and gas sector, 3139.2 million to the share of the industrial part of the non-oil and gas sector (18.3% of the total investment). In total, 50.2% of the funds allocated to fixed capital during the year were used in the industry.

The share of the private sector in industrial output in 2019 increased to 82.1%.

In 2019, the number of wage earners in the industry was 217.5 thousand, accounting for 13.2% of the employees engaged in the economic sphere of the country. The average monthly nominal wage of employees engaged in the industry was 1,017.0 AZN and it is 60.2% higher than the national average.

According to the UN, in 2019, due to the share of industry in GDP (41.4%), Azerbaijan was ahead of Norway (26.6%), Russia (23.6%), Turkey (22.3%), and Poland (21, 9%).

In 2019 the increase in the **non-oil sector** was mainly recorded in woodworking and wood products (82.9%), tobacco products (80.7%), finished metal products (80.0%), computer, electronic and optical products (51.8%), beverage production (41.4%), textile industry (33.2%), furniture production (29.5%), installation and repair of machinery and equipment (27.5%), chemical industry (25.6%), paper and cardboard production (25.5%), rubber and plastic products (22.0%), food production (10.8%), and construction materials (5.0%).

Products worth 759.4 million AZN were produced in the fields of metallurgical industry and production, 80.0% growth was recorded in the production of **finished metal products, and metallurgical products** worth 96.0 million USD were exported.

Chemical industry, pharmaceuticals, rubber, and plastic industry produced products worth 950.5 million AZN, production in the chemical industry increased by 25.6%, in rubber and plastic production by 22.0%, and in pharmaceuticals by 20.6% compared to the same period of last year.

In 2019, the **mechanical engineering** industry manufactured products worth 317.9 million AZN, production of machinery and equipment increased by 1.0%, the production of other vehicles decreased by 17.4%, and the production of cars, trailers, and semi-trailers decreased by 17.7% compared to the previous year.

Computers, electronic and optical products, electrical equipment worth 276.3 million were manufactured, and the production in this field increased by 51.8% compared to the previous year.

In 2019, the textile industry manufactured products worth 431.4 million AZN in the field of **clothing, leather and leather products, and footwear**, the textile industry grew by 33.2%, clothing by 22.6%, but the production of leather and leather products and footwear decreased by 2.9% compared to the previous year.

In 2019, the companies dealing with **wood processing and wood products**, furniture, paper, and cardboard production manufactured products worth 285,0 million AZN that is 44,4% more than the previous year.

The total value of production by companies dealing with the **production of construction materials** increased by 5.0% and reached 766.8 million AZN.

Area of activity	Production in 2019 (AZN)	in 2019 compared to 2018 (in percentage)
Textile industry	299,8	133,2
Clothing manufacture	111,2	122,6
Leather and leather products, footwear	20.4	97,1
Wood processing and wood products	62,9	182,9
Paper and cardboard	107,3	125,5
Printing products	138,5	142,2
Construction materials	766,8	105,0
Metallurgical industry	514,7	90,5
Finished metal products	244,6	180,0
Computers, electronic and optical products	88,6	151,8
Electric equipment	187,7	101,1
Machinery and equipment	217,4	101,0
Cars, trailers and semi-trailers	93,3	82,3
Other vehicles	7.2	82,6
Furniture	114,8	129.5
Jewelry, musical instruments, sporting goods, and medical equipment	69,4	113,3
Installation and repair of machinery and equipment	482,9	127,5

Table 1-12. Production of various products in 2019[10]

Electricity generation is the fast-developing field of recent years. Currently, there are 14 thermal and 19 hydroelectric power plants in the country, meeting the country's electricity needs. New thermal and hydroelectric power plants are being built, and existing ones are being reconstructed according to modern requirements thanks to state investments in the electricity sector. Moreover, the existing thermal power plants will eliminate the use of fuel oil and use gas instead, and it will have unprecedented environmental benefits including the mitigation of the effects of climate change.

A legal entity of public law - Energy Regulatory Agency was established under the Ministry of Energy of the Republic of Azerbaijan on the basis of State Energy Control Administration and the State Gas Control

[10] https://cabmin.gov.az/az/article/798/

Administration of the Ministry of Energy by the Decree dated December 22, 2017 of the President of the Republic of Azerbaijan.

Great attention is paid in the Republic of Azerbaijan to the development of alternative and renewable energy. Increasing the share of alternative and renewable energy sources in the energy balance, sustainable electricity supply to consumers, reducing technical and technological losses by creating generation sources close to consumers, and ensuring the effective management of available resources are among the priorities of reforms in the electricity sector. Important work has been done recently in terms of the effective use of alternative and renewable energy sources and the creation of a modern infrastructure in this area. All this enabled expanding the use of alternative and renewable energy in the economy and social spheres, created all conditions for the implementation of measures related to the production and consumption of such energy. The State Program on the Use of Alternative Energy Sources was adopted in 2004 as a result of the measures taken in this field. State Agency for Alternative and Renewable Energy Sources was established in 2009, and later by the Decree dated February 1, 2013 of the President of the Republic of Azerbaijan the Agency was restructured and Azeralternativenergy Limited Liability Company was established under the Agency in order to improve the management system in the field of alternative and renewable energy in the country. Strategic Plan of the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan for 2015-2018 was approved by the order dated December 10, 2014 of the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan. Currently, the Agency has been reorganized and operates as the State Agency for Renewable Energy under the Ministry of Energy.

Under the Decree dated December 22, 2017 of the President of the Republic of Azerbaijan on Additional Measures for the Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan, the Wind Power Park located on the 55th kilometer of Baku-Guba highway was removed to the charter capital of “Azerishig” OJSC.

In 2020, the Ministry of Energy and ACWA Power Company of Saudi Arabia and Masdar Company of the United Arab Emirates signed Executive agreements on the implementation of pilot projects on renewable energy. Under these agreements, pilot projects will be implemented with ACWA Power company for the construction of 240 MW wind power and with Masdar for 200 MW solar power plants. About 1.4 billion kWh of electricity is projected to be generated by wind and solar power projects.

In 2019, as a result of relevant reconstruction and modernization activities, energy efficiency increased, the difference between the capability of the power system (6012 MW) and installed capacity (6817 MW) decreased, the maximum peak power increased to 3879 MW and Azerbaijan became a leading state exporting electricity in the region.

In 2019, 26.1 billion kWh electricity was generated in the country, which means an 842.7 million increase compared to the previous year, while consumption increased by 819,4 million amounting to 22.5 billion kWh, and exports constituted 1.5 billion kWh. 92.7% of the electricity generation falls to the share of thermal power plants (TPPs), 6.0% of hydropower plants (HPPs), and 1.3% of renewable energy sources (RES).

In 2019, the main electricity producer “Azerenergy” OJSC produced 23.4 billion kWh of electricity including 22.1 billion kWh from TPPs and 1.3 billion kWh from HPPs.

The Shimal-2 power plant having a capacity of 409 MW and distinguishing itself in the South Caucasus in terms of fuel consumption (214-216 grams depending on the load regime) was commissioned in 2019, with the participation of the President of the Republic of Azerbaijan.

In 2019, “Azerenergy” OJSC implemented reconstruction works at 17 substations, including two 220 kV and fifteen 110 kV substations, and renewed their control, automation systems, and equipment for the development of a high-voltage power grid system.

In 2019, the country generated 349.5 million kWh of electricity from RES, 105.2 million of it came from wind, 48.4 million from solar, and the remaining 195.9 million from other sources.

According to the Global Competitiveness Index 2019, Azerbaijan ranked second in terms of electricity availability, and according to the Doing Business 2019 report, Azerbaijan rose by 24 points in comparison to 2018 and ranked 74th in the overall ranking of electricity supply networks.

Years	Capacity of power plants by the end of the year	among them:					
		Fuel operated power plants and thermal power plants - total	HPP	Wind PP	Solar PP	Solid domestic waste plant	Biogas PP
2000	4 912	3 990	921.9	-	-	-	-
2005	5 157	4 187	970.1	-	-	-	-
2006	5 624	4 599	1 025	-	-	-	-
2007	5 728	4 703	1 025	-	-	-	-
2008	5 798	4 773	1 025	-	-	-	-
2009	6390	5 401	987.0	1.7	-	-	-
2010	6398	5 401	995.0	1.7	-	-	-
2011	6350	5352	998.0	-	-	-	-
2012	6420	5397	1 023	-	-	-	-
2013	7 353,3	6 230,1	1 082,5	2,7	1.0	37.0	-
2014	7 353,4	6 233,4	1 077,9	2,7	2.4	37.0	-
2015	7 806,7	6 652,8	1 103,4	7.7	4.8	37.0	1,0
2016	7 910,4	6 726,8	1 105,0	15.7	24.9	37.0	1,0
2017	7 941,5	6 748,0	1 106,4	15.7	28,4	42.0	1,0
2018	7 828,9	6 552,2	1 130,8	66,0	34.9	44,0	1,0
2019	7,641.6	6,350.3	1,144.8	66.1	35.4	44,0	1,0

Table 1-13. Capacity of power plants, MW[11]

years	Electricity generation	among them:							
		Production in fuel operated power plants and thermal power plants	HPP production	production by the plants used for meeting the internal needs of enterprises (fuel-operated)	produced by generators	production by wind power plants	solar photovoltaic energy	electricity obtained from waste incineration	electricity obtained from burning biomass
2000	18699	17069	1534	83.1	13	-	-	-	-
2005	22872	19344	3009	430.5	88.0	-	-	-	-
2006	24543	21407	2518	475.9	141.8	-	-	-	-
2007	21847	19051	2364	432.0	-	-	-	-	-
2008	21642	19090	2232	319.6	-	-	-	-	-
2009	18869	16289	2308	269.2	-	2.1	-	-	-
2010	18710	15003	3446	259.7	-	0.5	-	-	-
2011	20294	17317	2676	301.0	-	-	-	-	-
2012	22988	19537	1821	1630.0	-	-	-	-	-
2013	23354.4	20065.6	1489.1	1664.0	-	0.8	0.8	134.1	-
2014	24727.7	21401.2	1299.7	1848.1	-	2.3	2.9	173.5	-
2015	24688.4	20904.6	1637.5	1955.3	-	4.6	4.6	181.8	0.0
2016	24952.9	20699.0	1959.3	2062.0	-	22.8	35.3	174.5	0.0
2017	24320.9	20445.4	1746.4	1899.5	-	22.1	37.2	170.3	0.0
2018	25229.2	21242.9	1768.0	1934.1	-	82.7	39.3	162.2	0.0
2019	26072.9	22289.7	1564.8	1872.9	-	105.4	44.2	195.9	0.0

Table 1-14. Electricity generation, million KW hours[12]

Oil and gas

37.5 million tons of oil and 35.6 billion m³ of gas worth 29.1 billion AZN in total was extracted in 2019. 83.1% of the produced oil and 84.2% of the produced gas fell to the share of foreign-invested companies.

[11] https://www.stat.gov.az/source/balance_fuel/
[12] https://www.stat.gov.az/source/balance_fuel/

In 2019, 64% of the total investment in the industrial sector falls to the share of the oil and gas sector.

Oil production in the country has increased by 1.5% compared to last year. Revenues from the exports of oil products amounted to 384.5 million USD, and to 2825.1 million from domestic sales. In 2019 oil production increased by 2.4 times, and gas production by 6.9 times compared to 2003.

In 2019, the volume of hydrocarbon production by the State Oil Company of Azerbaijan (SOCAR) increased and amounted to 7.7 million tons of oil and 6.8 billion m³ of gas. 140.8 thousand tons more oil, and 293.0 million m³ more gas was produced compared to 2018. 1.4 million tons of the extracted oil and 1.6 billion m³ of natural gas were exported. 600,000 tons of export oil was transported via the Heydar Aliyev Baku-Tbilisi-Ceyhan and 800,000 tons through the Baku-Novorossiysk pipelines. Total revenues obtained from oil and gas exports were equal to 904.6 million USD.

In 2019, SOCAR implemented drilling work amounting to 150,800 meters and put 76 new wells into operation in order to stabilize oil and gas production. Reconstruction and modernization continued at the Heydar Aliyev Oil Refinery and the relevant refineries of Azerkimya Production Association.

In 2019, the gas processing plant produced 3215.0 million m³ of natural gas, and 3161.0 million m³ of it was clean dry gas, 12.0 thousand tons were commercial butane and 20.0 thousand tons were natural gasoline.

In 2019, production growth was also ensured in the petrochemical sector, Azerkimya Production Association processed 459.3 thousand tons of raw materials to obtain 88.1 thousand tons of propylene, 94.6 thousand tons of polyethylene, and 143.5 thousand tons of other valuable petrochemical products.

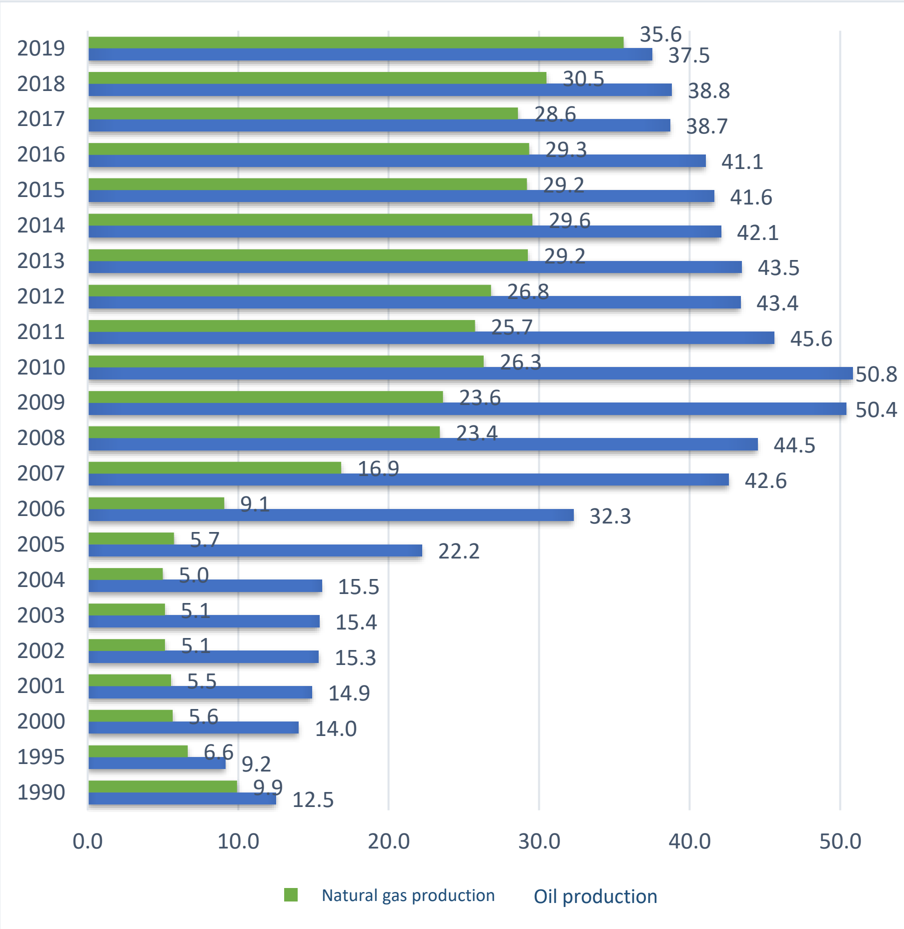


Chart 1-5. Oil and gas production in the Republic of Azerbaijan in 1990-2019 (million tons)[13]

[13] https://cabmin.gov.az/az/article/798/

Within the framework of the new agreement on the Azeri-Chirag-Guneshli block of oilfields, the second bonus payment of 450 million USD was made to the State Oil Fund of the Republic of Azerbaijan by international partners.

Trans-Anatolian Natural Gas Pipeline - TANAP, which is an important part of the Southern Gas Corridor project, increased the average daily gas supply of Shah Deniz gas to Turkey up to 11.0 million m³. In 2018-2019, 3.8 billion cubic meters of gas were transported through this important communication line. The opening ceremony of the second part of TANAP was held on November 30, 2019. Works continued for the construction of the Trans-Adriatic Pipeline - TAP, the project is complete for more than 90.0%, and its commissioning is scheduled for 2020. After the completion of the project, for the first time in history, the natural gas of Azerbaijan will be transported directly from the Caspian Basin to European markets via the South Caucasus Pipeline, TANAP, and TAP, and Azerbaijan will gain the status of the new gas supplier of Europe.

Space industry and satellite services

In 2019, “Azerspace” OJSC continued its activities for developing the space industry, took appropriate measures for the development of various elements of this field i.e. satellites, space devices and apparatus by local experts, and more importantly rocket modeling festival - Rocketry Azerbaijan was organized for the first time in the country. Moreover, as part of the Corporate Social Responsibility program, engineering students from various universities across the country participated in the International Astronautical Congress in Washington as young ambassadors.

In 2019, “Azerspace” OJSC will expand its satellite services and provide TV and radio broadcasting via the Azerspace-1 telecommunications satellite in more than 30 countries in Central Asia and the Near East (45%), Europe (40%), and Africa (15%). has done. In addition, data transmission services were provided to 10 large customers in the region and in total 80% of satellite revenue was obtained from the export of these services.

One significant development in this area was that Baku won the right to host the 2022 International Astronautical Congress during the elections to the General Assembly of the International Astronautical Federation, which took place October 21-25, 2019, in Washington. The Federation with 398 members representing 68 countries is the most prestigious international organization in the field of cosmic space.

1.6.2. Agricultural production

Historically, agriculture has been a strategic sector in Azerbaijan and plays an important role in the non-oil economy. Historically, viticulture, silkworm breeding, and fruit growing were widespread in this area. Cattle breeding has always played an important role in people’s lives, because a large part of the country has a mountainous relief. The development of cattle breeding led to the development of hand and carpet weaving. At that period, high-quality wines, carpets, leather, silk products, etc. were exported from the country to Europe and the East.

Although 47.2% of the population of Azerbaijan live in rural areas, the share of agriculture in GDP is only 5.7%. However, 36% of the total employed population (employed and self-employed) work in agriculture and this sector is their main source of income. The total land fund in the country is more than 8.641 million hectares. 4.78 million hectares or 55% of this are agricultural lands, including 1.45 million hectares of irrigated land. About 2.06 million hectares of agricultural land are arable lands.

As to the progress in the field of agriculture, gross agricultural output fell by an average of 12 percent annually between 1992 and 1995, but it has steadily risen since 1996 (excluding 1997, 2010, and 2014). In 2015, the increase amounted to 6.6%

The State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan in 2008-2015, the State Program on Reliable Food Supply of Population in the Republic of Azerbaijan in

2008-2015, the State Program on Socio-Economic Development in 2009-2013 signed by the President of the country for the development of the agrarian sector and the Decree dated January 23, 2007 on State Support to Agricultural Producers showed their positive results, and enabled the supply of the population with a number of agricultural products through domestic production.

Strategic Roadmap for Agricultural Production and Processing Industries developed on the basis of the Decree no. 1897, dated March 16, 2016 on Approval of Main Areas of Activity of the Strategic Roadmap for National Economy and Key Sectors of the Economy and Related Issues includes the strategic vision for the development of the agricultural sector of the country until 2020, the long-term vision until 2025 and the target vision for the period after 2025, and it shows that the state has a clear roadmap that will be consistently implemented to achieve long-term strategic development goals in the field of agriculture both in the medium and long term perspectives.

State Program for the development of cotton growing in the Republic of Azerbaijan in 2017-2022; State Program on the Development of Tobacco Growing in the Republic of Azerbaijan in 2017-2021; State Program for the Development of Tea planting in the Republic of Azerbaijan 2018-2027; State Program for the Development of Raw Rice Growing in the Republic of Azerbaijan in 2018-2025; State Program for the Development of Citrus Fruit Growing in the Republic of Azerbaijan in 2018-2025.

The Law of the Republic of Azerbaijan on Agrarian Insurance governing the relations for the insurance of risks in the agrarian sphere through coinsurance mechanism and establishing the legal, economic, and organizational bases of agrarian insurance came into force, and the Agrarian Insurance Fund was established for ensuring the organization, development, and sustainability of the agrarian insurance system and its authorized capital at the initial stage was determined in the amount of 1 million AZN. Moreover, Regulations for Subsidizing Agricultural Production and for Electronic Agriculture Information System were approved in order to establish new mechanisms for the measures of support in the agricultural sector, to ensure accountability, transparency, and more efficient use of budget funds in this area, and to facilitate the electronic application for subsidies.

In 2019, the actual value of gross agricultural output amounted to 7836.7 million AZN, 4085.5 million AZN or 52.1% of it fell to the share of livestock, and 3751.2 million AZN or 47.9% to the share of crop production. Agricultural production increased by 7.2%, including livestock production by 3.5%, and crop production by 11.7% compared to the corresponding period of the previous year. In 2019, 539.9 million AZN of the total funds allocated to fixed capital was spent for the fields of agriculture, forestry, and fishery.

	2019	2018	in 2019 compared to 2019 (in percentage)
Cereals and legumes, including:	3 538 489	3 309 244	106.9
Wheat	2 171 490	2 042 863	106.3
raw rice	12 043,7	12 413,2	97.0
corn for seeds	283 570	247 939	114.4
Cotton	295 279	233 592	126.4
Sunflower for grain	34 803	24 288	143.3
Sugar beet	236 990	299 449	79.1
Tobacco	6 038,6	6 316,6	95.6
Potato	1 004 172	898 914	111.7
Vegetable	1 714 678	1 521 931	112.7
Orchard products	447 637	401 943	111.4
Fruits and berries	1 099 709,8	1 010 816,3	108.8
Grapes	201 842,4	167 591,4	120.4
Green tea leaf (ton)	929.4	868/6	107.0

Table 1-15. Agricultural crop production in 2019[14]

[14] https://cabmin.gov.az/az/article/798/

Crop growing Compared to 2018, 3254.9 thousand tons or 6.3% more grain was harvested in 2019 from the sown areas of grain and leguminous crops (excluding corn). Moreover, 283.6 thousand tons or 35.7 thousand more corn seeds were harvested compared to the corresponding period of the previous year, the average yield per hectare increased by 1.8 centners and amounted to 59.5 centners. Total grain production including corn seeds increased by 6.9% compared to 2018 and reached 3538.5 thousand tons, the average yield per hectare increased by 2.1 centners and amounted to 32.1 centners. Autumn and spring-sown wheat has a special place among cereals and legumes. 61.4% (2171.5 thousand tons) of the produced cereal are wheat, 28.7% (1015.5 thousand tons) are barley, 8.0% (283.6 thousand tons) are corn, 0.3% (12.0 thousand tons) are raw rice, 1.0% (36.0 thousand tons) and 0.6% (19.9 thousand tons) are legumes and other cereal crops. Compared to the same period of the previous year, in 2019, 1714.7 thousand tons (or 12.7% more) of vegetables, 1004.2 thousand tons (11.7% more) of potatoes, 447.6 thousand tons (11.4% more) of orchard products were harvested from the fields. At the same time, the average yield per hectare increased by 14 centners for vegetables, 20 centners for potatoes, 18 centners for orchard products and amounted to 176, 169 and 209 centners respectively. In 2019, 295.3 thousand tons of cotton or 26.4% more cotton, 34.8 thousand tons (43.3% more) of sunflower were harvested from the fields compared to the corresponding period of the previous year. The average yield of cotton increased by 11.9 quintals and reached 29.5 quintals. Moreover, 237.0 thousand tons of sugar beets and 6.0 thousand tons of tobacco leaves were harvested from the fields. In 2019, 1099.7 thousand tons (8.8% more) of fruits and berries, 201.8 thousand tons (20.4% more) of grapes, 929.4 tons (7.0% more) of green tea leaves were harvested.

Cattle breeding. 573.3 thousand tons of meat in live weight, 2129.4 thousand tons of milk, 1827.1 million eggs, 16.1 thousand tons of wool and 643.7 tons of cocoons in wet weight were produced in 2019. Meat production increased by 3.0%, milk production by 2.4%, egg production by 9%, wool production by 1.6%, and cocoon production by 25.3% compared to 2018. In 2019, an average of 1,636 kg of milk was produced from each cow and buffalo (1,589 kg in 2018). According to preliminary data, as of January 1, 2020, there were 2658.1 thousand head of large cattle in the country, including 1281.2 thousand cows and buffaloes, 8296.3 thousand head of sheep and goats. Cows and buffaloes make up 48.2 percent of large cattle. Last year, poultry factories produced 67.2 thousand tons of poultry meat in live weight and 764.5 million eggs. Generally, the total number of birds in the factories amounted to 14068.1 thousand, on average 201 eggs were obtained from each laying hen.

Food safety. In 2019, 419.6 million AZN and agricultural subsidies were allocated from the state budget to ensure food security in the country and to implement other measures. In 2019, concessional loans in the amount of 21.2 million AZN were granted to 723 entrepreneurs engaged in the agricultural sector in 58 regions of the country.

In 2019, the work continued for establishing agro-parks and modern large farms that are important in the development for the agricultural sector. In accordance with instructions of the head of state, work is underway to establish 51 agro-parks and large farms worth AZN 1 billion in 262,000 hectares in 33 regions of the country. In this connection, within the framework of state support for agro-parks and large farms, the government allocated public capital funds in the amount of 535 million AZN including 339 million AZN for necessary infrastructure works and concessional loans in the amount of 196 million AZN were allocated for the creation of 27 agro-parks and large farms with total worth of 780 million AZN. Additionally, investment promotion documents were issued for 45 projects worth 759 million AZN to be implemented in 23 agro-parks and large farms.

33 agro-parks and large farms are already put into operation (including 16 in 2019). Design and construction works are in progress in 18 agro-parks and large farms.

Approved by the Decree of the President of the Republic of Azerbaijan No 2090 of April 29, 2019.

Due to the targeted measures implemented to ensure food security and promote non-oil exports, food production increased by 10.8% in value terms compared to 2018 and amounted to 3494.1 million AZN.

Over the reporting period, 63.6 thousand phytosanitary certificates and permits, 28.5 thousand food safety certificates, 15.1 thousand veterinary certificates were issued during the import and export for the surveillance of food safety, animal and plant health; in total 108.2 thousand tons and 99.4 thousand units of products were neutralized by various methods and means, 639 tons and 152 units of products were destroyed, and 33.3 thousand tons of products were utilized.

1.6.3. Transport and communication

Transport. The development of the transport system is of great importance for the Republic of Azerbaijan. Along with energy, communications, education, and health care, which are the infrastructure areas of a country's economy, transportation plays an important role in achieving social, economic, foreign policy, and other government priorities by meeting the basic needs of society.

Like in other areas, important work and projects are in progress in order to develop the transport sector, expand transit opportunities. A number of international transport corridors pass through the territory of Azerbaijan - East-West, North-South, and South-West. Baku-Tbilisi-Kars railway was put into operation in 2017, the Baku International Sea Trade Port was commissioned in May 2018, the Baku-Boyuk Kesik railway and the Yalama-Astara railway are under reconstruction, the bridge over Astara River and other terminal complexes are built in order to develop these corridors. Azerbaijan has the largest fleet of 270 ships in the Caspian Sea, the country has 6 international airports, a modern shipyard, and modern highways are under construction. All of this plays an important role in strengthening Azerbaijan's transport infrastructure and expanding the possibilities of participation in transit transportation.

In 2019, business entities operating in the transportation sector transported 235.3 million tons of cargo, and it means an increase of 2.2 percent compared to the corresponding period of 2018. 2.5% of cargo was transported by sea, 6.5% by rail, 0.1% by air, 66.0% by road, and 24.9% by pipeline. The volume of cargo transported by non-state sector vehicles increased by 2.5 percent, the share of this sector in the total volume of transported cargo was 82.5 percent. In 2019, transport agencies served 2056.5 million, or 2.7 percent more people compared to the same period of 2018. 88.2% of passengers were transported by road, 11.5% by metro, and the rest by other modes of transport.

In 2019, 2056.5 million people or 2.7% more passengers were transported compared to the previous year, and the total passenger turnover increased by 1.1% and reached 33864.8 million passenger/km. 1813.3 million passengers were transported by road, 236.7 million by metro, 2.7 million by air, 3.9 million by rail and 22.2 thousand by marine transport. In 2019, the volume of cargo transported through the international transport corridors passing through the territory of Azerbaijan increased by 0.2% compared to the previous year and amounted to 52.8 million tons.

Motor transport. In 2019, 4.0% more cargo and 2.6% more passengers were transported compared to 2018, cargo turnover amounted to 17530.8 million ton/km, and passenger turnover constituted 25950.1 million passenger/km. Compared to 2017, these figures increased by 4.0% and 2.7%, respectively. As of the end of 2019, the number of vehicles in the country increased by 3.5% and amounted to 1.4 million, and the number of private cars per 100 families reached 54.

In 2019, 1845.7 million AZN including targeted foreign loans under state guarantee were allocated for the construction, reconstruction, repair and maintenance of motor roads. Generally, in 2019, construction and reconstruction work was completed on 54 projects, including five projects of national importance, 39 inter-village, and 10 inter-settlement motor highway projects in Baku.

Railway In 2019, the volume of transported cargo increased by 9.1% and amounted to 15.2 million tons, and passenger transportation increased by 35.6% and reached 3.9 million tons compared to 2018. Cargo turnover was 5151.7 million ton/km, and passenger turnover amounted to 543.8 million passenger/km. Compared to 2018, these figures increased by 14.7% and 16.7%, respectively.

3.8 million tons (25.0%) of the transported cargo was transit cargo, 11.9 million tons (78.3%) of them were general cargo, and 4,358.6 million tons/km (84.6%) of cargo turnover fell to the share of international shipments. Domestic transportation accounted for 21.7% of cargo and 94.3% of passenger transportation. In 2019, transit transportation of non-oil cargo increased by 39.2% compared to the previous year and amounted to 2583.0 thousand tons.

In 2019, 299.8 million AZN of revenue was generated from rail transport and increased by 10.7% compared to 2018. In 2019, total investments into the fixed capital of Azerbaijan Railways amounted to 1,001.3 million AZN, including 653.9 million AZN allocated from the state budget as part of state capital investments.

Baku Metro. In 2019, passenger transportation and turnover increased by 2.5% compared to the previous year and amounted to 236.7 million passengers and 2611.5 million passenger/km respectively. 6.9 million passengers used metro on preferential terms. Existing inventory fleet of Baku Metro Closed Joint-Stock Company included 295 wagons, while the number of operational fleet was 252 wagons.

Maritime transport In 2019, the volume of cargo transportation in Azerbaijan Caspian Shipping CJSC decreased by 27.5% compared to 2018 and amounted to 6 million tons. 22.2 thousand people or 41.4% more passengers were transported by sea compared to the previous year. Cargo turnover decreased by 26.8% and passenger turnover increased by 39.7% and amounted to 3350.7 million ton/km and 9.5 million passenger/km respectively.

2156.1 thousand tons of total cargo were transported by tankers, 1004.3 thousand tons by dry cargo vessels, and 2808.3 thousand tons by ferries. 80.8% of the total volume of cargo was transported through the Eurasian transport corridor.

Ro-Pax/Ferry vessel "Azerbaijan" with a capacity of 100 passengers, 56 wagons or 50 trucks (TIR) built by Baku Shipyard as its first production by the order of Azerbaijan Caspian Shipping Company CJSC, and a new generation tanker "Lachin" were launched.

In 2019, Baku International Sea Trade Port CJSC performed 4061.6 thousand tons of loading and unloading operations; it is 7.2% more compared to 2018, and 3444.2 thousand tons (84.8%) of the handled cargo were transit cargo. In 2019, the number of handled containers in TEUs increased by 53.6% compared to 2018 and reached 35,152 containers.

Air transport. In 2019, the passenger flow at the international airports of Azerbaijan Airlines Closed Joint-Stock Company amounted to 5572.0 thousand people, and this number is 6.5% higher compared to 2018. 4760.7 thousand of the passengers fell to the share of Heydar Aliyev International Airport and this indicator increased by 7.1% compared to the previous year. Heydar Aliyev International Airport served to 4126.0 thousand passengers of international flights.

In 2019, AZAL and Buta Airways (Low cost) passenger airlines of Azerbaijan Airlines JSC have expanded their flight geography and as a result, the number of transported passengers has increased by 12.7% compared to 2018, and reached 2,700.4 thousand people.

The number of passengers carried by international flights increased by 16.6% and amounted to 2077.4 thousand people. 623.1 thousand passengers were transported by domestic routes.

Communication. Over the recent years, significant work has been carried out in order to accelerate the development of communications and information technology in the country, to improve the regulatory framework in this area and bring it into line with international agreements to which the Republic of Azerbaijan is a party, and to further liberalize the telecommunications and postal services market. The Laws of the Republic of Azerbaijan on Postal Communications and on Electronic Signature and Electronic Document" were adopted in 2004 and the Laws on Telecommunications and on E-commerce in 2005. State Program for the Development of Communication and Information Technologies in the Republic of

Azerbaijan in 2005-2008 ("Electronic Azerbaijan") was approved by the Decree dated October 21, 2005 of the President of the Republic of Azerbaijan.

Relevant measures were taken to ensure the implementation of the Decree dated 04.11.2008 of the President of the Republic of Azerbaijan on Establishing Space Industry in Azerbaijan and Launching Telecommunications Satellites into Orbit and the State Program for the Establishment and Development of the Space Industry in the Republic of Azerbaijan approved by Presidential Decree dated August 17, 2009 in connection with the strategic goals of eliminating the dependence of the Republic of Azerbaijan on foreign countries in the field of information exchange, developing and launching a telecommunications satellite, which is one of the main components of economic and information security.

The activity for the establishment of e-government in the Republic of Azerbaijan was launched under the 2003-2012 National Strategy on Information and Communication Technologies for the Development of the Republic of Azerbaijan approved in 2003. Numerous state programs adopted for the development of various spheres in the years following that period include targeted measures aimed at the application of ICTs, improving the efficiency of management in this area and better organization of the provided services.

The e-government portal (www.e-gov.az) was established and launched in order to organize the exchange of information between the information systems of government agencies and to create conditions for citizens to use e-services provided by government agencies on the basis of the one stop shop principle.

The first telecommunications satellite was launched in Azerbaijan in 2013. 2013 was declared the Year of Information and Communication Technologies in the Republic of Azerbaijan.

In 2019, the share of the information and communication sector in GDP increased by 0.1% and amounted to 2.2%, while its share in the non-oil sector was 3.4%. Compared to 2018, in the reporting year, the volume of services provided in this area increased by 17.2% in real terms and amounted to 2.22 billion AZN. 72.8% of these services were used by the population and 82.6% of the revenues fell to the share of non-public sector. 41.0% or 912.2 million AZN of service revenues were generated in the field of mobile communication.

The number of fixed-line network subscribers per 100 people in the country is 15, the number of subscribers per 100 families is 62, and the number of mobile subscribers per 100 people is 105. 80% of the population use Internet and 75% of them are the users of broadband Internet.

In 2019, 500 units of Braille Teach device that has the project cost of 30,000 USD and teaches interactive, voice-enabled Braille alphabet will be produced for the first time in a 3D lab at the initial production stage for people with disabilities and the visually impaired in order to foster innovative entrepreneurship and support startup projects.

In 2019, the New Certification Center issued 895.9 thousand e-signature certificates for new generation ID cards.

SmartPay payment system supports payment through POS terminals. The 25th Anniversary Azerbaijan International Telecommunications, Innovations and High Technologies Exhibition Bakutel 2019 was organized in 2019. 238 companies from 23 countries participated in Bakutel 2019 exhibition.

1.6.4. Tourism

The development of tourism in Azerbaijan is considered an important factor for economic progress and growth and has become an integral part of state policy. The trend of development in the field of tourism was first of all expressed in the highest legislative acts of the country. In 1999, the Parliament adopted the Law on Tourism.

On September 25, 2001, the Republic of Azerbaijan became a member of the 14th General Assembly of the World Tourism Organization (WTO) held in Seoul, the capital of the Republic of Korea.

The tourism resources of the country are used effectively as the result of the approval of the State Program for the Development of Tourism in the Republic of Azerbaijan in 2002-2005. 7 major (Baku-Khachmaz, Baku-Astara, Baku-Balakan, Baku-Gazakh, Baku-Absheron peninsula - Gobustan, Baku-Nakhchivan, Baku-Shusha) tourism routes meeting international standards were identified in 2002 in order to ensure the development of tourism in the country.

Preparation of specialists meeting modern international requirements for the tourism industry in the Republic of Azerbaijan; Azerbaijan Institute of Tourism was established by a Resolution of the Cabinet of Ministers of the Republic of Azerbaijan on February 13, 2006 to ensure the training of highly qualified specialists, combining high cultural activity and civic engagement with profound professional knowledge, through the use of various forms of training. Azerbaijan Tourism and Management University was established under the Decree dated December 22, 2014 of the President of the Republic of Azerbaijan, given the rapid development achieved in the fields of tourism, management and other services in the Republic of Azerbaijan, Development Concept Azerbaıjan - 2020: Outlook for the Future, the State Strategy for the Development of Education in the Republic of Azerbaijan.

Every year September 27 is celebrated as Tourism Day in Azerbaijan In this connection, various events, national tourism conferences, projects in the field of tourism are being implemented.

The Association of Travel Agencies of Azerbaijan was established in 2009 in order to develop the activities of tourism companies, eliminate the gaps in their work and protect the interests of tourism companies, to be represented in local and international events.

Over the past period, the commissioning of tourist complexes, hotels, recreation centers in the regions along with Baku has created great opportunities for the development of tourism and recreation of the population.

State Program for Tourism Development in the Republic of Azerbaijan in 2010-2014 was approved by the Decree dated April 6, 2010, of the President of the Republic of Azerbaijan. The purpose of the program's approval is to create modern tourism services meeting high economic, social and environmental requirements, ensure that tourism becomes one of the main pillars of the country's economy, develop tourism as a profitable non-oil sector, create, and ensure the sustainable development of high-quality services in this area.

Considering the necessity to further develop tourism in the Republic of Azerbaijan and create favorable conditions for tourism activities, Year of Tourism was declared by the Decree dated February 2011 of the President of the Republic of Azerbaijan in order to ensure the large-scale recognition of natural monuments of our country that has a rich geographical landscape, and the ancient cultural and historical heritage of our people.

Strategic Road Map for Development of Vocational Education and Training in the Republic of Azerbaijan is approved by the Presidential Decree dated December 6, 2016.

Hotels, recreation areas, entertainment and sports centers operate in the regions of Azerbaijan. Examples are the Qafqaz hotels and resorts, the Gabaland amusement park in Gabala, the Tufandag Winter Summer Tourism Holiday Complex, and the magnificent Shahdag Tourism Center in the Gusar region.

The climate, rich nature, material, and cultural monuments of the republic allow the development of new types of tourism. Tourism resources are promising in terms of historical, ecological, exotic, nature, sports, cultural tourism development.

65 of the 6,308 historical and cultural monuments protected by the state in Azerbaijan are of global significance, 2,034 are of national importance, while the rest are of local significance. In total 3 sites

from Azerbaijan were included in the UNESCO World Heritage List. These are Icheri Sheher (together with the Palace of The Shirvanshahs and Maiden Tower) included in the list in 2000 and Gobustan Rock Art included in the list in 2007. Among interesting tourist attractions are the 10 monuments of global and 27 monuments of national importance, located in the territory of Icheri sheher historical-architectural reserve.

In 2019, during the 43rd session of the UNESCO World Heritage Committee held in Baku, it was decided to include the historical center of Sheki (including the Palace of Shaki Khans) city in the UNESCO World Heritage List.

Azerbaijan's potential for various types of tourism. Supporting private initiatives to develop tourism products in the Republic of Azerbaijan, creating beneficial coordination at local and regional levels, focusing on consumer demand, strengthening regional and thematic goals in product development, and linking interesting and attractive products are among important considerations. Generally, Azerbaijan has a potential for numerous types of tourism.

Cultural tourism. Art galleries operating in Baku city, national music - mugham, developed jazz music tradition, national and foreign dances, rich and delicious cuisine, a tolerant approach to all different religious and secular views can be cited as examples of the country's cultural tourism capacity. As part of cultural tourism, historical itineraries (for example, the Great Silk Road, famous military campaigns, historical battlefields, etc.) can also be found in various areas. Historical and cultural tourist routes with additional features that meet the tastes of tourists are better accepted in the world, and therefore can be regarded as a potential tourist product for the Republic of Azerbaijan.

Health tourism. There are both traditional and modern treatment options in Azerbaijan. There are thousands of hot and mineral springs in the country, and among them Istisu, Turshsu, Badamli, Galaalti, Shikhburnu, Surakhani are the most well-known. Naftalan oil is also one of the most important resort resources in Azerbaijan. Naftalan oil is used to treat rheumatism, vascular, motor, metabolic, skin and gynecological diseases. At the same time, the Nakhchivan Autonomous Republic is very famous for its unique salt mountain.

Alpine tourism and winter tourism. Mountain and winter tourisms are among promising areas in Azerbaijan. Therefore, there are possibilities for using tourism in the mountainous areas of the Republic of Azerbaijan. These areas mostly attract special groups of tourists, including those who love nature, watch birds and wildlife, enjoy physical activity and exciting sports. As a result of targeted steps implemented to develop mountain and winter tourism in the country, the slopes of the mountains were developed to become tourist destinations. In other words, currently, the recreation areas such as Shahdag Tourism Center CJSC and Tufandag Winter-Summer Tourism Holiday Complex have become popular recreation centers.

Sports tourism. Generally, it should be noted that sport is one of the rapid growing areas in Azerbaijan. Large investments have been made for the development of sports infrastructure in the recent years. In other words, the commissioning of Olympic complexes and centers in Baku, Masalli, Shaki, Guba, Gazakh, Ganja, Nakhchivan, Barda, Lankaran, Zagatala, Shamakhi, Aghdam, Bilasuvar, Oghuz, Shamkir, Kurdamir, Sabirabad and other cities and regions and the creation of various sports grounds and institutions allows the country to host prestigious sports competitions (European and world championships). International competitions of wrestling, gymnastics, boxing, volleyball, etc. can be cited as examples.

Business tourism Business tourism is one of the most widespread types of tourism in our country. Currently, the capacity of hotels is used in order to develop this type of tourism in the country. However, conference centers and cultural centers located in different cities of the country can be widely used for the organization of such events.

Coastal tourism Starting from the Absheron Peninsula, the northern (Khizi, Siyazan, Shabran, Khachmaz regions) and southern (Lankaran, Astara districts) zones of the Republic of Azerbaijan have the capacity of coastal tourism, and to achieve the development of this tourism sector, the service infrastructure (e.g. basins pools, pools) in the coastal areas needs to be brought up to relevant standards, and the offer of additional services (e.g. entertainment centers, amusement rides) should be expanded.

Ecological tourism Azerbaijan has a huge ecotourism capacity evidenced by its rich flora and fauna. The territory of Azerbaijan is home to more than 4,100 different plant species. The diversity of plants in Azerbaijan reflects the deep traces of the history of nature. This is also due to the concentration of several floristic regions and the differences in current natural conditions. At the same time, 10 percent of Azerbaijan is covered by mountain forests, consisting mainly of oak, hornbeam, peanut, maple, and ash trees. These opportunities allow us to organize trips and excursions to the open nature (mountains, rivers, forests). In 2019, the number of tourists entering the area of national parks was 98,837, and it is 12,840 more compared to 2018.

Events related to sports, adventure tourism, amateur fishing, cycling and hiking, running marathons, bird watching are held in the national parks starting from November 2018.

Hunting tourism In Azerbaijan, licensed hunters are allowed to hunt many forest animals and wild birds. Wintering grounds for waterfowls can be found in Aghjabadi, Astara, Jalilabad (excluding the Girmizi Kand hunting farm), Beylagan, Imishli (excluding the Sarisu and Bozgobu hunting farms), Lankaran (excluding the Havzava hunting farm), Masalli, Bilasuvar (excluding Mahmudchala and Zavvar hunting farms) Lake Jeyranbatan and other eater reservoirs of the Absheron Peninsula, and Mingachevir reservoir. Hunting for mountain goats and other forest animals is possible in the hunting farms of Guba, Ismailli and Shaki regions on the basis of special permits.

In 2019, Azerbaijan hosted 3.17 million visitors (guests, foreign citizens), and it is 11.3% more than the previous year.

29.4% of those who came to our country were Russian citizens, 22.9% were from Georgia, 10.0% from Turkey, 8.1%- from Iran, 3.4% from Saudi Arabia, 2.2% from the United Arab Emirates, 2.1% from India, 1.9% from the Ukraine, 3.2% from Turkmenistan and Iraq (1.6% from each), 4.5% from Kazakhstan, Pakistan and Israel (1.5% from each), 1.2% from the United Kingdom, 11.0% from other countries, and 0.1% of theme were stateless persons.

In 2019, 2971.4 million AZN (or 1748 million USD) were spent in Azerbaijan by foreigners and stateless persons who visited Azerbaijan for tourism purposes.

Steady increase was recorded in the volume of the added value created in the field of tourist accommodation and public catering, and in 2019 this indicator was equal to 6.4%. The growth rate was 2.1% in 2016, 6.9% in 2017 and 7.6% in 2018.

In 2019, the creation of added value in the field of catering and tourist accommodation amounted to 1976.7 million AZN (or 1163 million USD). The specific weight of this field, which is part of the tourism sector, in the economy was 2.4%.

In 2019, a total of 59.3 million AZN was invested in fixed assets in the field of tourist accommodation and catering and 0.3% of the total funds invested in fixed assets in the country fell to the share of this area. Investment in this area comes from domestic sources only. In 2015-2018, a total of 914.7 million AZN was invested in fixed assets in the field of tourist accommodation and public catering. 65.8% or 602.2 million AZN of the investment were allocated for the provision of services in accommodation facilities and 34.2% or 312.5 million AZN for rendering public catering services.

1.6.5. Retail trade and sale of personal services

In 2019, the volume of goods sold to people through country's retail network increased by 3.6 percent as compared to 2018 and amounted to 39,391.7 million AZN. 21.0% of consumer goods were sold in trading enterprises, 52.0% in trading entities owned by individual entrepreneurs, and 27.0% in markets and fairs. In 2019, each consumer purchased an average of 331.4 AZN worth goods per month from the retail network, which is 16.6 AZN more compared to 2018.

The amount of non-food products sold in the retail network increased by 4.0% compared to the same period in 2018 and amounted to 19,424.3 million AZN. The share of food, beverages and tobacco products in the total volume of retail trade turnover amounted to 19,967.4 million AZN and exceeded the level of the corresponding period of 2018 by 3.2 percent in real terms. In 2019, each consumer purchased on average 168.0 AZN worth food products, beverages, and tobacco products per month in retail trade enterprises for individual consumption, and 163.4 AZN worth non-food products.

Catering services. In 2019, the population was provided with catering services worth 1,655.2 million AZN, or 6.7 percent more in real terms compared to the same period last year. 42.3% of public catering turnover in the private sector fell to the share of legal entities, and 57.7% of individual entrepreneurs engaged in entrepreneurial activities in this field. In 2019, catering turnover in enterprises with legal entity status increased by 6.4 percent compared to 2018 and amounted to AZN 694.4 million.

Paid services. In 2019, the value of paid services rendered to the population increased by 3.1 percent in real terms compared to the same period of the previous year and amounted to 9,607.3 million AZN. Legal entities rendered services to the population in the amount of 6,953.9 million AZN and it accounts for 72.4% of total services. Each resident of the country used various kinds of paid services for an average of 970.0 AZN, which in nominal terms is 40.1 AZN more than last year.

1.6.6. Capital investments

In 2019, investments in fixed assets amounted to 17184.3 million. AZN, in other words decreased by 2.3% compared to the previous year. This decrease was due to a decrease in investment in the oil and gas sector. In 2019, the amount of funds allocated for the non-oil sector increased by 1.9%, and the funds allocated for the non-oil industry by 23% compared to the previous year.

69.8% of investments in fixed assets was formed from domestic resources, and 5489.5 million AZN (31.9%) of it was allocated to the oil sector. Investment flows in fixed assets by foreign enterprises and organizations continued in 2019. The amount of investments in fixed assets from foreign sources amounted to 5.2 billion AZN, which is 30.2% of total investments in fixed assets. Most of the funds invested in the fixed capital by foreign countries and international organizations belong to investors from the United Kingdom, Luxembourg, Turkey, Russia, Iran, the United States, Japan, Malaysia, Switzerland, Norway, and France.

In 2019, 68.1% or 11694.8 million AZN of total investments in fixed assets in the economy was allocated to the non-oil sector. 26.8% or 3139.2 million AZN of investments in the non-oil sector was used for the development of the non-oil industry.

The funds invested in fixed capital includes the funds of enterprises and organizations amounting to 8942.6 million AZN (1.0% increase), bank loans in the amount of 2061.8 million AZN (4.0% increase), budget funds in the amount of 4857.2 million AZN (6.4% increase), extra budgetary state resources in the amount of 207.6 million AZN (27.3% decrease), personal funds of the population in the amount of 980.9 million AZN (33.1% decrease) and other funds in the amount of 134.2 million AZN.

1.6.7. Forestry management

Azerbaijan is one of the countries with low forest cover. The total area of the State Forest Fund is 1,213,700 hectares. 1,036,270 hectares of this are covered by forests, and accounts for 12.0% of the country's territory. The Forest Fund includes forests of mountainous and lowland areas.

Most of our forests (85%) are located on the Greater Caucasus, Lesser Caucasus and the Talysh Mountains. Although the forested area in Azerbaijan is small compared to its total area, the forests of this country are well known for the abundance of species. The various and complex terrain of the areas has led to the formation of a rich and colorful diversity of species along with the forest trees and shrubs reaching the altitudes of 2000-2200 meters above sea level. From this point of view, there are over 435 species of trees and shrubs in the forests of the Republic. About 70 of them are endemic and grow naturally only in Azerbaijan.

The forest resources of the country belong to the first-group forests and are divided into the following categories in terms of protection:

1. reserve forests
2. recreation forests
3. most valuable forest areas
4. greenbelts in cities and around other settlements
5. wild fruit forests
6. state protective forest strips
7. other forests.

Forest Fund is managed by the Forestry Development Department of the Ministry of Environment and Natural Resources. The service ensures protection of the forest ecosystem on the territory of the state forest fund, reforestation and afforestation, cultivation of planting material, supply of seeds of forest tree and shrub species, creation and maintenance of the state forest cadaster of the forest fund, and other forestry activities, as well as targeted and effective management of secondary agricultural lands and alternate land use.

It ensures that the forestry measures are implemented to protect the soil protecting, water conservation, ecological purification, sanitation and other useful functions of forests, takes steps for the protecting natural systems and objects of scientific, cultural and recreational value, biodiversity, and the fauna species found in the forest fund, maintaining and increasing the gene pool during forest sowing activities. Work is also in progress in order to prevent erosion and degradation in forest areas.

The sources of forest fires, pests and diseases in the territories of the forest fund are identified, and regular monitoring is conducted to prevent their spread and protect forests.

Work has been implemented for site landscaping, vegetation restoration and planting on non-forest lands, including around highways, especially in arid areas, and new large-scale agroforestry (thousands of hectares) has been created in the recent years.

The gas supply policy pursued in the country plays an important role in terms of expansion and protection of forests. Thus, due to the gas supply measures, the use of firewood was minimized, which, in turn, contributed to the protection of forests This factor plays an important role in reducing pressure on forests and thus in increasing forest areas.

Azerbaijan is one of the few countries that has managed to prevent deforestation and increase the area of forested areas. Afforestation activities have increased many times, and millions of trees have been planted over the last 15 years. Because of the intensity of afforestation, the forested area of the country increased from 11.4% to 12%. Thousands of hectares of forested area were planted in Azerbaijan as part of urgent measures following the adoption of the Paris Climate Agreement.

The creation of modern agro-forestry areas, in its turn, contributes to the diversification of the national economy and reduces carbon emissions. Currently, the rich forests of Azerbaijan are managed only for conservation purposes and are not used for industrial purposes. Nevertheless, they represent untapped potential in terms of production, including carbon sequestration.

Currently, cameras are installed in the forests of Azerbaijan to protect forest areas from fires, strengthen control of entrances and exits, and effectively protect forests using the best global and national practices.

In 2019, reforestation measures were implemented on 14,000 hectares, including forest planting on 580.5 hectares, forest sowing on 199.0 hectares and regeneration by planting on 107.0 hectares. Service work was performed on 60.4 thousand hectares, irrigation works were carried out on 61.7 thousand hectares, and land preparation works were carried out on 1288 hectares for the purpose of forest planting and forest gardening.

1 million 764 thousand fruitful and evergreen trees were planted as part of the measures to establish agro-forest massifs made of orchards through more efficient use of forest and non-forest lands. In total, in 2019, more than 1 million 310 thousand different types of planting material were provided to legal entities and individuals on a pro-bono basis. 650,000 trees were planted on the occasion of the 650th anniversary of poet and thinker Imadeddin Nasimi on December 6, 2019, at the initiative of First Vice President of Azerbaijan.

Agricultural gardens were created in an area of 642 hectares over the reporting period in order to meet people’s demand in agricultural products.

By a resolution adopted at the 43rd session of the UNESCO World Heritage Committee held in Baku, the Hirkan forests of the Islamic Republic of Iran were included in the World Natural Heritage List, and the Republic of Azerbaijan was invited to join the nomination file as per paragraph 9 of this Resolution. In this connection, a joint working group was established to prepare a relevant nomination for the inclusion of Hirkan forests in the UNESCO World Natural Heritage List.

The representatives of the general public in all regions of the country, state and government agencies, diplomatic corps, executive authorities, NGOs and young volunteers joined this noble initiative aimed at popularizing the world-class poetry of the great poet in the international arena, perpetuating his memory, and promoting the literary and cultural heritage of Azerbaijan. In total, more than 200 organizations took part in the tree planting campaign.

Measures of group planting will also contribute to the global initiatives our country has joined. Thus, 650,000 trees that were planted will lead to the absorption and reduction of carbon emissions. It will also make a significant contribution to the reduction of climate change effects and the improvement of the environmental situation.

Moreover, tree planting and landscaping in all of our regions will contribute to the Bonn Challenge for the restoration of the forest landscape in degraded lands. It should be noted that Azerbaijan has joined the Bonn Challenge and our country aims to restore 270,000 hectares of degraded land and forests by 2030.

Desertification is also a very pressing issue for Azerbaijan, which is located in an arid climate. Therefore, taking into account the improvement of the ecological situation in the country, the efficient use of natural resources, and national interests, Azerbaijan has joined the UN Convention to Combat Desertification and global initiatives to achieve land degradation neutrality.

	2000	2005	2010	2015	2016	2017	2018	2019
Total area of the country, thousand ha	8660.0	8660.0	8660.0	8660.0	8660.0	8660.0	8660.0	8660.0
Forest-covered fields, thousand ha	1037.4	1037.8	1040.7	1040.3	1040.3	1040.3	1040.2	1040.3
their share in the territory of the country, in percentage	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Total area of the land in the country, thousand ha	8260.5	8265.9	8265.5	8265.5	8267.0	8266.2	8265.4	8265.4
Total timber reserves, million cubic meters	133.0	139.0	144.2	151.9	153.4	154.8	156.5	157.4

Table 1-16. The main indicators of the forest fund[15]

1.6.8. Waste management

As a result of effective use of the economic potential of the Republic of Azerbaijan, protection of the environment and ecological balance, development of Greater Baku on the basis of modern urban planning principles, as well as improvement of public utilities in the country, especially solid waste management system, favorable conditions have been created for the construction of waste collection, transportation, disposal, and disposal in a way that meets modern standards.

Landfills for the collection, disposal, and neutralization of hazardous (including radioactive) wastes were created with the involvement of international investment as part of the National Program on Environmentally Sustainable Socio-economic Development, Comprehensive Action Plan for Improving Environmental Situation in the Republic of Azerbaijan in 2006-2010, 2011-2013 State Program on Socio-Economic Development of Baku City and its Settlements approved by relevant decrees and orders of the President of the Republic of Azerbaijan and strategic roadmaps for the national economy and key sectors of the economy.

A Solid Waste Incineration Plant with a production capacity of 500,000 tons was constructed in Balakhani settlement in order to neutralize the waste collected in Baku city. This plant is one of the largest of its type in Eastern Europe and the CIS for its production capacity and was built in accordance with the strictest EU standards in the field of environmental protection with the application of fourth-generation technology (4G). Waste incineration at the Baku Solid Waste Incineration Plant generates 231.5 million kWh of electricity annually, and a part of the generated electricity is transferred to the state grid to meet domestic demand.

Open Joint Stock Company "Tamiz Shahar", established in 2008 for the effective management of solid waste generated in Baku reconstructed the Balakhani landfill to neutralize solid waste, which creates serious environmental issues in the capital, as a result, the factors causing a threat to the environment were eliminated by way of removal, the sites for waste collection and storage were expanded, internal roads were upgraded, and landscaping work was implemented.

Moreover, in order to recycle municipal solid waste, the Balakhani Solid Waste Sorting Plant, built on the basis of advanced German technology and with an annual capacity of 200,000 tons, was put into operation. Separation of ferrous and non-ferrous metal, glass, recyclable paper, plastics, and other raw materials, allowed to reduce the total amount of waste, to establish an additional raw material market and recycling in the country and, most importantly, to minimize the negative impact of waste on the environment.

In 2011-2014, studies were conducted to improve the system of solid waste collection and disposal in Baku as a part of the Integrated Solid Waste Management project implemented by the Government of Azerbaijan jointly with the World Bank.

[15] https://www.stat.gov.az/source/environment/

In addition to the above-stated, the Balakhani Industrial Park was founded in 2012 and put into operation in 2017 in order to develop solid waste recycling. The main purpose for establishing this park is to provide favorable conditions for potential entrepreneurs and investors interested in the field of recycling. Favorable tax incentives and infrastructure was created for potential entrepreneurs in order to increase the interest in green business, especially in the recycling industry.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Amount of production and consumption wastes	2287.6	2281.5	2789.6	3096.7	2575.6	2386	2421.2	3019.7	2754.5	2896.1	3276.5
per capita, kg	256	252	304	333	274	250	251	309	283	295	331
Amount of used, neutralized production and consumption wastes	503.1	476.1	572.3	665.0	537.2	497.3	771.2	796.6	767.3	848.3	712.8
	56	53	62	72	57	52	80	82	79	85	72

Table 1-17. Waste generation, use, and disposal (thousand tons)[16]

Considering that close cooperation with several countries and international organizations to improve hazardous waste management, develop the system in accordance with international requirements and strengthen control over waste management is a major issue, Azerbaijan has been a member of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal since 2001, and the Ministry of Ecology and Natural Resources is the competent body of the Republic of Azerbaijan to promote the implementation of the Convention.

Over these years, the designated authority has implemented a number of activities related to the implementation of the commitments arising from the requirements of the Convention. In other words, the legal framework related to hazardous waste was improved and new legislative acts came into force to meet the requirements of the Convention.

İt is necessary to take measures for effective waste management in order to minimize the negative impact of plastic packaging waste on the environment. Over the recent years, the country has implemented a lot of target-oriented work in this area, including achieving the goals of environmental protection, efficient use of natural resources, waste utilization, recycling, reuse, and the introduction of low-waste or non-waste technologies.

According to the State Statistics Committee of the Republic of Azerbaijan, in 2017 the volume of plastic packaging products produced in the country increased by about 2.5 times compared to 2010. Moreover, compared to 2009, in 2017 the country imported 5 times more plastic packaging. Experts estimate that the country generates an average of 24 kg of plastic waste per capita annually.

National Strategy for Improving Solid Waste Management in the Republic of Azerbaijan in 2018-2022 was approved, and areas of activity for improving solid waste management in the country were identified under the Decree dated November 1, 2018 of the President of the Republic of Azerbaijan.

Currently, the state policy in the field of waste management is subject to the Law, no. 514-IQ, dated June 30, 1998, on Industrial and Household Waste of the Republic of Azerbaijan in order to prevent the harmful effects of industrial and household wastes on the environment, to ensure environmental balance, and to use such wastes as recyclables. However, the annual increase in the volume of plastic packaging waste makes it necessary to improve the legal framework to strengthen governance in this area, taking into account international experience, and to establish accounting, reporting and monitoring systems, and appropriate economic mechanisms.

[16] https://www.stat.gov.az/source/environment/

2019-2020 Action Plan for reducing the negative impact of plastic packaging waste on the environment in the Republic of Azerbaijan was approved by Decree no. 935 dated February 7, 2019 of the President of the Republic of Azerbaijan.

The Action Plan was developed in accordance with the Strategic Road Map for Production and Processing of Agricultural Products in the Republic of Azerbaijan, approved by Decree No. 1138 of December 6, 2016, of the President of the Republic of Azerbaijan and based on the assessment of the negative impact of the mass use of plastic packaging products on plants, animals, land and water resources in order to implement measures aimed at reducing pollution in this area.

The Action Plan covers the strategic vision until 2020, the long-term vision for the period up to 2025, and the targeted vision beyond 2015. It provides for the implementation of large-scale measures to achieve efficient management and a high level of service.

The main goal is to create an improved environment, legal framework, and advanced management system in the management of special waste streams, including plastic packaging waste, reduce the environmental impact by using modern technology, apply innovative technologies in waste management and achieve broad private sector participation.

It is necessary to carry out significant improvements in the utilization and recycling of consumer waste, expand the use of alternative packaging, and, as a result, significantly reduce the negative impact on the environment as part of long-term goals for the management of plastic packaging waste.

Introduction of the extended producer responsibility model, the production of packaging products with less impact on the environment through efficient use of resources, and ultimately efficient collection of the generated waste, eco-friendly neutralization of the collected waste and enhanced recycling efficiency and the application of know-how for each component of the sector are envisaged in order to ensure efficient operation along the entire value chain from production to recycling in the consumer waste management sector in the Republic of Azerbaijan after 2025.

Currently, the global practices in handling plastic packaging waste, including the organization of sorting, collection, transportation, and recycling processes, are being studied and based on these practices the options that are acceptable for our country are analyzed and applied.

Special containers were placed in different regions of the country for the selective sorting and collection of plastic packaging waste at the initiative of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan. More than 250 containers are put into use in densely populated areas of 37 cities and regions, including Baku, Sumgait, and Ganja.

Picture 1-1. Containers for the collection of plastic packaging waste

Waste collected in containers is periodically transported and recycled by recycling companies. Thus, along with preventing the release of plastic waste into the environment, it also stimulates the development of the economy in this sector.

For the same purpose, another initiative was implemented as a part of the joint project by the Ministry of Ecology and Natural Resources, ADA University, and Coca-Cola. Special containers placed within the framework of the My Clean Country pilot project can be found in parks, residential areas, universities, and other public places. Moreover, the plastic containers collected in this place are sent for recycling.

Picture 1-2. Containers for the collection of plastic packaging waste

The executive power of Baku city implements the concept of organizing the collection, transportation, and sorting of solid waste at the most modern level. Work in this field is implemented together with the well-known British company Mott MacDonald, and new and modern containers are installed at landfills in each neighborhood of Narimanov district of Baku city within the framework of a pilot project.

These containers are available in two colors - green and orange. Paper, cardboard, glass, metal, and plastic waste should be thrown in the orange container and other waste in the green container. This work serves to keeping our city clean, protecting the environment and our health, establishing a new ecological sanitary and hygiene, and achieving economic efficiency.

Picture 1-3. Containers for collecting solid domestic waste

It is planned to amend the legislation for the prohibition of the import and production of polyethylene bags up to 15 microns from January 1, 2021 and import, production, sale, and granting to commercial, catering and other service facilities of disposable plastic mixing sticks, forks, spoons, knives, plates and cups by entrepreneurs and for the provision of 15-50 micron polyethylene bags to buyers in markets as a separate product (paid) in the territory of the country from July 1, 2021.

Assessments are conducted together with international experts to introduce the producer responsibility model, which is considered a platform for recycling. The draft Law of the Republic of Azerbaijan on the Circulation of Packaging and Packaging Waste includes the principles of Extended Producer Responsibility.

International experience in the use of alternative packaging is studied and the introduction of various economic incentives for manufacturers of such products is under consideration.

One of the implemented extensive measures is the call to limit the use of plastic bags in markets. As a result of these measures, most markets began selling biodegradable paper and cloth bags made of environmentally friendly material.

The interest of the private sector in alternative packaging has increased after the adoption of the Action Plan. Several new enterprises have already started operating. Paper bags are also produced by private individuals with the support of the National Fund for Entrepreneurship Support.

CHAPTER 2. NATIONAL GHGs INVENTORY AND EMISSION TRENDS

2.1. Total emissions by sectors

Inventory was carried out under I (1990-1994 years), II (1995-2005 years) and III (2006-2012 years) National Communications (NC) of the country before preparation of First Biennial Update Report under the UN Framework Convention on Climate Change.

GHG emissions data of the country for 1990-2005 years was recalculated in First Biennial Update Report and the GHG inventory was carried out as for 2006-2010 years. Updated 1996 IPCC methodology and NAIIS software recommended by the UN Framework Convention on Climate Change were used during inventory process.

Second Biennial Update report considered GHG inventory for 2011-2013 years in accordance with 2006 IPCC methodology. The present report covers 2014-2016 GHG calculations, and recalculation of GHG for 1990-200 in all sectors in line with 2006 IPCC methodology. Total emissions calculated within the report are shown in the following table.

In the second biennial report, the inventory of GHG for 2011-2013 was conducted in accordance with the 2006 IPCC Rules. The current report covers the assessment of GHG for 2014-2016 and the recalculation of GHG for all sectors for 1990-2010 in accordance with the 2006 IPCC Rules of Procedure. The total emissions calculated within the report are given in the table below.

Sector	GHG emissions and removals (Gg CO_2 eq.)										
	1990	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Energy	74134	47222	40360	40915	41000	43196	44622	45817	46788	47650	48128
SMPI	1505	481	452	1868	1977	2212	3277	3192	3265	3676	3137
AFOLU	6264	3799	5370	6469	7243	8237	8375	8449	8582	8647	8666
Waste (RH)	772	846	917	1004	1155	1180	1228	1287	1315	1332	1326
Total emission	**82675**	**52348**	**47099**	**50256**	**51375**	**54825**	**57502**	**58746**	**59949**	**61306**	**61257**
Removals	-3690	-2456	-4870	-5349	-5410	-5773	-6082	-6335	-7044	-7119	-7224
Net emission	**78985**	**49892**	**42229**	**44907**	**45965**	**49052**	**51420**	**52411**	**52905**	**54187**	**54033**

Table 2-1. GHG emissions and removals by sectors

In 1991-1999, there was a significant decrease in GHG emissions, which can be explained with a sudden breakdown in economic relations between the countries of the Soviet Union, formed over 70 years, paralyzed production, deepening inflation due to rapidly changing price index, i.e., by the occurred crisis. From 1991 to 1994, the Gross Domestic Product (GDP) in the country's economy decreased by an average of 16.5 percent annually. The declining trend was particularly sharp in industry, with industrial production falling by 10 percent in 1991, 37 percent in 1992, and 50 percent in 1993 compared to 1985.

On September 20, 1994, one of the most important agreements in the history of Azerbaijan in the twentieth century for its political, economic, and strategic importance – the Agreement on joint development and production sharing for the Azeri, Chirag and Gunashli fields in the Azerbaijani sector of the Caspian Sea was signed. In December 1999, Azerbaijan's first tanker filled with 'profit oil' was delivered to world markets. The development of the oil industry has also had a significant impact on the development of the non-oil sector. As a result, in 2009-2010, the Republic of Azerbaijan became the leading country in the CIS in terms of GDP growth. Since these years, a large inflow of investments has been directed to the non-oil sector, including the agricultural sector and waste management. The increase in emissions in the energy sector after 2010 is explained by the increase in electricity and heat production, oil, and gas production.

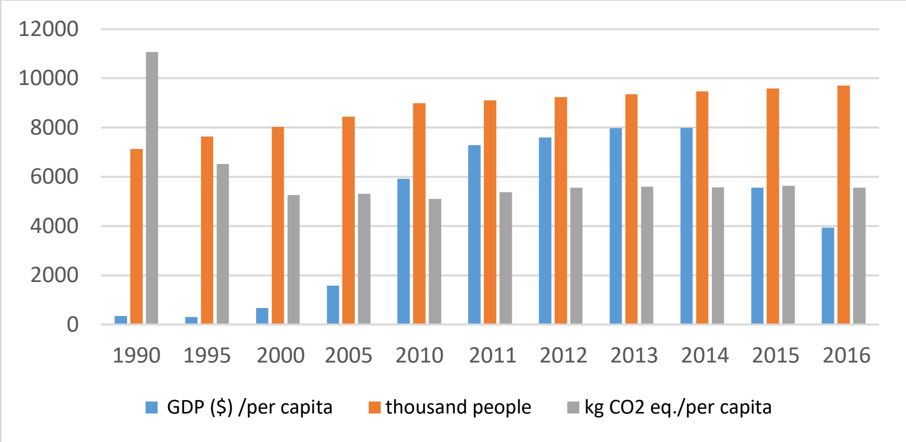


Chart 2-1. Dynamics of GDP and GHG per capita in Azerbaijan compared to population growth

It is to note that the chart shows GDP per capita in dollar equivalent. As of February 21, 2014, the manat rate was stable against the dollar and the euro. Although until February 21, 1 manat was 1.28 dollars, on the same day the Central Bank decided to reduce the exchange rate to 0.95 dollars and after a while, it stabilized at the level of 0.59 dollars. This is the third largest reduction of the manat exchange rate after a sudden depreciation in 1994-1995 and 1999.

The greenhouse gas emissions estimated for the Fourth National Data for 1990-2010 have been recalculated in accordance with the recommendations of the 2006 IPCC methodology in order to follow TACCC principles. Total net emission in the country makes 68% from 1990 base year level. Thuswise, total net emissions level has decreased by 31.7%, while removals have increased by 2 times.

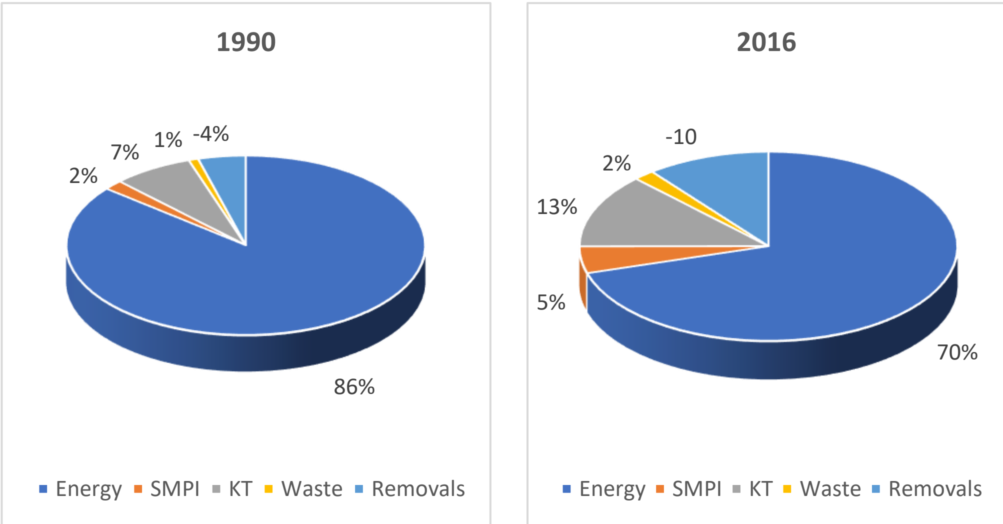


Chart 2-2. Dynamics of greenhouse gas emissions by sector (in %)

Emissions from the energy sector decreased compared to the base year and in 2016 amounted to approximately 65% of the base year or reduced by 35%.

On the contrary, emissions from industrial enterprises increased by 108%. The increase in production processes is explained by the development of new production facilities, including the opening of new plants to produce cement and methanol to ensure the sustainable development of our country.

Emissions from the agricultural sector increased by 38%. The growth in agriculture is explained by the increase in production of agricultural and processing products competitive in both domestic and foreign markets.

The 71.8% increase in the waste sector is explained by the increase in methane emissions from the decomposition process as a result of open dumping, and an analysis of population growth (0.8% per year) showed that a significant increase in the amount of waste in the country is expected.

2.1.1. Energy sector

Reference and Sectoral approaches were applied in the calculation of emissions from Energy Sector, in accordance with 2006 IPCC GHG Inventory Guidelines. This report, for the first time, includes the difference between Reference and Sectoral approaches in percentage and presents detailed information about that difference. In addition, with support from State Oil Company of The Republic of Azerbaijan, emission source database was established to calculate emissions from oil and gas industry. This report covers all emission categories shown in 2006 IPCC methodology, for the calculation of fugitive emissions in oil and gas industry. Emissions of energy sector are mainly composed of CO_2, CH_4 and N_2O gases. These gases are usually obtained from combustion of fossil fuels, as well as loses during oil-gas production, storage, refinery, delivery, and distribution processes.

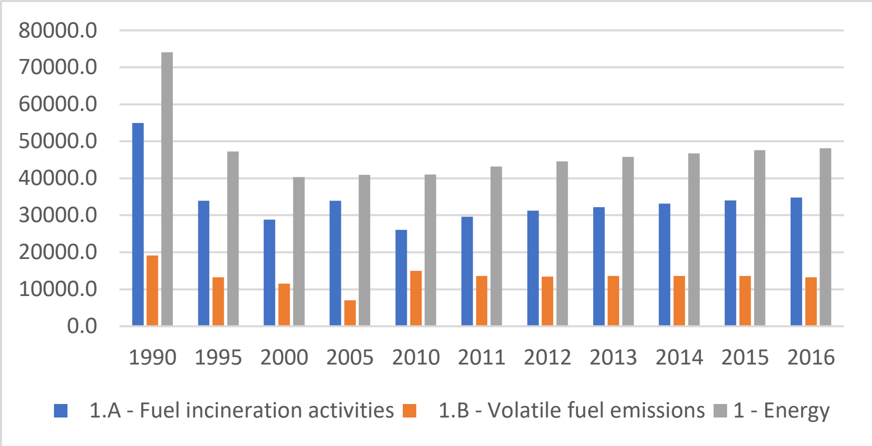


Chart 2-3. Distribution of emissions in the energy sector (kt CO_2 equivalent)

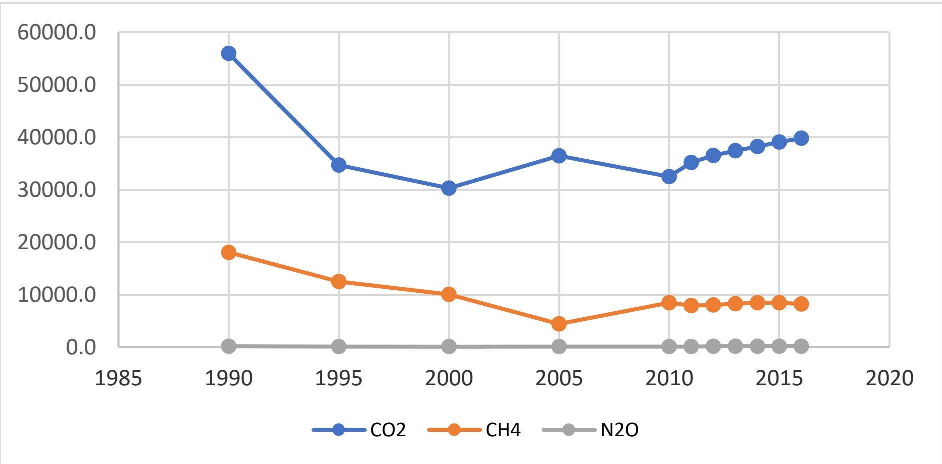


Chart 2-4. Major GHG emissions from the energy sector (kt CO_2 equivalent)

To note that in order to increase the productivity of oil fields, more and more associated gas is required to be used in the gas lift system every year, which increases gas losses.

2.1.1.1. Emissions from fuel combustion (1.A)

In accordance with 2006 IPCC methodology, emissions released during combustion processes are mainly composed of CO_2 gas. However, small amount of CH_4 and N_20 gas emissions might be released due to uncomplete combustion depending on technological processes. Tier 1 approach and default emission factors (EFs) for developing countries were used in the calculations.

1.A	Coal	Liquid fuel	Fuel gas	SMW	Biomass
1990	NE	272673.84	613274	NO	NE
1995	NE	237491.19	282301.01	NO	NE
2000	NE	226803.028	204736.27	NO	NE
2005	NE	185691.711	354257.842	NO	NE
2010	NE	114586.2	318858.6	NO	NE
2011	210.2	123977.773	366310.583	NO	4043.7
2012	154.9	133505.489	383204.618	NO	4117.2
2013	138.3	142076.907	386148.7	2104.2	3885.6
2014	85.8	142946.1	400643.154	2628	3388
2015	124.5	148639.868	406362.382	3036.6	3030.7
2016	49.8	156171.269	411069.528	2773.2	1284.1

Table 2-2. Quantity of fuels combusted due to energy sector activity (TJ, by type)

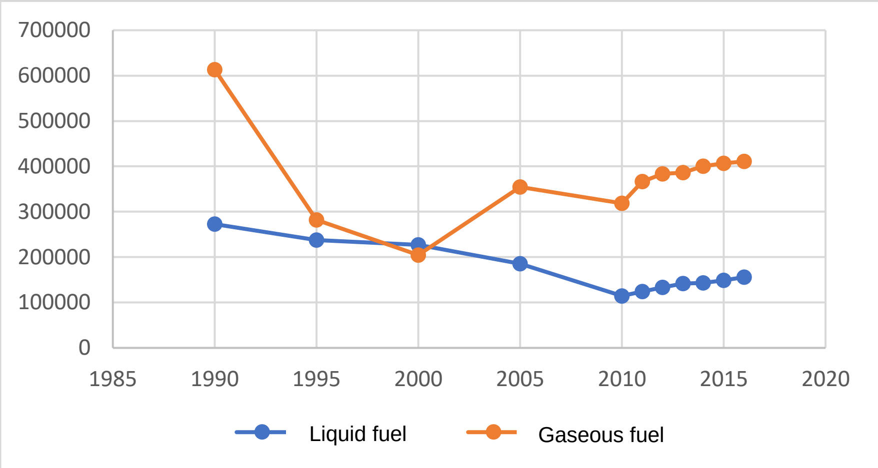


Chart 2-5. Dynamics of liquid and gaseous fuel use in the energy sector (in TJ)

As shown in the diagram, economy of Azerbaijan mainly based on natural gas, consumption of which is considered to be the most environmentally friendly than other fossil fuel, contributing to Sustainable Development Goals. In recent years, there has been a slight increase in the use of liquid fuels, but the share of liquid fuels remains at 27%.

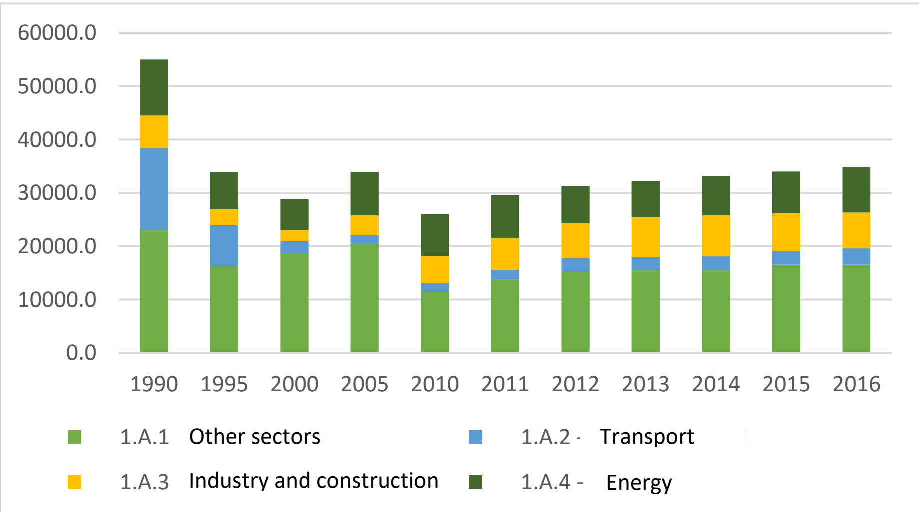


Chart 2-6. Amount of emissions from combustion processes by main categories (kt CO_2 equivalent)

As can be seen from the chart, there is a significant reduction in the use of Category 1.A.2 fuel compared to 1990, a process that has occurred due to the replacement of energy-intensive technologies in industry with new energy-efficient technologies. Furthermore, it is to note that despite population growth, there was a significant decline in per capita emissions from the residential sector in 1990, due to the transition from stove fuel and fuel oil to natural gas. It is to note that Category 1.A.4 includes emissions from fuel burned for energy purposes in the commercial and institutional, residential, agricultural/forestry/fisheries sectors.

Energy industry (1.A.1)

In accordance with 2006 IPCC Guidelines, **1.A.1 – Energy industry** category consists of three sub-categories. Annual information obtained from State Statistics Committee on the amount of fuel consumed for production of electric and heat was used to calculate the emissions from **1.A.1.a – Main activity consumption of electric and thermal energy, the first subcategory.** The official statistics of the SSC provide a summary of the amount of fuel burned to produce electricity and heat for 1990-2005. According to expert estimates, most of the fuel was burned at power and heating plants, so emissions fall into this sub-category. The emissions from oil refining (1.A.1.b) and other energy industries (1.A.1.c.ii) were calculated based on the information provided by SOCAR. Earlier, there were two large oil refineries in Azerbaijan: “Azerneftyag” Refinery and Heydar Aliyev Oil Refinery. However, by the order of SOCAR dated December 24, 2014, the “Azerneftyag” oil refinery was merged with the Heydar Aliyev Oil Refinery on January 1, 2015, and its activity as an independent entity was terminated. Later, the modernization and reconstruction project of the Oil Refinery was launched at the expense of state funds, and thanks to optimization measures, a decrease in emissions from the oil refining process was observed. Other energy industry categories include emissions from fuel burned to meet domestic needs at the Gas Processing Plant, “Azneft” PU, other operating companies operating in the oil and gas industry, and joint ventures.

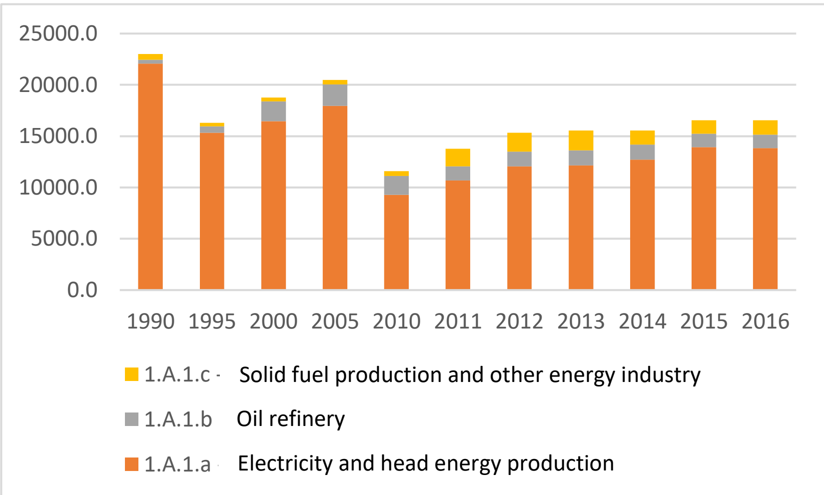


Chart 2-7. Dynamics of emissions from energy industry (kt CO_2 equivalent)

As can be seen from the chart, the major emissions are emitted into the atmosphere from power and thermal power plants, and the decrease in GHG emissions by category until 2010 is explained by the changes in the fuel types. Thus, if in 1990 more liquid fuels were used, after 2010 more natural gas was used in the production of electricity and heat. The increase observed in recent years is explained by the increase in electricity production shown in chart 2-8.

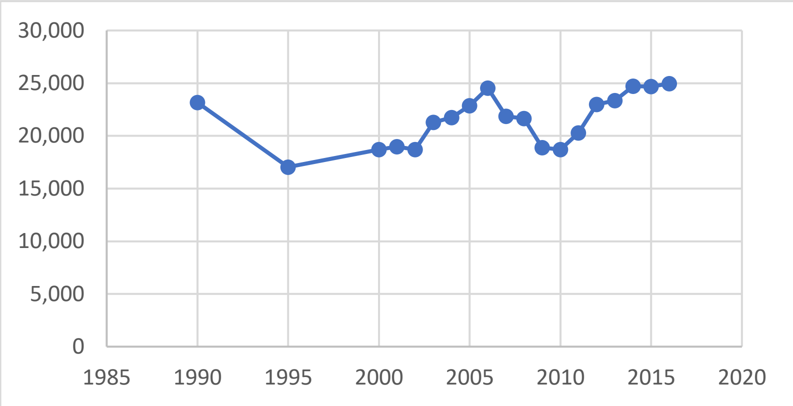


Chart 2-8. Electricity production in Azerbaijan (million kWh)

Furthermore, the foundation of the Solid Waste Incineration Plant was laid down on November 3, 2009, and inaugurated the plant on December 19, 2012. As known, electricity is generated from waste incineration there, and emissions from this process are added to the 1.A.1.a.i - Power Plants subcategory. In the calculation of emissions from the subcategory, the IPCC emission factor was used for the combustion of the generalized (default) non-biomass fraction.

Year		2013	2014	2015	2016	2017
Amount of incinerated household wastes	TJ	2104.2	2628	3036.6	2773.2	2782.2
GHG emissions from household waste incineration, in CO_2 eq.	kt	196.753	245.638	284.0331	259.453	260.253
CO_2	kt	192.95	240.9	278.4	254.3	255.1
CH_4	kt	0.,063	0.078	0.0911	0.083	0.083
N_2O	kt	0.008	0.01	0.012	0.011	0.011
Electricity produced	million kW	134.1	173.5	181.8	174.5	170.3

Table 2-3. GHG from incinerated waste in electricity generation

After 2005, emissions from sub-category 1.A.1.c have increased. This increase is explained by the increase in fuel used to meet domestic demand during oil and gas production. Due to the complexity of the oil refining process, as well as the determination of the amount of products produced on the basis of updated orders each year, it is impossible to follow the trend in the dynamics of emissions of category 1.A.1.b. Starting from 2015, modernization and reconstruction works are being carried out at the refinery. Emissions of sulfur oxides and other harmful gases into the atmosphere are expected to be sharply reduced by increasing the depth of oil refining through the newly installed technologies. The opening of new production lines may increase fuel consumption and, consequently, GHG to meet domestic demand. There is a need for additional research to assess the process, as well as to make future forecasts for GHG emissions. Within such studies, the assessment of precursors directly in combination with GHG is also considered appropriate.

Processing Industries and Construction (1.A.2)

Processing Industries and Construction (1.A.2) category consists of 13 sub-categories and covers the industrial fields shown in 2006 IPCC Guidelines. It is to note that, information obtained from State Statistics Committee was used to calculate emissions of this category. The amount of emissions from this category reduced by 85% in 2013 compared to that in 1990.

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
1.A.2 – Manufacturing Industries and Construction	15390.8	7683.5	2140.2	1586.0	1552.7	1902.7	2406.3	2423.5	2536.5	2564.9	3070.8
1.A.2.a –Iron and steel	724.3	347.8	122.6	237.2	61.8	86.1	91.2	97.0	98.8	105.1	38.8
1.A.2.b – Non-ferrous metals	1390.1	670.2	208.0	273.7	18.5	8.0	11.5	8.8	9.0	9.8	16.8
1.A.2.c – Chemicals	2128.9	1029.3	272.8	116.6	447.9	484.8	554.1	554.7	566.5	570.7	888.5
1.A.2.d – Pulp, paper and print	4.0	1.9	0.5	0.2	2.6	2.2	3.3	3.9	5.7	4.4	1.8
1.A.2.e – Food processing, beverages and tobacco	1435.9	701.9	200.7	177.0	507.8	513.2	794.7	814.5	831.1	853.4	848.7
1.A.2.f – Non-metallic minerals	6752.8	3271.0	871.8	378.6	257.8	426.3	496.7	498.8	584.7	562.3	742.5
1.A.2.g – Transport equipment	12.7	8.8	11.7	17.1	11.7	17.0	17.9	17.9	20.1	20.9	3.6
1.A.2.h – Machinery	1086.5	528.4	144.7	70.8	31.0	34.5	46.7	48.9	57.6	64.1	63.9
1.A.2.i – Mining (excluding fuels) and Quarrying	151.3	122.3	95.4	123.6	31.0	34.7	34.9	35.6	33.0	28.7	43.8
1.A.2.j – Wood and wood products	4.0	1.9	0.5	0.2	0.4	4.3	4.6	6.6	6.8	6.1	0.2
1.A.2.k – Construction	423.0	386.2	48.8	121.4	171.7	247.0	283.1	277.7	261.7	268.9	320.1
1.A.2.l – Textile and leather	74.0	31.1	8.2	3.5	9.0	8.3	12.1	10.6	10.7	15.4	28.6
1.A.2.m – Non-specified industry	1203.2	582.6	154.4	66.0	1.2	36.4	55.4	48.6	50.8	55.2	73.4

Table 2-4. GHG emission from processing and construction category (kt CO_2 eq.)

It is to note that, Category 1.A.2 estimates cover emissions from energy-burning fuels in the industrial sector, while emissions from industrial processes are calculated for the IPPU sector. There has been an increase in the emissions released from this category within last 5-6 years, for example, in 2016, 2 times in sub-categories 1.A.2.c – “Chemistry” and 1.A.2.h – “Machinery and equipment production” compared to 2010, 3 times in sub-categories 1.A.2.f - “Production of non-metallic minerals” and 1.A.2.l - “Textile, leather and clothing industry ”, and 60 times increase in other industries (This increase is explained by the development of the non-oil sector in the country’s economy. Davos World Economic Forum, the most influential economic agency of the world, ranked Azerbaijan at 35th place in the world for economic competitiveness in 2017.

Despite the rapid economic development of the country, small increase in the amount of emissions is explained by establishment of new industrial enterprises, expansion of production capacity of existing industrial enterprises through reconstruction, application of control-measurement system in technological processes.

Transport (1.A.3)

GHG emissions of Transportation category were calculated based on information obtained from State Statistics Committee. This category includes emissions from road transportation, domestic air and marine transportation, railways, and pipeline transportation. The amount of emissions emitted from transport sector in 2016 increased by 9.8%, compared to 1990.

Category/year	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
1.A.3 - Transport	6085.8	2933.2	2098.8	3724.1	5002.2	5922.3	6527.4	7425.6	7675.0	7118.0	6680.6
1.A.3.a.ii - Domestic aviation	462.6	56.1	52.9	199.3	280.0	321.7	339.4	485.5	513.8	588.0	704.1
1.A.3.b - Road transportation	5360.8	2801.9	1958.2	3383.4	4622.3	5418.8	5999.8	6762.3	6998.4	6378.4	5814.6
1.A.3.c - Railways	126.1	42.5	58.3	92.1	11.5	62.4	61.3	63.0	53.6	56.3	56.9
1.A.3.d.ii - Domestic water-borne navigation	100.8	32.7	29.4	49.3	88.2	110.5	117.2	102.2	95.8	83.2	91.7
1.A.3.e - Other transports	35.4	0.0	0.0	0.0	0.3	8.9	9.7	12.6	13.4	12.2	13.4
1.A.3.e.i - Pipeline transport	NO	NO	NO	NO	0.3	0.3	0.3	1.2	1.2	1.4	2.4
1.A.3.e.ii - Non-road transport	35.4	0.0	0.0	0.0	0.0	8.6	9.4	11.4	12.2	10.8	11.0

Table 2-5. Change in GHG emissions released from Transport sector (kt CO_2 eq.)

In recent years, emissions from road transport have been increased significantly, the reasons for such increase are studied in the following table:

Years/categories	2015	2016	2017	2018
Share of vehicles over 10 years in the total transport fleet (in %)				
passenger cars	65.6	66.64	72.39	76.56
bused	79.43	74.33	76.6	80.18
vehicles	74.13	77.49	81.52	86.39
Total GHG emissions (thousand t CO_2 equivalent)	**6378.5**	**5814.7**	**6515.2**	**6656.7**
from diesel-powered vehicles	2364.77	1987.08	2531.21	2660.6
from gasoline-powered vehicles	3939.71	3784.162	3944.23	3921.9
from LPG powered vehicles	64.5	23.42	19.91	53.5
from CNG powered vehicles	8.98	20.1	20.1	20.1

Table 2-6. Statistical information on the vehicle fleet

It is to note that official statistics do not provide information on the use of CNG (compressed natural gas). Information related to the CNG sales obtained from SOCAR Petroleum CJSC on the basis of an official request was used for the calculations.

It is to note that that of the more than 1,402,000 vehicles currently in operation, 35% are 10 years, 23% are 20 years, and 19.1% are more than 30 years old. The car fleet wear and tear occur continuously in the country. In order to reduce the harmful effects of the transport sector on the atmosphere, it may be effective to renew the country’s car fleet, as well as apply various fiscal (tax, customs) incentives and appropriate subsidies to promote the use of environmentally friendly vehicles.

In order to improve the environmental situation in the country, as well as to stimulate local car production, the Ministry of Economy is preparing a vehicle utilization program to remove obsolete, technically unsafe and environmentally unfit vehicles from circulation.

The data provided in the annual statistical bulletin for the road transport sub-category do not fully meet the requirements of the 2006 IPCC Guidelines. Thus, for example, depending on the type of vehicle (i.e., cars, trucks, light trucks, buses, and motorcycles), information on the amount of fuel refilled during the year for each type of transport (separately for diesel, gasoline and LPG) is not available.

According to the Ministry of Transport, Communications and High Technologies, due to the low fuel prices in the Republic of Azerbaijan and the introduction of a visa-free regime for citizens of neighboring countries, the citizens of neighboring countries living in the border zone use filling stations that are located in Azerbaijan and are relatively cheap. This increases emissions from vehicles in the country.

The amount of emissions from domestic air transport and international flights was calculated on the basis of data provided in the SSC's annual statistical collection "Energy of Azerbaijan".

Railway transport is considered as one of the efficient types of transportation from the ecological point in the world. The advantage of railway transportation to other means of transportation is the wide use of traction which excludes pollution of ambient air and the areas adjacent to railroad. Electric traction is used in more than 90% of cargo, while 95% of passenger transportation in The Republic of Azerbaijan.

The information obtained from Azerbaijan Railways Closed Joint Stock Company was used in the calculation of emissions from railway transportation.

Other sectors (1.A.4.)

GHG emissions from "Other sectors category" were calculated based on the information provided by State Statistics Committee. This category covers commercial and public services, households, agriculture, forestry, and fish industry. Amount of emissions from this category increased by 18.9% in 2016 in comparison with 1990. This increase can be explained by increase in population and living standards, with household emissions accounting for 14.7% of the energy sector.

Category/year	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
1.A.4 – Other sectors	**10502.4**	**7038.1**	**5868.2**	**8156.8**	**7904.9**	**7990.3**	**6957.9**	**6827.2**	**7383.2**	**7776.5**	**8518.6**
1.A.4.a – Commercial /Public services	1581.9	247.9	1191.2	388.1	307.7	297.7	386.8	420.6	459.7	521.1	418.5
1.A.4.b – Households	5639.7	5666.5	4146.3	6999.9	6530.3	6581.7	5430.3	5227.8	5790.8	6144.6	7064.6
1.A.4.c – Agriculture /Forestry/Fishery/Fish farms	3280.8	1123.7	530.7	768.8	1066.9	1110.9	1140.8	1178.8	1132.7	1110.8	1035.5
1.A.4.c.i – Stationary combustion	2945.6	1102.5	509.7	731.5	1030.2	1076.8	1107.4	1145.3	1101.1	1078.9	997.7
1.A.4.c.ii – Off-road vehicles and other machinery	303.9	18.1	21.0	24.1	33.1	33.4	33.1	33.1	31.3	31.0	33.1
1.A.4.c.iii – Fishery (mobile combustion)	31.3	3.2	0.0	13.2	3.6	0.7	0.3	0.3	0.3	1.0	4.6

Table 2-7. GHG emissions from "Other Sectors" category (kt CO2 eq.)

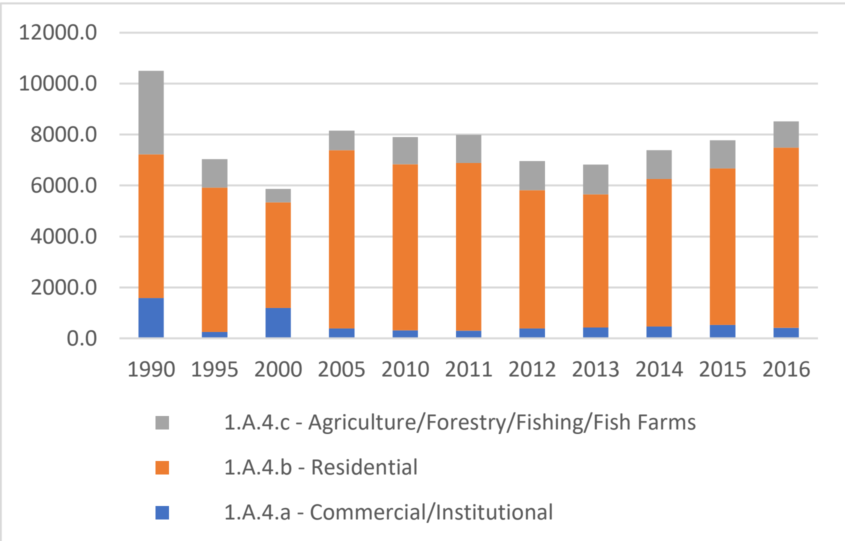


Chart 2-9. GHG emissions from "Other Sectors" category (kt CO2 eq.)

2.1.1.2. Fugitive emissions (1.B.)

Oil and natural gas (1.B.2)

Unlike some countries, oil and gas in Azerbaijan are extracted both onshore and offshore. Industrial oil extraction onshore was started in 1847, while offshore extraction began about a hundred years later, in

1949. At all times, about 80% of oil produced in Azerbaijan have been extracted from offshore oil and gas fields.

Years	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Onshore	2925	1866	1705	2013	2072	1988	1910	1910	1904	1797	1718
Offshore	11134	8427	14045	22947	55002	49278	46826	46918	45372	45167	44339

Table 2-8. Oil production in Azerbaijan (1990-2016) (in thousand m^3)

The year of 1994 was a turning point for Azerbaijan's oil industry. A historic agreement called the "Contract of the Century" was signed, and joint development of the deepwater Azeri-Chirag-Guneshli (ACG) oil field in the Azerbaijani sector of the Caspian Sea and the production sharing among 11 largest oil companies worldwide was started.

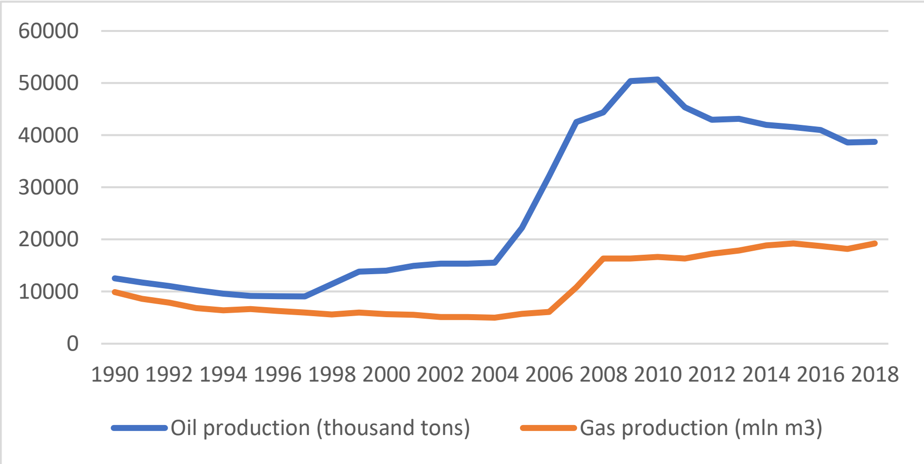
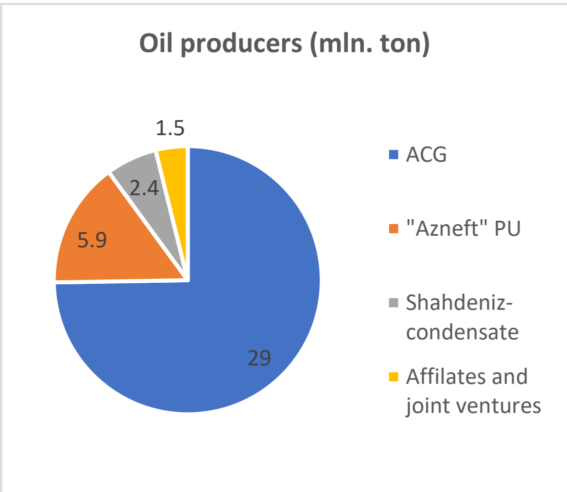


Chart 2-10. Dynamics of hydrocarbon production in Azerbaijan

It is to note that as of 01.01.2017, 81 oil and gas fields have been discovered in the territory of the Republic of Azerbaijan. At present, hydrocarbons are extracted from 61 fields, and 20 fields have not been developed or stopped for some reason.

As officially stated by SOCAR, 38 of the operated fields are oil fields, 7 are oil and gas fields, 14 are oil and gas condensate fields and 2 are gas fields. 42 of the operated fields are onshore (15 fields are operated by "Azneft" PU, 27 fields are operated by Affiliates and operating companies), and 19 fields are offshore (including 13 are operated by "Azneft" PU, 6 fields by Affiliates and operating companies).



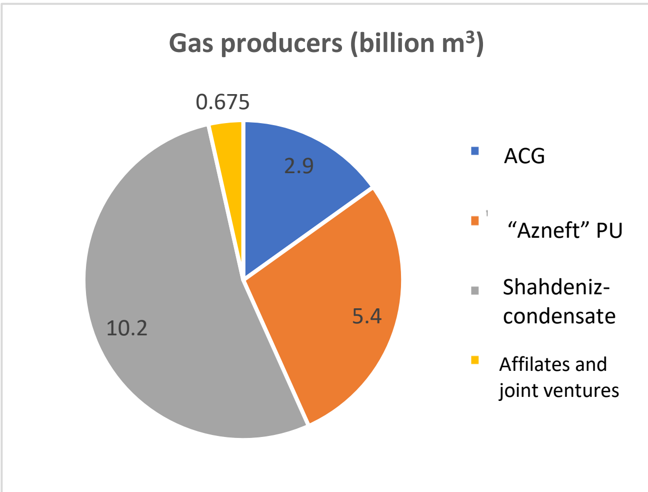


Chart 2-11. Sources of oil and gas production in 2017

It is to note that ACG and ShahDeniz are offshore oil and gas fields, and the main operator of these fields is BP Exploration (Caspian) Limited.

1.B.2.a.iii.2 - For emissions from the oil produced under the BP-operated sub-category “Oil and Gas Production and Preliminary Preparation”, the Tear 1 related emission factors for developed countries provided in the IPCC methodology were used.

Fugitive emissions from “Oil and natural gas” category for 1990-2016 years were calculated in accordance with requirements shown in 2006 IPCC Guidelines. Calculations were carried out based on information obtained from SOCAR and BP Azerbaijan. This report includes calculation of CO_2, CH_4, N_2O and non-methane volatile organic compounds emissions from 1.B.2 “Oil and Natural Gas” category.

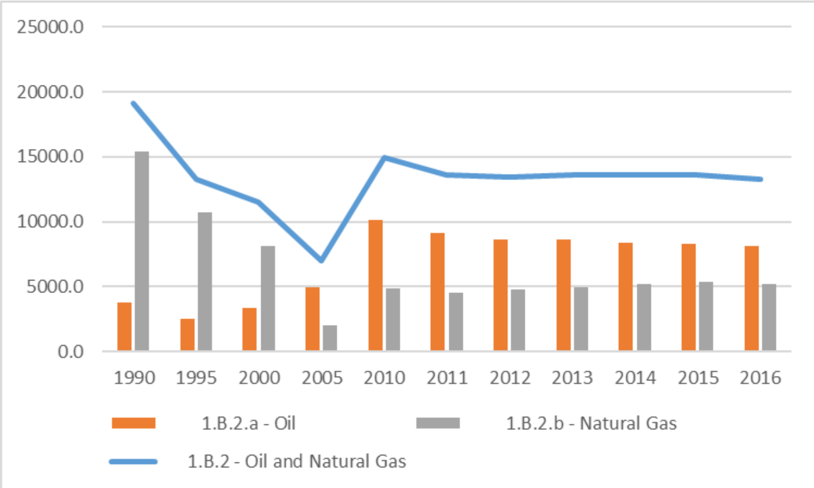


Chart 2-12. Fugitive emissions from “Oil and natural gas” category (in kt)

In 2016, the share of 1.B Category emissions in the energy sector was 27%, and in total emissions (excluding removals) was 21%. The Tier 1 approach was used to calculate emissions for this sector. Undoubtedly, this category is one of the main categories in the GHG inventory, where the main source of emissions is methane gas, which is released directly into the atmosphere during the production, transportation and distribution of oil and natural gas. It is to note that in recent years, BP Azerbaijan and SOCAR have taken important steps to reduce methane emissions, but it is impossible to assess the impact of these measures due to the lack of an effective MRV (MRV) system by category. There is need for additional studies to move to higher tiers (Tier 2 or Tier 3) for the calculation of emissions in this category. Due to the above-mentioned difficulties, there are serious uncertainties between the GHG inventory results in the current report and the information presented in the mitigation section.

The 2002 “Fuel-Energy and Material Resources Balance of Azerbaijan” statistical collection was used to estimate fugitive emissions for 1990-2000.

	1990	1995	1999	2000	2001
Natural gas losses	913	639	565.3	477.3	512.4

Table 2-9. Losses in main gas pipelines and electric networks (in mln. m^3)

According to the data obtained from chromatographic analysis, the share of methane and carbon dioxide in untreated natural gas is 93.5% and 3.5-4%, respectively, and the share of methane gas in processed natural gas is 98%.

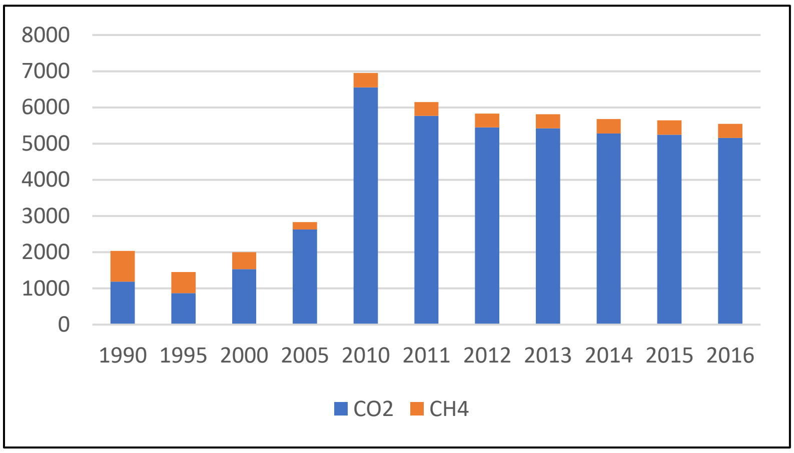


Chart 2-13. Main GHG emissions released in the "Oil and Natural Gas" category (kt)

The diagram shows that the amount of methane emissions in 2016 more than doubled compared to 1990, as various methods were used in the calculation of emissions from oil and gas production, gas transportation and distribution for 1990-2001 and 2001-2016. The volume of oil and gas production, as well as the volume of transportation and distribution of natural gas were used to calculate methane emissions for 2001-2016, in accordance with the Tier 1 approach used in the calculation of methane emissions.

NMVOC emissions calculated for the oil and gas industry were used for the first time to estimate the NMVOC amount emitted into the atmosphere from the oil and gas industry.

		1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Category	subcategory											
well drilling	1.B.2.a.ii or 1.B.2.b.ii	0.112	0.082	0.125	0.198	0.453	0.407	0.387	0.387	0.375	1.221	0.366
well start-up	1.B.2.a.ii or 1.B.2.b.ii	1.490	1.091	1.669	2.646	6.050	5.434	5.166	5.176	5.011	4.978	4.887
well operation	1.B.2.a.ii or 1.B.2.b.ii	2.088	1.529	2.339	3.706	8.475	7.613	7.237	7.251	7.021	6.974	6.847
gas production	1.B.2.b.iii.2	6.431	4.302	3.642	3.700	16.984	16.607	17.297	18.878	19.078	18.832	18.933
gas production	1.B.2.b.ii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
gas processing	1.B.2.b.iii.3	1.497	0.908	0.959	1.015	1.495	1.485	1.457	1.376	1.334	1.242	1.095
gas processing	1.B.2.b.ii	0.005	0.003	0.003	0.003	0.005	0.005	0.005	0.004	0.004	0.004	0.003
gas transportation and storage	1.B.2.b.iiI.4	0.114	0.076	0.065	0.066	0.192	0.188	0.198	0.206	0.217	0.221	0.215
gas transportation and storage	1.B.2.b.i	0.077	0.052	0.044	0.045	0.130	0.128	0.134	0.140	0.147	0.150	0.146
gas transportation and storage	1.B.2.b.iii.4	0.006	0.004	0.003	0.003	0.010	0.010	0.010	0.011	0.011	0.011	0.011
gas distribution	1.B.2.b.iii.5	0.464	0.229	0.155	0.247	0.243	0.086	0.094	0.100	0.117	0.122	0.133
NGL transportation	1.B.2.a.iii.3	0.632	0.266	NE	NE	NE	NE	NE	NE	NE	NE	NE
NGL transportation	1.B.2.a.iii.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
oil production	1.B.2.a.iii.2	110.101	69.988	63.920	75.483	77.686	74.538	71.631	71.631	71.420	67.405	64.426
oil production	1.B.2.a.iii.2	0.008	0.006	0.010	0.017	0.041	0.036	0.035	0.035	0.034	0.033	0.033
oil production	1.B.2.a.i	7.170	5.250	0.869	1.027	1.057	1.014	0.974	0.974	0.971	0.917	0.876
oil production	1.B.2.a.ii	NO	NO	0.295	0.482	1.155	1.035	0.983	0.985	0.953	0.949	0.932
oil transport	1.B.2.a.iii.3	0.759	0.556	0.850	1.348	3.082	2.768	2.632	2.637	2.553	2.536	2.490
oil transport	1.B.2.a.i	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total NMVOC (thousand tons)		**130.954**	**84.340**	**74.949**	**89.987**	**117.057**	**111.353**	**108.240**	**109.790**	**109.245**	**105.596**	**101.394**

Table 2-10. NMVOC emissions from oil and natural gas industry (kt)

2.1.1.3. Analysis of base and sectoral approaches

The amount of greenhouse gasses for 1990-2016 was calculated on the basis of the "Base Approach" and "Sectoral Approach" methods for all fuels produced and used in the energy sector in the country, as well as taking into account import-export operations and changes in reserves. Data from the Azerbaijan State Statistics Committee were used to assess the "baseline approach". The carbon content and oxidation coefficients of fuels in the calculations were taken from the 2006 IPCC Guidelines.

Indicators	1990	1995	2000	2005	2010
Base approach	57138.79	37484.27	32065.58	35839.05	29209.25
Sectoral approach	54748.16	33823.62	28747.44	33782.24	25911.82
Difference (in %)	**4.37**	**10.82**	**11.54**	**6.09**	**12.73**

Indicators	2011	2012	2013	2014	2015	2016
Base approach	31311.26	32931.76	33596.47	35457.63	36236.78	36516.26
Sectoral approach	29388.5	31017.69	32002.7	32917.42	33803.35	34631.34
Difference (in %)	**6.54**	**6.17**	**4.98**	**7.72**	**7.2**	**5.44**

Table 2-11. Comparative characteristics of CO2 in the basic and sectoral approach, Gg

The base approach is the calculation of CO2 emissions from fuel combustion as per data on the country's energy supply. The sectoral approach is understood as the calculation of GHG emissions as per actual fuel consumption data depending on the type of fuel and economic sector. The difference between the base and sectoral approaches is due to the following reasons:

- failure to take into account in the SSC report the fuel burned by special equipment in agriculture, road repair and airport by year;
- The SSC report does not take into account the amount of fuel oil used for non-energy purposes;
- Failure to provide timely information to the SSC about fuel used in small-scale private enterprises operating in the industrial sector.

However, it can be seen from Table 2-11 that the introduction of new methodology has enabled to reduce the gap between the base and sectoral approaches.

2.1.1.4. International Bunker

Emissions from International bunker were calculated based on the fuel quantity filled in the tanks for international travels. It is to note that, diesel fuel was used for ships, while reactive fuel was used for planes. Emissions as for 1990-2007 years were calculated jointly with the SSC.

Category/year	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
International bunkers	**1296.5**	**317.8**	**459.0**	**1222.4**	**1455.5**	**1571.0**	**1431.6**	**1436.3**	**1315.0**	**984.9**	**699.9**
1.A.3.a.i – International aviation	1058.8	308.3	305.2	1124.2	1221.1	1322.9	1155.7	1181.8	1079.7	825.3	545.6
1.A.3.d.i - International water-borne navigation	237.7	9.5	153.8	98.2	234.4	248.1	275.9	254.5	235.4	159.7	154.2

Table 2-12. GHG emissions from international bunker (kt CO_2 eq)

2.1.2. Industrial processes and product use

This Section, Industrial Processes and Products Use, covers greenhouse gas emissions released from industrial processes, use of products, use of carbon in flammable natural resources for non-energy purposes. This section also includes revised GHG inventory for "Solvents and Other products use" sector, based on IPCC 1996 Guideline.

Greenhouse gas emissions are released during various industrial processes. Emission sources are usually formed during chemical and physical transformations in industrial processes (such as furnace melting operation in iron and steel industry, production of ammonia or other chemical products from natural resources used as chemical raw material, and cement industry are examples of industrial processes releasing significant amount of CO_2). Carbon gases (CO_2), methane (CH_4), nitrogen 1 oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC) are released during these processes.

In addition, greenhouse gases are widely used in refrigerators, foams, and aerosol boxes. For example, HFC's are used as alternatives of ozone-depletion substance in different kinds of products. As such, sulfur hexafluoride (SF_6) and N_2O are mainly used in some products (SF_6 power equipment or N_2O gas removal substance for aerosol products in food industry) utilized in industry or by end-users (SF_6 in jogging shoes, while N_2O during anesthesia).

In any case, one of the main features of product use is presence of enough time between product production and release of greenhouse gas emissions. As in rigid foams (such as from aerosol boxes) the delay might vary from several weeks up to several decades. Some part of greenhouse gas emissions are used for products in some applications (such as, cooling) and are recovered at the end of product operation or re-processed and destroyed. In addition, some fluoric greenhouse emissions might be used in special processes, such as production of semi-conductors:

- Nitrogen trifluoride (NF_3);
- Trifluoromethylesulfur pentafluoride (SF5CF3);
- Halogen ethers (such as, $C_4F_9OC_2H_5$, $CHF_2OCF_2OC_2F_4OCHF_2$, $CHF_2OCF_2OCHF_2$), halocarbons including CF3I, CH_2Br_2, $CHCl_3$, CH_3Cl, CH_2Cl not covered under Montreal Protocol.

Several methods might be applied for halocarbons not regulated under Montreal Protocol.

Industrial processes and use of products are on the second place after energy production sector in IPCC methodology. Main factors of Greenhouse Gas Emissions Calculation are availability of necessary data and emission factors. Such data is usually obtained from State Statistics Committee. In addition, other data providers include ministries, governmental agencies, international associations, private and state companies and other relevant bodies. Emission factors are taken from IPCC methodology. If the country has its national coefficient for any emission, IPCC recommends to use that coefficient.

This report has prepared GHG inventory in the "Industrial processes and product use" sector in the Republic of Azerbaijan for 1990-2016.

Direct gases (CO_2, CH_4, N_2O) as well as fluorocarbons (CF_4, C_2F_6) were assessed in the inventory. The emission values were converted to the equivalent CO_2 amount according to the IPCC methodology and the total amounts were calculated for each year. Information on the amount of substances produced and consumed, respectively, was collected for the assessment. This information was obtained from the State Statistics Committee, the Ministry of Energy and the Ministry of Economy, as well as relevant companies and enterprises.

The general results of the inventory are given in the following tables.

Source	1990	1995	2000	2005	2010
2A. Production of mineral products	424,36	84,69	104,99	643,77	532,63
2B. Chemical industry	192,98	71,56	92,62	126,40	127,18
2C. Metal industry	868,39	87,31	0,27	304,49	325,80
2D. Non-Energy Products from Fuels and Solvent Use	19,45	24,76	28,89	25,89	18,10
2F. Product Uses as Substitutes for Ozone Depleting Substances	0	212,68	224,99	767,43	972,87
Total for IPPU	**1505,18**	**481,00**	**451,76**	**1867,98**	**1976,58**

Table 2-13. Total emissions from IPPU sector, kt CO_2-eq.

Source	2011	2012	2013	2014	2015	2016
2A. Production of mineral products	466,77	669,49	729,76	601,64	997,95	687,35
2B. Chemical industry	179,35	159,89	181,42	325,30	360,78	331,40
2C. Metal industry	509,82	1336,80	1111,53	1138,55	1094,35	891,92
2D. Non-Energy Products from Fuels and Solvent Use	24,70	24,76	26,35	27,53	27,23	18,33
2F. Product Uses as Substitutes for Ozone Depleting Substances	1031,42	1086,09	1143,22	1171,92	1195,95	1206,66
Total for IPPU	**2212,06**	**3278,27**	**3192,28**	**3264,94**	**3676,26**	**3135,66**

Table 2-13 (continued). Total emissions from IPPU sector, kt CO_2-eq.

The amount of Greenhouse gas emissions from Industrial Processes in 1990 base year was equal to 1447 kt CO_2 equivalent. Previous IPCC (1996) methodology for this sector included following categories:

1. Cement production;
2. Lime production;
3. Cast iron and steel production;
4. Aluminum production;
5. Chemical-petrochemical industry.

At that time, only CF_4 and C_2F_6 gases from aluminum production were known. Also, in the “Ethylene Production” subcategory, only CH_4 emissions were estimated in the IPCC (1996) methodology, CO_2 gas was not included. Since the amount of CH_4 emission was very low, it was not included into the table. In addition, the categories of “Lubricant production” and “Alternate products and permanent cooling systems” were included into Industrial processes and Product use sector.

GHG emissions from IPPU sector for 1990-2016

Recently, industrial sector of Azerbaijan has started developing rapidly. A wide range of products has been and is being used in industry. Obviously, industrial development causes increase of greenhouse gas emissions from technological processes. Calculation of greenhouse gas emissions for 1990-2016 years in Industrial Processes and Product Use sector has been reviewed.

2.1.2.1. Emissions from the production of mineral products (2.A.)

This category includes the following subcategories:

- 2A1. Cement production;
- 2A2. Lime production;
- 2A3. Glass production;
- 2A4. Other processes uses of carbonates;
- 2A5. Others.

First three of above-mentioned processes exist in the country. The greenhouse gas emissions from such processes were studied and assessed.

Due to reconstruction of glass production in Azerbaijan since 2010, the production of tempered shatter-proof glass has been started as of 2013. The lack of information on tempered shatter-proof glass in the available methodology has made it difficult to select the emission factor. As additional study is necessary for selection of the emission factor, the emission from his subcategory is not included in the report.

Source	1990	1995	2000	2005	2010
2A1. Cement production	411,84	81,49	104,29	639,77	531,98
2A2. Lime production	3,30	2,25	0,13	3,68	0,65
2A3. Glass production	9,22	0,95	0,56	0,32	0
Total	424,36	84,69	104,99	643,77	532,63

Table 2-14. GHG emissions from mineral raw materials, thousand t

Source	2011	2012	2013	2014	2015	2016
2A1. Cement production	465,09	658,06	721,76	591,08	984,93	666,80
2A2. Lime production	1,68	11,43	8,00	10,56	13,02	20,55
2A3. Glass production	0	0	0	0	0	0
Total	466,77	669,49	729,76	601,64	997,95	687,35

Table 2-14 (continued). GHG emissions from mineral raw materials, thousand t

2A1. Cement production

The largest emission source in the category of mineral production is the cement production. This process causes CO_2 emissions, and it is emitted from clinker production. Data on cement production in the country per year is shown in the reports of State Statistics Committee. Information on the amount of produced clinker would eliminate uncertainty during calculation. Because some part of cement produced in the country are formed from imported clinker.

Cement plants operating in the country operate with “dry method” technology. The advantage of this modern technology in cement production is that the product is of high quality, there is no need for water in the grinding of raw materials compared to the wet method, and almost twice as little fuel is used. In addition, this method provides a sharp reduction in the amount of gases and dust from furnace, which in turn increases furnace efficiency. Modern dust filters are installed along production line.

2012 can be considered as the starting point of new era for cement industry in Azerbaijan.

In 2012, reconstruction of the Soviet-era Garadagh Cement Plant was completed. This factory meets modern requirements and is supplied with equipment made in USA, Germany, Italy, Switzerland, and other developed countries. Old four furnaces working by “wet method” were replaced with one furnace lining, working by “dry method”. Thus, the volume of cement production increased by 30 percent from 1.3 million tons to 1.7 million tons per year, and clinker production from 0.86 million tons to 1.2 million tons.

On May 30, 2012, a cement plant was put into operation in Kangarli district, Nakhchivan Autonomous Republic. All types of raw materials and additives used in the plant, including limestone, iron clay, quartz, and gypsum are provided from the mines in Kangarli, Sharur and Babek districts of the Autonomous Republic. The production capacity of the Plant is 800 tons/day of cement and 1300 tons/day of clinker.

In 2013, the Gazakh cement plant put into operation clinker production lines with production capacity of 1 million tons/year of cement and in 2014, and 2,500 tons/day of klinker.

The Norm cement factory has been operating since 2014. The factory’s production capacity is 2 million tons/year and 5000t/day of cement. This cement factory is the largest factory involved in cement production not only in Azerbaijan, but also in South Caucasus. The enterprise has the capacity to increase its production capacity to 4 million tons.

IPCC general coefficients and information on annual clinker production were used to calculate CO_2 amount released to atmosphere from cement production. Selection of coefficient was carried out based on % share of CaO substance (more than 65%) in the composition of raw material. CO_2 emission released from cement production was calculated in accordance with annual production data and composition related coefficient (chart 2-14).

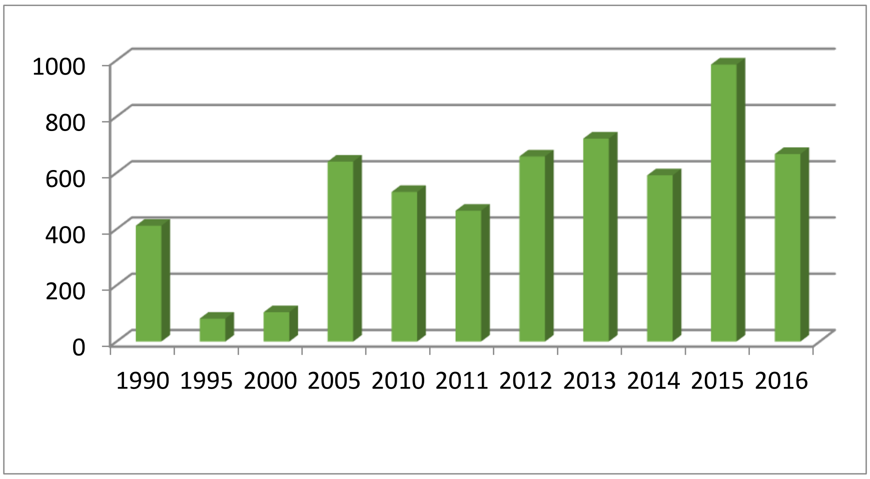


Chart 2-14. CO_2 emissions from cement production A2. Lime production

Lime production was one of the most developed fields in the country until 1990's. At present, lime production is developing as fast as other industries.

Officially inaugurated on December 26, 2011, by President of Azerbaijan, "AAC" Modern Building Materials Plant produces 100 tons of burnt and 120 tons of slaked lime per day. Burnt and slaked lime is produced with "Wehrhahn" advanced technology. The quality of raw materials and finished products is fully controlled by laboratory equipped with modern German equipment. This ensures the production and quality of the product in accordance with modern standards.

Lime production area of "Carbonate-1" Limited Liability Company with production capacity of 20 tons per day was put into operation in Atbulag village of Hajigabul in 2008.

The construction of lime plant with annual production capacity of 50,000 tons has been completed by "Matanat A" in Dash Salahli village, Gazakh district. The new plant is equipped with high technology.

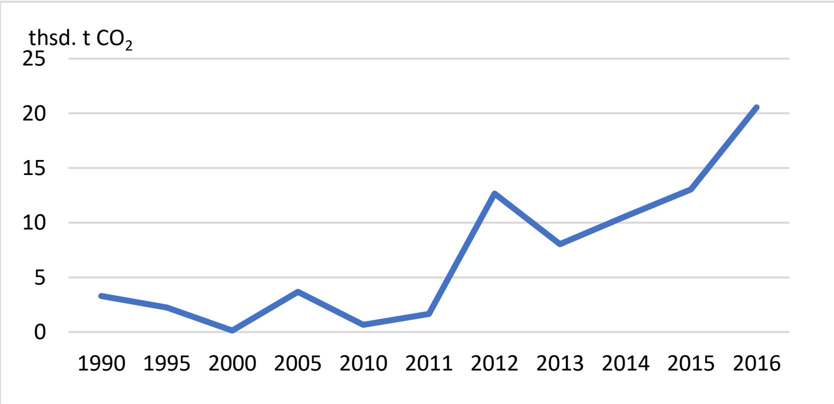


Chart 2-15. CO_2 emissions from lime production

As can be seen from the chart, lime production has increased in recent years.

2A3. Glass production

In order to develop glass production in Azerbaijan, the construction of plant for the production of 8 million square meters of glass panels per year based on German technology continues in Sumgait Chemical Industrial Park.

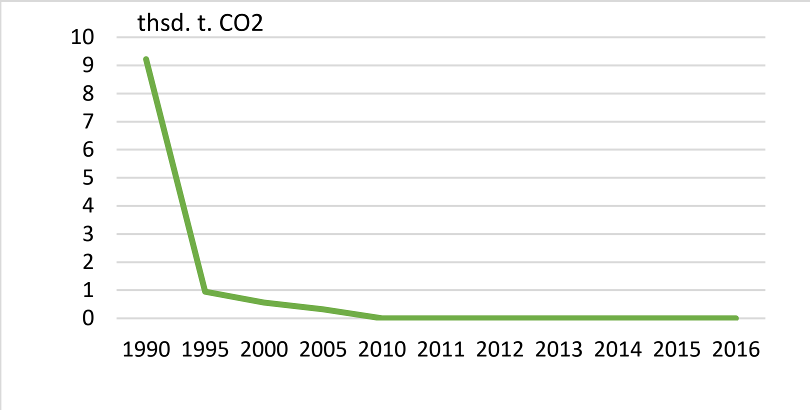


Chart 2-16. CO_2 emissions form glass production

2.1.2.2. Emissions from chemical industry (2.B)

The Emissions released from chemical industry to the atmosphere are caused by:

- 2B1. Ammonia production;
- 2B2. Nitric acid production;
- 2B3. Adipic acid production;
- 2B4. Caprolactam, glyoxal and glyoxylic acid production;
- 2B5. Carbide production;
- 2B6. Titanium dioxide production;
- 2B7. Soda ash production;
- 2B8. Petrochemical and carbon black production;
- 2B9. Fluorochemical Production.

The chemical industry in Azerbaijan, being part of the former Soviet Union, has undergone enormous development. After the collapse of Soviet Union, chemical industry declined. In order to develop the chemical industry, in accordance with the Order of the President of the Republic of Azerbaijan “On improving the management mechanisms in the petrochemical industry” dated April 2, 2010, “Azerikimya” State Company was transferred to SOCAR.

After “Azerikimya” was transferred to SOCAR, multiple measures were taken to provide production with stable raw materials, improve the quality of products and increase production, new modern type nitrogen-oxygen complex, water cooling unit, absolute isopropyl alcohol production unit, unit for purification of propane-propylene fraction from sulfur compounds and unit of hydrogenation of butane-butylene fraction were constructed and put into operation. As a result, for the first time during the operation period, the company produced 103,000 tons of polyethylene.

In order to ensure the required quantity and quality of ethylene, propylene and hydrogen to the Polypropylene (PP) and High Density Polyethylene (HDPE) plants being constructed as part of the “SOCAR Polymer” project, the modernization and reconstruction of existing productions, as well as construction of new production facilities and auxiliary productions have been started at “Ethylene-Polyethylene” Plant of “Azerkimya” PU.

Large-scale reconstruction works have been started by the Italian company “TECHNIP”. In order to increase the productivity of the high-density hydrogen production unit and propylene production, it is planned to increase the production of both propylene and ethylene by replacing obsolete equipment with more modern equipment in the course of the modernization works along with the construction of propane-propylene fraction treatment plant and EP-300 production control center.

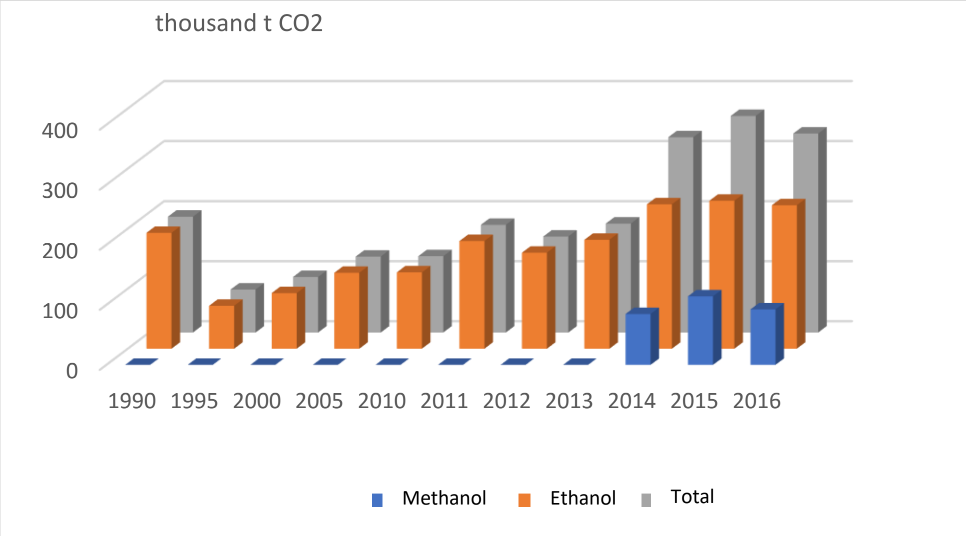


Chart 2-17. Emissions from chemical industry

2B8. Petrochemical and carbon black production

2B8a. Methanol production

The only methanol plant in the Caucasus, located in the Garadagh district of Baku, was put into operation in 2013 and is the first gas-chemical production facility in the country. The plant uses low-pressure methanol production technology from the British company ICI, which is considered the world's leading technology. The management of the plant has been taken over by SOCAR Methanol LLC, a subsidiary of SOCAR, since November 2016. Natural gas, which is the main raw material in the production process, is supplied by SOCAR. The location of the plant in the Garadagh region plays an exceptional role in the transportation of products to European and Asian markets. The annual production capacity is 650-700 thousand tons.

Emission	2014	2015	2016
Carbon dioxide (CO_2)	79,06	106,53	86,22
Methane (CH_4)	0,27	0,37	0,30
Total CO_2-equivalent	**84,73**	**114,3**	**92,52**

Table 2-15. Amount of methanol emissions, thousand t

2B8b. Ethylene production

In addition to ethylene, which is the main product, other valuable products, including propylene, butadiene and aromatic hydrocarbons, are produced from petrochemical raw materials In the oil-cracking process at the Ethylene-Polyethylene Plant of "Azerkimya" PU. Although other products are obtained from the steam-cracking process, the total emissions are calculated based on the amount of ethylene produced, which is the main product. Based on IPCC (2006) methodology, CO_2 and CH_4 emissions are released to the atmosphere from ethylene production.

Below, the amount of CO_2 and CH_4 emissions from ethylene production is indicated in thousand t.CO_2-eq.

Emission	1990	1995	2000	2005	2010
Carbon dioxide (CO_2)	187,72	69,61	90,10	122,96	123,71
Methane (CH_4)	0,25	0,09	0,12	0,16	0,17
Total CO_2-eq.	**192,98**	**71,56**	**92,62**	**126,40**	**127,18**

Table 2-16. Emissions from ethylene production, thousand t.

Emission	2011	2012	2013	2014	2015	2016
Carbon dioxide (CO_2)	174,47	155,54	176,48	233,99	239,86	232,46
Methane (CH_4)	0,23	0,21	0,24	0,31	0,32	0,31
Total CO_2-eq.	**179,35**	**159,89**	**181,42**	**240,54**	**246,57**	**238,97**

Table 2-16 (continued). Emissions from ethylene production, thousand t.

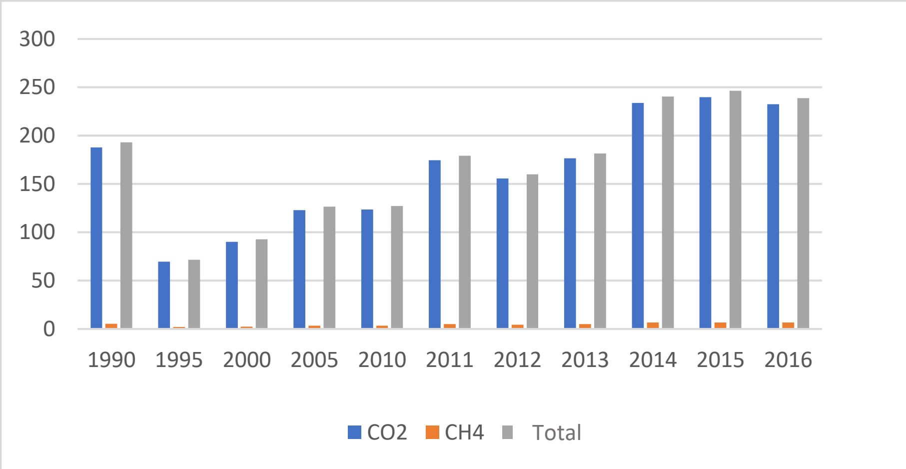


Chart 2-18. Emissions in ethylene production (thousand tons of CO_2 equivalent)

It is to note that, only CH_4 emissions from ethylene production were taken into account in IPCC (1996) methodology, but CO_2 gas was not included. CH_4 was not taken into account due to the small amount of its emissions.

Emission coefficients in this report were taken from IPCC (2006) methodology.

2.1.2.3. Emissions from metal industry (2.C.)

Metal industry is a set of methods used for the extraction and use of metals, as well as important semi-metals and non-metals from the earth, ores, salts.

This category of Industrial Processes and Product Use sector includes the following sub-categories:

- 2C1. Iron and Steel Production;
- 2C2. Ferroalloys Production;
- 2C3. Aluminium Production;
- 2C4. Magnesium production ;
- 2C5. Lead production;
- 2C6. Zinc production.

Only two out of above listed subcategories exist in Azerbaijan: 2C1 and 2C3. The emissions from these two categories are assessed below.

The inventory allowed to calculate the amount of GHG released into the atmosphere from the sources of these two subcategories (Table 2-17).

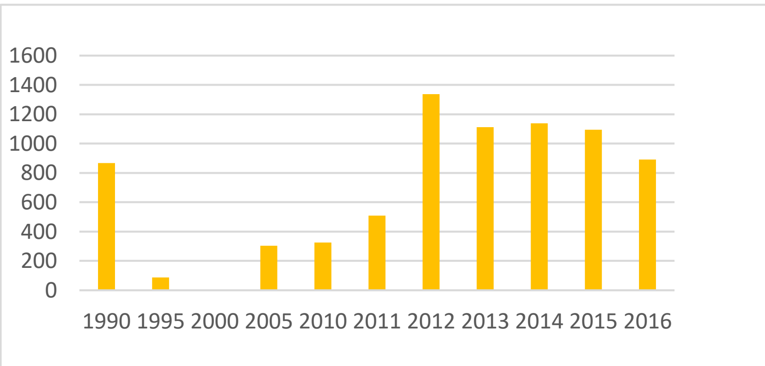


Chart 2-19. Emissions in the metal industry (thousand tons of CO_2 equivalent)

The assessment process of the emissions in these two subcategories is shown below.

The inventory allowed to calculate the amount of CO_2, CH_4, CF_4, C_2F_6 emissions from these sources.

Source	1990	1995	2000	2005	2010
Iron, steel production	445,48	28,92	0,27	304,49	325,80
Aluminum production	422,90	58,39	0,00	0,00	0,00
Total	**868,39**	**87,30**	**0,27**	**304,49**	**325,80**

Table 2-17. GHG emissions in metal industry, (kt CO_2 eq)

Source	2011	2012	2013	2014	2015	2016
Iron, steel production	402,52	472,06	272,03	344,82	321,13	368,02
Aluminum production	107,30	864,74	839,50	793,73	773,22	523,90
Total	**509,82**	**1336,80**	**1111,52**	**1138,55**	**1094,35**	**891,92**

Table 2-17 (continued). GHG emissions in metal industry, (kt CO_2 eq)

Iron and steel production (2.C.1.)

Greenhouse gas emissions from iron and steelmaking are released during various technological processes. Emission sources are melting furnaces available in iron and steel industry.

There are two steelmaking factories operating in Azerbaijan: "Baku Steel Company" and "Baku Steel Construction" OJSC. The annual production capacity of "Baku Steel Company" was 386,456 tons, and that of Baku Steel Casting OJSC was 70,770 tons in 2007. These enterprises and others mainly use scrap metal as a raw material.

"Baku Steel Company" is supplied with thirty melting equipment and a furnace (with annual output of 550 thousand ton steel), 3 units of modern 3.5 MW gas/oxygen burners. "BAKU STEEL CONSTRUCTION" JSC produces various classes of steel casts weighing 5-5000 kg with different configurations at I-IV complexity level, in accordance with modern demands. CO_2 and CH_4 emissions might be released from steel melting process subject to the technologies applied in steel industry.

The following enterprises produce various metallurgical products and mainly ferrous metal products with low production capacity. "Global Construction" LLC and "Atahan Demir Sanaye" LLC each produce about 1,000-2,000 tons. In addition, there are enterprises with an annual production capacity of 10-100 tons in Baku ("Azad NM" LLC) and in the regions. The products mainly meet domestic demand.

According to the IPCC (2006) methodology, CO_2 and CH_4 emissions are released from the iron and steel production (Table 2-18).

Emission	1990	1995	2000	2005	2010
CO_2	445,20	28,91	0,27	304,30	325,60
CH_4	0,28	0,01	0,00	0,19	0,21
Total	**445,48**	**28,92**	**0,27**	**304,49**	**325,80**

Table 2-18. Emissions from cast iron and steel production, (kt CO_2 eq)

Emission	2011	2012	2013	2014	2015	2016
CO_2	402,26	471,76	271,85	344,60	320,93	367,79
CH_4	0,25	0,30	0,17	0,22	0,20	0,23
Total	**402,52**	**472,06**	**272,03**	**344,82**	**321,13**	**368,02**

Table 2-18 (continued). Emissions from cast iron and steel production, (kt CO_2 eq)

Amounts of CH_4 emissions are very small and therefore are not reflected in Chart 2-20.

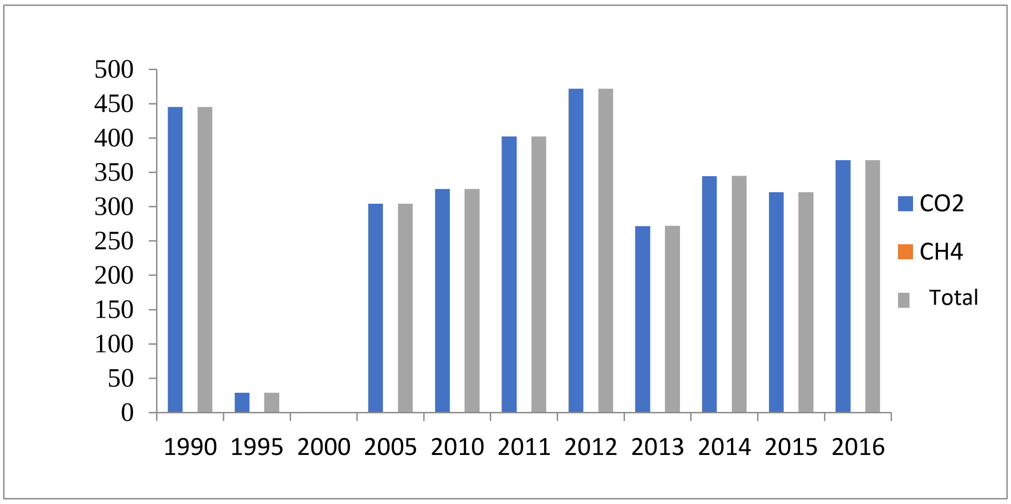


Chart 2-20. Emissions from cast iron and steel production (kt CO_2 eq)

Aluminum production. (2.C.3).

“DET.AL HOLDING” is a leading group of companies in Azerbaijan Republic in the sphere of non-ferrous industry that produce aluminum oxide (alumina), primary aluminum and semi-final aluminum products (such as aluminum sheet – in list and roll forms, both sides painted sheet and lists) of bauxite and alunite ore.

Main office of “Det.Al Aluminum Complex”, is located in Ganja. This Complex includes 4 factories (Electrolysis Plant, Anode Processes Plant, Metal Casting and Continuous Rolling Plant, Rolling and Coating Plant), 2 subsidiary fields (110 kw and Silicon Rectifier Substations, Mechanical Repair Station), a lot of workshops, industrial and social objects.

Annual production capacity of the Complex is 50.000 tons. Preliminary production capacity in Sumgait Aluminum Factory is 60 thousand ton/year. Second phase is under completion at present. It is planned to increase annual production capacity of Det.Al Aluminum Complex Electrolysis Plant up to 200.000 tons. CO2, CF4 and C2F6 are emitted from aluminum production.

Emissions	1990	1995	2000	2005	2010
CO_2	45,56	6,29	0,00	0,00	0,00
CF_4	0,04	0,01	0,00	0,00	0,00
C_2F_6	0,01	0,00	0,00	0,00	0,00
Total, CO_2-eq.	**422,90**	**58,39**	**0,00**	**0,00**	**0,00**

Table 2-19. Emissions from aluminum production, thousand t

Emissions	2011	2012	2013	2014	2015	2016
CO_2	11,56	93,16	90,44	85,51	83,30	56,44
CF_4	0,01	0,09	0,09	0,08	0,08	0,05
C_2F_6	0,00	0,02	0,02	0,02	0,02	0,01
Total, CO_2-eq.	**107,30**	**864,74**	**839,50**	**793,73**	**773,22**	**523,90**

Table 2-19 (continued). Emissions from aluminum production, thousand t

Since CF_4 and C_2F_6 emissions of from aluminum production mentioned in Table 2-19 are equal to 6500 and 9200, respectively, their CO_2-eq. quantities will be thousand t. higher. This is more clearly shown in chart 2-21.

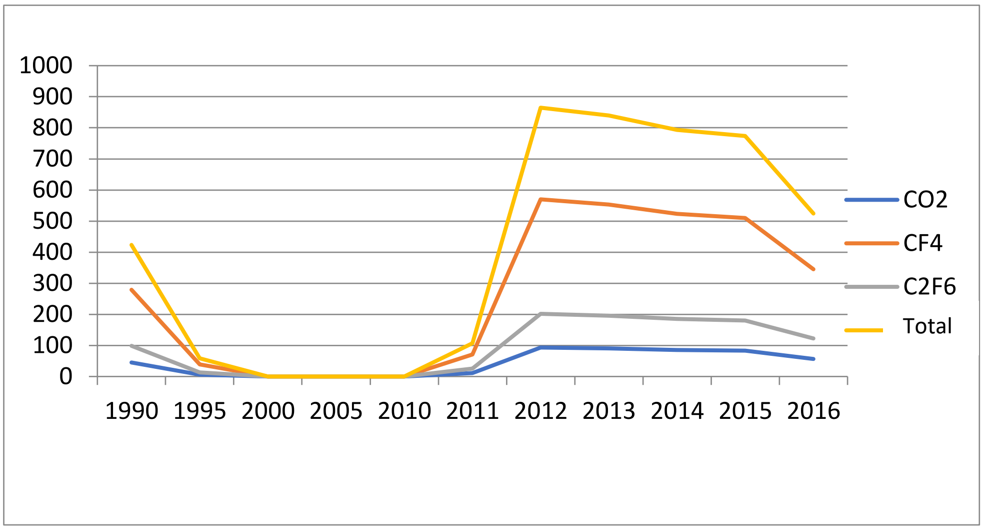


Chart 2-21. Emissions from aluminum production (kt CO_2 eq.)

2.1.2.4. Non-Energy Products from Fuels and Solvent Use (2.D.)

Use of lubricants 2.D.1

GHG emissions estimate by obtaining data from enterprises that use these raw materials would reduce the uncertainty. However, this information is not always available.

Application of "non-energy use" term varies in different countries. Oil lubricants are the liquids used as lubricants. It is divided into petroleum oil, synthetic oil, and half-synthetic oil for its composition. Whereas for the purpose intended is divided into the following groups:

- Engine lubricants;
- Lubricants for two-stroke engines
- Transmission lubricant;
- Industrial lubricant;
- Jet-engine lubricant;
- Working oil for automatic gearing system;
- Working oil for hydraulic actuator of steering control;
- Lubricating-cooling emulsions for metal cutting devices, etc.

"Alco Lubricant Company" intends to construct a lube producing factory in Sumgait Chemical Industrial Park. The factory with 30 thousand tonsq2 annual capacity will be put into service at the end of 2017. The factory will employ about 100 people. The products to be manufactured by the factory will be directed to meet the demand of the country as well as directed to the export.

Sumgait Chemical Industrial Park was established to form suitable condition to develop competitive industrial production based on innovative and high Technologies in the country, support entrepreneurship in this field, ensure sustainable development of non-oil sector and improve employment in production field.

Various factories involved in manufacturing and processing of competitive products (Works, services) in petro-chemical and other prioritized fields will be established within the Park.

This category has been assessed in "Energy" sector based on IPCC (1996) methodology. However, in IPCC (2006) methodology, this category is included in Industrial Processes and Product Use Sector. CO_2 emission from greenhouse gas emissions, which was calculated, based on statistic data is shown in the chart below.

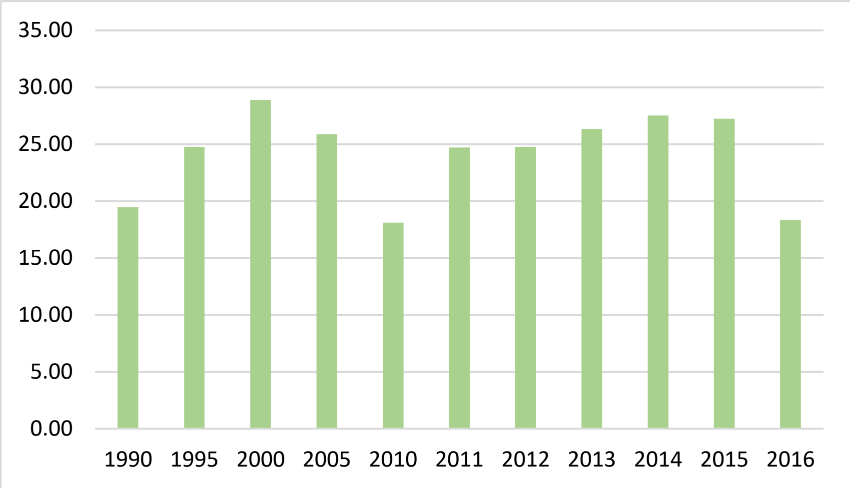


Chart 2-22. CO_2 emissions from the use of lubricants (kt)

2.1.2.5. Products used as substitutes for ozone depleting substances. (2.F.)

Hydrofluorocarbons (HFC) and limited amount of perfluorocarbons are alternative ozone-depletion substances, which were phased out under Montreal Protocol.

HFC and PFC are included in following current and possible applications (IPCC/TEAP, 2005):

- Cooler and air conditioner;
- Fire-fighting and explosion prevention system;
- Aerosols;
- Chemical cleaning with solvents;
- Pressurized foam blowing;
- Other applications.

Main groups of above mentioned current and possible operations are shown as application fields in the category of ODS alternatives in this chapter.

Other application fields, such as cleaning with aerosols and solvents might have short-term fund resources; however, they might be considered as temporary emission sources from the point of emission assessment.

Montreal Protocol does not control HFC and PFC, because they do not have any impact on ozone-depletion of stratosphere. HFC's are chemical substances consisting of hydrogen, carbon and fluor.

The only HFC produced before they were phased out from Montreal Protocol and operation of different ODS's include low-temperature refrigerator which is an intermediate product of HFC-152a, HFC-23 HXFC-22 production, a component of R-500 refrigerator mixture. In 1991, HFC-134a was produced and used as ODS alternatives in other applications (IPCC/TEAP, 2005).

While collecting information on consumption of HFC and PFC for reporting purposes, it is necessary to pay special attention at inclusion of HFC's in compounds, however some components (such as XFC and HXFc) in the compounds which do not require reporting shall not be taken into account. HFC and PFC's have high Global Warming Potential and exist in the atmosphere for a long time.

Significant HFCs and PFCs are summarized in the IPCC Assessment Reports, as well as their areas of application (IPCC Second Assessment Report (IPCC, 1996); IPCC Third Assessment Report (IPCC, 2001); IPCC / TEAP, 2005, Table 7.1).

Various HFC and PFC's have different potentials as greenhouse gas emissions. Regardless of the existence in the atmosphere, HFC's have high Global warming potential.

Consumption of individual gas patterns shall be determined. Thus, it is possible to assess emissions from these chemical substance groups to global warming with adequate accuracy.

Use of Chemical substances in ventilation and cooling systems (2.F.7.).

This category describes the assessment of greenhouse gas emissions released from the use of chemical substances (alternatives of ozone depletion substances) to the atmosphere. Inventory of greenhouse gas emissions from the substances included to this category was described in the report developed by German Agency for International Cooperation (GIZ) in 2011-2013.

The results of the inventory process in these subcategories have shown many uncertainties in the inventory. Nevertheless, a number of data have been obtained, uncertainties have been analyzed, and actions to be taken to obtain the data sources, instructions and methodologies necessary to conduct future inventories. The inventory revealed the following:

1. None of the GHG generating substitutes are produced in Azerbaijan;

2. GHG-generating substances R-22 (CHF2Cl), R-134a (CH2FCF3), R-32 (CH2F2), R-404a (HFC) and R-407c (HFC) are used in Azerbaijan;

3. R-22 is also not included in the GHG inventory as it is an ozone-depleting substance and is regulated by the Montreal Protocol;

4. The sources of substitutes used are mainly stationary cooling/heating systems and air conditioners, as well as transport.

During the inventory, requests were made to existing firms, companies and joint ventures in the country to obtain information on the repair and sale of refrigeration systems and air conditioners and information was obtained. According to this information, R-22, R-134a, R-32, R-404a and R-407c are used in the enterprises. According to this information, GHG emissions from "Cooling systems and air conditioners" subcategory for 1995-2016 were estimated with CO_2-eq. (chart 2-23). The emissions from other two subcategories were practically calculated according to the number of means of transport and the amount of gas used in the country.

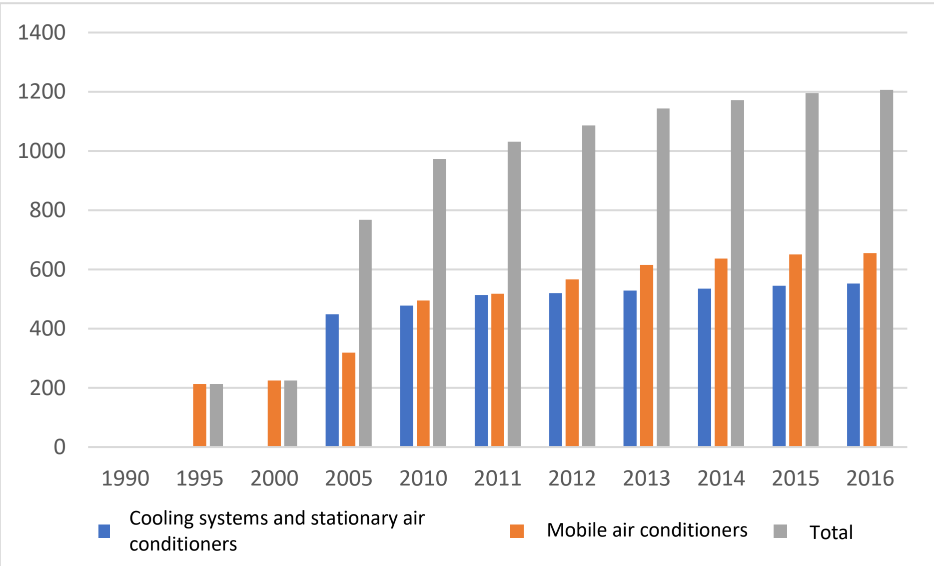


Chart 2-23. Emission of F-gases (kt CO_2 eq.)

2.1.3. Agriculture, Forestry and Other Land Use

The current report covers the inventory results for 3A-3C categories, which are included in the "Agriculture, Forestry and Other Land Use" structure, the third IPCC sector, according to the terms of reference of the project.

In order to implement the report, previous National Communication and other relevant documents were studied, as well as data from the State Statistics Committee of the Republic of Azerbaijan were reviewed and assessments were made.

The inventory process was based on the Tier 1 approach outlined in the 2006 IPCC Guidelines (IPCC), and emission factors for Non-Annex 1 countries of the Convention were used the calculations.

The AFOLU sector discussed in this report consists of three categories. Being the third sector in the IPCC methodology, AFOLU, i.e., the Agriculture, Forestry and Other Land Use sector has three categories:

- 3A Livestock;
- 3B Lands;
- 3C Aggregate sources and non-CO_2 emission sources on land

3A - Livestock category includes sub-categories such as enteric fermentation of livestock and manure management, i.e., the collection, storage and use of manure. Mainly CH_4 and N_2O gases are released from the sources of this category. N_2O gas released from collection, storage and use of manure, which is the source of this category, is considered within 3C category ($3C_6$ - Indirect N_2O emissions from manure management).

3B - Land categories include subcategories such as forestland, cropland, grassland, wetlands, settlements and other land. In these subcategories, mainly CO_2 is removed or decomposed by soil, trees and other green plants, depending on the type of plowing, as well as the direct or indirect release of N_2O into the atmosphere from the use of nitrogen fertilizers.

3C - Aggregate sources and non-CO_2 emissions sources on land, i.e., CH_4, N_2O, NO_x, CO, SO_2 and other gasses are released.

This report identifies the sources of GHG emissions within inventory work for the period 1990-2016 and calculates and analyzes the results (Chart 2-24).

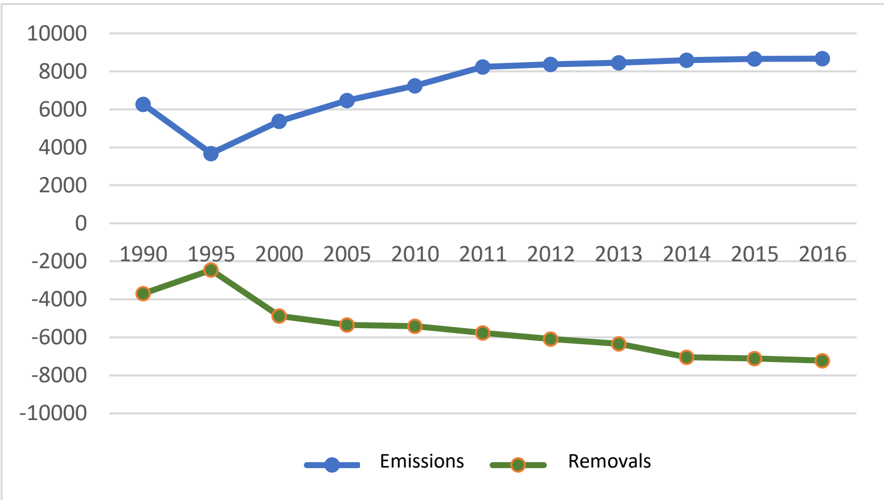


Chart 2-24. GHG emissions and removals from AFOLU sector (thousand tons of CO2 eq.)

As can be seen from the chart, the sector's emissions exceed the absorption. However, if we compare 1990 and 2016, we can see that the difference has started to decrease. This is because green areas are growing faster than the livestock number. Indeed, reforestation, establishment of new forest areas, expansion of green belts in cities and settlements, and planting of gardens and greenery in areas allocated to the urban population have reduced the gap.

2.1.3.1 Livestock

In the current report of livestock inventory, greenhouse gases from enteric fermentation (3A1) and manure management (3A2) subcategories were calculated. The inventory period of the said issues covered 1990-2016.

Statistics show that the number of livestock in the country, especially cattle, varies from year to year. Consequently, methane and nitrogen dioxide are mainly emitted into the atmosphere from the livestock sector due to the excretion of manure and subsequent manure management.

It is known that methane gas (CH_4) is produced in animals by enteric fermentation (in the gastrointestinal tract), while nitrogen dioxide (N_2O) gas is released depending on the system of manure management and accumulates in the atmosphere.

It is clear from the above that inventory of these two main sources of greenhouse gas emissions in livestock and taking preventive measures in this regard is very important.

Given that livestock sector emits more methane gas in the country's whole agricultural sector, and if this sector is not controlled, then the agricultural sector will continue to be a source of greenhouse gases that cause global warming.

It is to note that in accordance with the UN Sustainable Development Goals, each country is committed to implementing urgent, courageous, and transformative measures that will make the world sustainable and strong. Azerbaijan is among those countries.

What is the current situation in Azerbaijan to reduce greenhouse gas emissions in the livestock sector and what preventive measures are being taken?

To answer this question, we analyzed the current situation and future prospects for reducing greenhouse gas emissions in the livestock sector in Azerbaijan. The results of the study are described in Table 2-20 in GAP analysis format.

Our studies show that during the 1990-2016 inventory period in the country, almost no preventive measures were taken to reduce greenhouse gas emissions in the livestock sector.

Since 2016, issues for taking certain measures in this area have been mentioned in the "Strategic Roadmap for the production and processing of agricultural products in the Republic of Azerbaijan", Paragraph 7.7.2. Priority 7.2. Improve environmental protection mechanisms in agriculture. However, the level of measures taken to address the problem and the control mechanism are very poorly developed.

The results of our studies show that it is necessary to carry out activities aimed at the development of livestock in the country, in accordance with the activities designed to reduce greenhouse gas emissions. Thus, there is a great need for the state to control the number and productivity of animals, analyze statistics, reduce production, or apply quotas, depending on the demand of local and foreign markets. In general, the results of our analysis in this regard are explained in more detail in Table 2-20.

Current situation	Further targets	Action plan (improvement measures)
✓These issues were almost ignored during the inventory period covered by the report. ✓However, although these issues were mentioned in the "Strategic Roadmap for the production and processing of agricultural products in the Republic of Azerbaijan" since 2016, the level of preventive measures to reduce greenhouse gas emissions in the livestock sector is very low. ✓The country has no regulatory mechanisms in this area.	Achieve reduction in greenhouse gas emissions in the livestock sector and constantly monitor the issue	- Provide State control on the number and productivity of livestock, to analyze statistical data, to reduce production or apply quotas depending on the demand of local and foreign markets - Set live weight limits for livestock, especially for cattle, which emit more methane gas, if the demand of the domestic market is met. - Impose taxes on excessive emissions of carbon dioxide - Develop regulatory mechanisms and legislative framework as a state policy to reduce greenhouse gases in livestock sector - Implement Measure-Reporting-Verify system by the State to take

		measures to reduce greenhouse gases in livestock - Monitor the improvement of the effective manure management system in livestock farms by the Ministry of Environment and Natural Resources of the Republic of Azerbaijan and the Ministry of Agriculture of the Republic of Azerbaijan - Strengthen public-private partnership and organize joint activities - Implement activities aimed at the development of livestock in the country, in line with the activities designed to reduce greenhouse gas emissions - Encourage the collection and use of methane gas and nitrogen dioxide generated from collection of in livestock farms as renewable energy
No inventory work was conducted on sources of greenhouse gas emissions in the livestock sector and related statistical database is weak.	Inventory of sources of greenhouse gas emissions in livestock sector, improvement of statistical database in this area and forecast further activities	- Train local specialists on inventory of sources of greenhouse gas emissions in livestock sector - Establish central inventory database - Review obtained figures and submit future action plans to the State
Not available	Strengthen research to reduce greenhouse gas emissions in the livestock sector and improve selection in this area	- Select more specific diets in animals, especially in dairy and beef cattle, to reduce the amount of methane gas generated by enteric fermentation, while maintaining the nutritional value of feed, and to conduct substantiated studies in this area. - Conduct selection work in research institutes aimed at reducing methane gas in livestock, especially in dairy and meat cattle, and obtain new breeds for this purpose. - Develop more efficient management system for the collection, storage and transportation of manure and disseminate successful results to farms
Not implemented	Raise awareness of farmers to reduce greenhouse gas emissions in livestock sector	Raise awareness of farmers in this area, organize periodic workshops and trainings, prepare, and distribute booklets and brochures
Characteristic for only a small number of modern livestock farms	Implement an effective management system for cleaning, collecting, and storing manure on farms	- Immediately remove manure from barns and stalls and store in liquid tanks. - Provide state support for the distribution of biogas facilities in the regions.

Table 2-20. GAP analysis of the current situation and future prospects for reducing greenhouse gas emissions in the livestock sector in Azerbaijan

In order to calculate the emission (release) of greenhouse gases in livestock sector in Azerbaijan and assess the outcomes, the country-wide statists were collected, the number of livestock in different categories was determined, various manure management systems (collection, storage and use of manure) were studied.

The inventory identified 10 most widely spread livestock species of in the country. The number of livestock in 1990-2016 is given in Table 2-21, as provided by the SSC.

Years	Cow	Buffalo	Sheep	Goat	Swine	Poultry	Horse	Donkey	Camel
1990	2141,7	290,5	5224,1	194,6	156,7	29050,8	36,8	29,9	0,2
1995	2028,3	298	4434,2	210,2	30,4	13333,4	43,1	24,8	0,1
2000	2541,3	298,7	5553,1	532,6	18,6	14740,5	63,7	37,7	0,2
2005	3066,7	302,8	7074,8	593,7	22,9	19036	69,4	45,4	0,2
2010	3466,7	277,1	7784,8	620,2	6,3	22432,3	76,5	46,1	0,2
2011	1130,1	131,3	7784,8	620,2	6,3	22432,3	76,5	46,1	0,2
2012	1143,7	128,3	7847,4	626,9	6,1	23162,0	77,2	45,9	0,3
2013	1162,6	126,6	7924,6	644,8	6,5	24581,4	77,2	44,3	0,3
2014	1177,7	123,9	7979,4	651,1	6,7	25172,7	76,6	43,4	0,3
2015	1179,6	119,6	7987,3	658,1	6,1	28851,7	75,4	40,0	0,3
2016	1187,6	115,4	8025,6	651,5	5,2	27559,4	73,7	35,8	0,2

Table 2-21. Number of livestock and poultry in Azerbaijan (Source: The State Statistics Committee; www.stat.gov.az)

The number of livestock and poultry described in Table 2-21 is the basic information for calculating greenhouse gas emissions from livestock. The main sources of greenhouse gas emissions in the livestock sector are gases produced by fermentation in the gastrointestinal tract of animals and released during the management of manure.

In order to analyze the emissions of non-carbon dioxide (CO_2) gases, especially methane (CH_4) and nitrogen dioxide (N_2O) produced from enteric fermentation and manure management in livestock based on the principles of the United Nations Framework Convention on Climate Change, the International Panel on Climate Change Guidelines (2006 IPPC Guidelines, Volume 4: Agriculture, Forestry and Other Land Use -AFOLU) was used.

Estimation of CH_4 gas emissions from enteric fermentation in livestock gave the following results (chart 2-25).

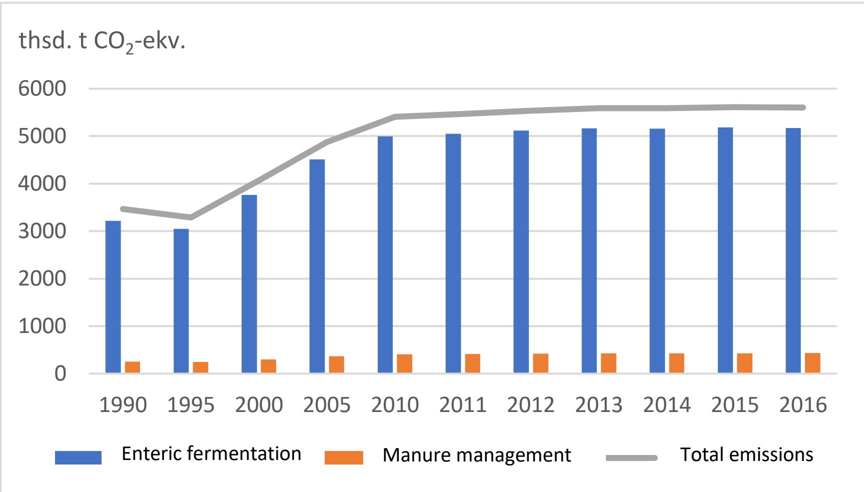


Chart 2-25. CH_4 emissions in livestock category

The actual values of methane gas released into the atmosphere from enteric fermentation and manure management are given in the table below.

Indicator	1990	1995	2000	2005	2010
Enteric fermentation	153,27	145,03	179,31	214,86	237,88
Manure management	11,89	11,51	14,37	17,44	19,49
Total emission	165,16	156,54	193,68	232,3	257,37

Table 2-22. Methane emissions in livestock category, (kt CO2 eq.)

Indicator	2011	2012	2013	2014	2015	2016
Enteric fermentation, CH_4	240,61	243,62	245,97	245,76	246,76	246,23
Manure management, CH_4	19,72	20,03	20,27	20,35	20,42	20,49
Total emission, CH_4	260,33	263,65	266,24	266,11	267,18	266,72

Table 2-22 (continued). Methane emissions in livestock category, (kt CO2 eq.)

2.1.3.2. Land use

2.1.3.2.1. Brief information about lands

The Republic of Azerbaijan is among the countries with limited land resources. According to official statistic data as of end of 2016, there is only 0.20 ha cultivated land per capita while 0.49 ha arable land in the country. Limited number of arable land plots in Azerbaijan is one of the factors causing low share of agriculture in emissions.

It is to note that, 20% of the country's territory, i.e., about 17.32 thousand km^2, was under occupation about 30 years by Armenia. These are Khojavend, Khojaly, Shusha, Jabrayil, Kalbajar, Lachin, Zangilan, Gubadli, Fuzuli, Agdam, Tartar districts and Khankendi city. Therefore, no information was available about processes in those lands.

All soils on the earth's surface are the result of complex interactions between local climate, plant and animal organisms, the composition and structure of rocks, the topography of area, and finally the age of the country. The development of soil and land cover, formation of fertility is closely related to various influences of the natural factors that make up the soil and human society. Variety of climatic conditions, vegetation, rocks and relief, and age differences of different areas make soils different. Soil plays vital role in the life of the organic world and human food security.

Land is the main factor of production in agriculture. In order to use soil as a means of production in accordance with its fertility properties, the humankind studies the properties, conditions and fertility of soils. The humankind significantly changes the properties of soil by directly affecting natural factors. Reforestation and deforestation, cultivation of agricultural crops change the appearance of natural vegetation, and soil drying, and irrigation change the humidity conditions in area. Soil fertilization, natural and chemical reclamations have significant impact on soil.

As mentioned above, the following sub-categories are included in the 3B-Land category:

1. Forest land;
2. Cropland;
3. Grassland;
4. Wetlands;
5. Settlements;
6. Other land.

In each of the sub-categories mentioned in the report, issues related to GHG sources and the amount of gases emitted from them are considered.

2.1.3.1.1. GHG emissions and removals in the category

Sources of GHG emissions to be inventoried are in 3B Category. In these sub-categories, CO_2 gas is mainly removed or decomposed by soil, trees, and other green plants, as well as N_2O gas is released directly or indirectly into the atmosphere. N_2O gas released from this subcategory is included in 3C Category.

The territorial division of the Republic of Azerbaijan is given in the table below.

Years	Territory, 1000 km^2	Arable land, 1000 ha *	Cropland, 1000 ha	Fallowed lands, 1000 ha	Perennial plantings, 1000 ha	Hayfields and pastures, 1000 ha	Forests, 1000 ha
1990	86,6	4382,9	1589,0	80,8	347,4	2365,7	1038,8
1995		4489,1	1628,4	97,9	309,5	2453,3	1038,3
2000		4740,4	1766,8	58,8	236,8	2678,0	1037,4
2005		4758,6	1797,6	45,6	221,5	2693,9	1037,8
2010		4766,8	1842,7	41,4	227,4	2655,3	1040,7
2011		4768,7	1843,8	41,9	227,2	2655,8	1040,8
2012		4768,3	1855,0	41,8	230,9	2640,6	1040,8
2013		4769,8	1884,3	41,0	230,3	2614,2	1040,2
2014		4769,7	1885,6	40,9	233,5	2609,7	1040,3
2015		4769,8	1897,5	40,2	237,0	2595,1	1040,3
2016		4772,9	1959,1	39,8	241,1	2532,9	1040,3

Table 2-23. Land reserves in the territory of Azerbaijan Republic (Data from the State Service for Property Issues)

As mentioned above, 20% of the country's territory was occupied by Armenia. No inventory work was conducted on these lands. Emissions and removals of carbon dioxide (CO_2) are observed in the sources of this soil category. The total amount of calculated emissions and removals in this category, i.e., net emissions/removals, is given in the table below.

Source	1990	1995	2000	2005	2010
Forest land remaining forest land	-3080,72	-2251,94	-3230,53	-3231,77	-3240,81
Forest land converted to forest land	-19,13	-16,84	-56,37	-86,26	-112,77
Cropland remaining cropland	-590,59	-187,34	-1534,86	-1687,85	-1198,89
Lands converted to cropland	0	0	0	0	0
Grassland	0	0	0	-255,37	-682,26
Settlements	0	0	-48,7	-87,66	-175,32
Total removals	**-3690,44**	**-2456,12**	**-4870,46**	**-5348,91**	**-5410,05**

Table 2-24. Removals in the Lands category, (kt CO2 eq.)

Source	2011	2012	2013	2014	2015	2016
Forest land remaining forest land	-3241,12	-3241,12	-3239,25	-3239,56	-3239,56	-3239,56
Forest land converted to forest land	-119,65	-128,16	-120,37	-129,07	-127,16	-126,46
Cropland remaining cropland	-1246,97	-1256,27	-1598,99	-1246,97	-1256,27	-1598,99
Lands converted to cropland	0	-53,39	-186,65	-6,68	-87,48	-278,27
Grassland	-902,28	-1061,25	-676,88	-1806,24	-1608,57	-1100,63
Settlements	-262,98	-341,874	-512,811	-615,373	-799,985	-879,984
Total removals	**-5773,00**	**-6082,06**	**-6334,95**	**-7043,89**	**-7119,03**	**-7223,89**

Table 2-24 (continued). Removals in the Lands category, (kt CO2 eq.)

As can be seen from the table, the amount of removals increases over the years. Calculations from the base year to the last inventory year show significant uncertainties. Thus, in 1990-1995, removals decreased, as the amount of deforestation by the population increased. From 1997-1998, this tendency decreased, and absorption started to increase.

Other sources and non-carbon emissions

Sources of GHG emissions from carbon dioxide, the quantitative and qualitative indicators of GHG emissions released into the atmosphere in the "Aggregate Sources and non-CO_2 emissions sources on land" category were evaluated.

Inventory work, the analysis of appropriate methodology, calculation of emissions and expert assessment was conducted in the sources of the category. These sources are:

3C1. Biomass Burning (applicable to all soil types);
3C2. Liming;
3C3. Urea Application;
3C4. Direct N2O Emissions from Managed Soils;
3C5. Indirect N2O Emissions from Managed Soils;
3C6. Indirect N2O emissions from the collection, storage and use of manure;
3C7. Rice Cultivations;
3C8. Other (please specify);
3D1. Harvested Wood Products;
3D2. Other (please specify).

3C1. Biomass Burning

This report studied all the above sources and calculated GHG emissions from the sources from which incidents occurred. The reports, i.e., methodological support, selection of data sources, as well as emission factors were evaluated based on the IPCC (2006) and IPCC (1996) methodologies and some sources were evaluated based on expert opinions.

Here the 3C1. GHG emissions from Biomass Burning subcategory has its own sources, depending on the type of soil. These sources may include subcategories that fall into the Land category. Because in each of them, both natural and anthropogenic fires can occur.

Direct GHG emissions from this subcategory include CH_4, N_2O gases and indirectly GHG-generating NOx, CO, SO_2 gases. Furthermore, contaminants generate, but they are not noticeable due to the small area of fire and the small amount of burnt material. In general, in the total calculation of GHG emitted from sources in this category, GHG gases are converted to CO_2 equivalent and summed. In summing, the amount of each gas is multiplied by its heat generation factor. The heat generation potential of these gases is taken as CH_4-21, N_2O-310 equivalent.

It is known that changes of cultivation conditions in agricultural lands, including mineral and organic fertilizers applied to soil, soil cultivation system, rules for use of plant residues in the field (their burning, shredding, etc.) and other activities result in significant greenhouse gas emissions. From this point of view, it is very important to study the greenhouse gases emitted from the fields and select adaptive technologies to reduce their emissions.

In this category, the emission factors for Tier 1 of the IPCC (2006) methodology were used to perform calculations to determine the sources of GHG gases emitted from the soil. During the inventory period, the amount of gases emitted into the atmosphere from the “Aggregate Sources and non-CO_2 emissions sources on land” category was calculated for 2011-2016 (Chart 2-26).

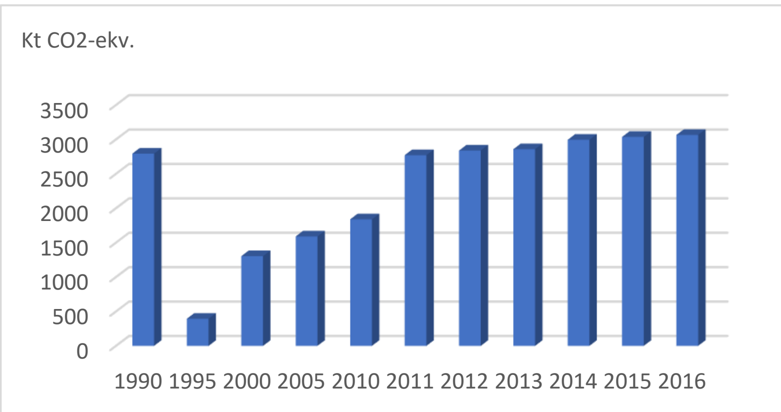


Chart 2-26. Total GHG emissions in 3C category

It is to note that the calculation of GHG in 3C category covers the years of 2011-2016. This is explained by the fact that no information is available for previous years.

Information on the sources affecting the amount of total emissions and the amount of their gases is given in the table below.

Indicators	1990	1995	2000	2005	2010
Forest fires, CH_4	0	0	0,038	0,003	0,005
Forest fires, N_2O	0	0	0,002	0,0002	0,0003
Soil management, N_2O	7,2	0	2,12	2,62	3,18
Manure management, N_2O	1,81	1,27	2,08	2,51	2,75
Rice cultivations					

Table 2-25. Emissions from 3C category sources, (kt CO2 eq.)

Indicators	2011	2012	2013	2014	2015	2016
Forest fires, CH_4	0	0,001	0	0,006	0	0
Forest fires, N_2O	0,00002	0,00005	0	0,0003	0,00001	0
Soil management, N_2O	1,71	2,1	1,05	4,09	3,95	0,75
Manure management, N_2O	2,78	2,81	2,83	2,83	2,83	2,81
Rice cultivations	65,62	62,68	78,83	40,44	44,49	93,41

Table 2-25 (continued). Emissions from 3C category sources, (kt CO2 eq.)

Separate emissions from 3C-subcategories

One of the subcategories is the 3C1 - Biomass Burning Subcategory. Sources of biomass burning (which can apply to all soil types) cover the following main areas and others in the methodology:

3C1a. Emissions from Biomass Burning - Forest Land;
3C1b. Emissions from Biomass Burning - Cropland;
3C1c. Emissions from Biomass Burning - Grassland;
3C1d. Emissions from biomass burning - other areas.

During the identification of these sources in the inventory process, only information on forest fires was obtained from the SSC. Forest fire statistics are provided only for 2000-2016 (Chart 2-27).

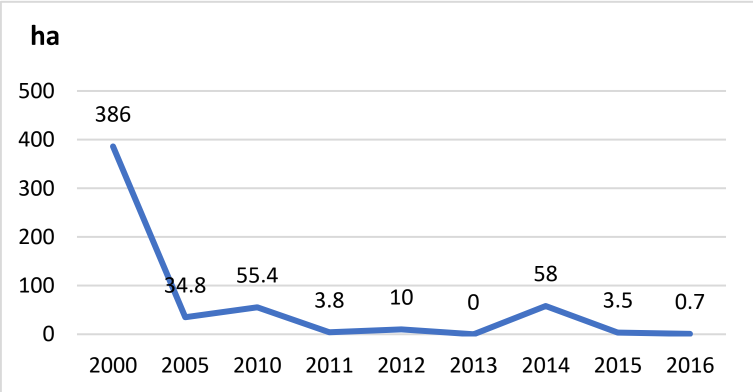


Chart 2-27. Areas of forest fires

As can be seen from the chart, the largest fire occurred in 2000. Information on the amount of GHG emissions from these fires is provided in Table 2-26.

Indicator	2000	2005	2010	2011	2012	2013	2014	2015	2016
CO_2	12,789	1,153	1,836	0,126	0,331	0	1,922	0,116	0,023
CH_4	0,038	0,003	0,005	0	0,001	0	0,006	0	0
N_2O	0,002	0,0002	0,0003	0,00002	0,00005	0	0,0003	0,00001	0
Total	**14,21**	**1,28**	**2,03**	**0,13**	**0,37**	**0,00**	**2,14**	**0,12**	**0,02**

Table 2-26. 3C1. Direct GHG emissions from forest fires, (kt CO2 eq.)

Indicator	2000	2005	2010	2011	2012	2013	2014	2015	2016
NOx	0,024	0,002	0,003	0,0002	0,001	0	0,004	0,0002	0
CO	0,873	0,79	0,125	0,009	0,023	0	0,131	0,008	0,002

Table 2-26 (continued). 3C1. Indirect GHG emissions from forest fires, thousand t

It is to note that the SSC has lots of information on forests and land use. However, there is almost no information on the specific sub-categories listed.

According to Article 244-1 of the Code of Administrative Offenses, burning of croplands and pastures on croplands and managed pastures is practically prohibited. According to this article, individuals will be fined from 400 to 600 manat, officials from 1,500 to 2,000 manat and legal entities from 5,000 to 6,000 manat for burning croplands. The population was informed about this by the State Committee for Property Issues in 2018.

The burning of croplands destructs the fertile layer of agricultural lands and the violation of the nutrient balance in croplands. Also, burning of croplands creates fire hazard in other nearby areas, settlements, and forest areas, as well as disrupts engineering communication systems. And finally, by their burning, GHG emissions, as well as pollutants and persistent organic pollutants are released into the atmosphere.

After this warning, the burning of croplands and grasslands has stopped. No information is available about fires in previous years and their scale.

Thus, in this subcategory, only the amount of GHG emissions into the atmosphere from forest fires was calculated. The direct and indirect CO_2-eq. and GHG emissions calculated in metric tons are provided in the following tables.

Greenhouse gas emissions from liming (3C2_Liming) and urea (3C3_Urea Fertilization)

In order to calculate greenhouse gas emissions from liming and urea fertilization for 1990, 1995, 2000, 2005 and 2010, first there's need to collect information about the volume of imported lime and carbamide, the croplands to which these substances were applied, etc. For this purpose, we sent official letters to the authorities (Ministry of Agriculture of the Republic of Azerbaijan and the Ministry of Environment and Natural Resources of the Republic of Azerbaijan) and clarified that no official and unofficial statistics on soil liming and urea fertilization in Azerbaijan is available. Therefore, making estimations on these categories was not possible.

During the preparation of the report, our studies in various regions of Azerbaijan revealed that since the Soviet era (after the collapse of the collective and state farms) the country has not conducted large-scale chemical land reclamation, including liming. For the last 20 years, farmers have not applied lime to the soil on large scale. Our analysis shows that while lime is used only in some greenhouses in small quantities if peat is used (on average 150-200 grams of 50 kg of peat) to neutralize its pH reaction, and such farmers are very few in number. As for urea, this fertilizer has been rarely used in the country recently. Urea is imported in very small quantity, as farmers prefer ammonium nitrate as a nitrogen fertilizer.

Based on the above, it can be concluded that this category, i.e., the greenhouse gas emissions from liming of soils and fertilization with urea/carbamide, is not typical case for Azerbaijan.

3C4. Direct N2O emissions from managed soils

No data is available at the SSC to calculate N_2O emissions from 3C4 - emissions from managed soils. Data were obtained from the SSC to calculate the amount of indirect N_2O emissions from 3C5 – Managed Soils. The amount of N_2O emissions from managed soils by years is shown in the diagram below.

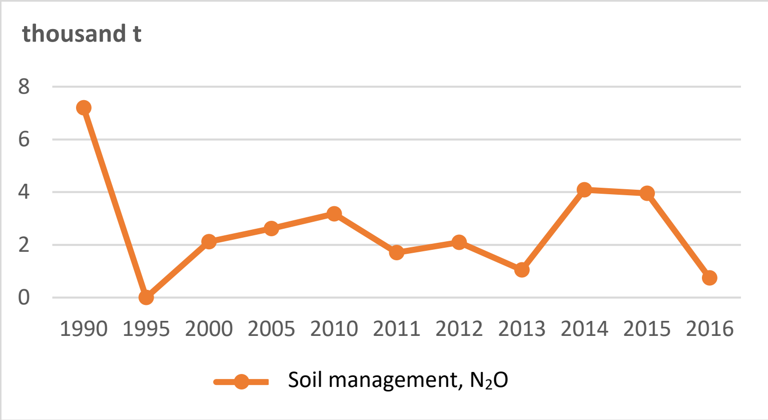


Chart 2-28. N_2O emissions from managed soils

As noted above, in (3A) Livestock category, along with CH_4 emissions from enteric fermentation and manure management, N_2O gas is emitted from manure management, i.e., manure collection, storage and use, which is included in $3C_6$ sub-category. The results of the inventory are given in the table below.

Source	1990	1995	2000	2005	2010
N_2O	1,81	1,27	2,08	2,51	2,75
CO2-eq.	**561,1**	**393,7**	**644,8**	**778,1**	**852,5**

Table 2-27. N_2O emissions from manure management, thousand t

Source	2011	2012	2013	2014	2015	2016
N_2O	2,78	2,81	2,83	2,83	2,83	2,81
CO2-eq.	**861,8**	**871,1**	**877,3**	**877,3**	**877,3**	**871,1**

Table 2-27 (continued). N_2O emissions from manure management, thousand t

3C7. Rice Cultivation

The 3C7-Rice Cultivation subcategory was one of the most developed areas until the 1990 base year. Later, interest to this area was not significant. Starting from 2015, the development of this area was included in the state programs. Information on the annual rice cultivation fields is provided in the chart below.

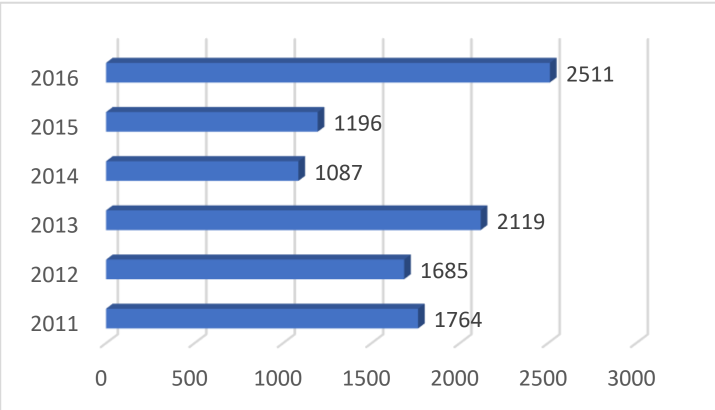


Chart 2-29. Rice cultivation areas, in hectares

Methane gas is mainly emitted from rice fields, and if nitrogen fertilizers are applied to the fields, nitrogen-1 oxide (N_2O) gas is also emitted. If the amount of CH_4 gas is determined by the technological process and the area, it is necessary to know the amount of nitrogen fertilizer to find the amount of N_2O gas. Unfortunately, it is not possible to judge about amount as farms are fragmented.

The amount of CH_4 gas from this subcategory by years is given in the diagram below.

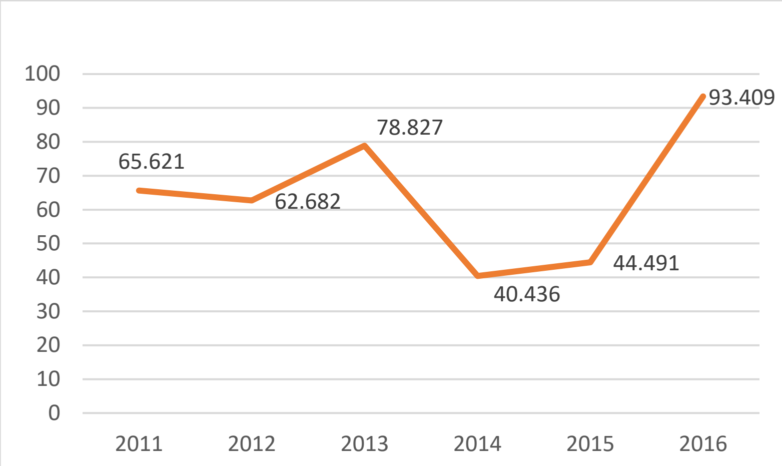


Chart 2-30. CH_4 emissions from rice cultivation (thousand t)

As can be seen from the chart, rice cultivation fields are growing. This means that methane gas will continue to increase.

Subsequent 3C8-Other, 3D1-Harvested Wood Products and 3D2-Other subcategories were not evaluated.

According to the methodology, there is a great deal of uncertainty in the emissions of this source, and that experts have differing opinions, which could lead to further studies in the GHG emissions.

2.1.4. Waste sector

Waste continues to increase in response to rapid industrial enterprises and population growth. The problem of "Solid Domestic Waste" among the waste has become one of the most acute economic and environmental problems. In large cities, the specific indicators of the waste generation per capita are about 0.5 kg. per day, and these indicators are increasing day by day.

Waste is one of the sectors of gas sources generating thermal effect. In this sector, inventory of methane (CH_4) and carbon dioxide emissions generated from the solid waste landfill and wastewater treatment, as well as N_2O emissions from human life activity are considered.

Treatment and disposal of solid domestic waste of industries and urban areas result in generation of GHG emissions. Solid waste can be eliminated by disposal, recirculation, or turning into energy (waste is used directly as fuel). Liquid waste can pass through various types of wastewater treatment. Methane is the most important gas in this sector. Two main sources of methane generation are waste landfills and wastewater treatment.

The methane component of gases generated in solid waste landfills can pose a threat to the environment unless precautionary measures are taken to prevent uncontrolled waste dumping or its migration to surroundings. According to the estimates, methane emissions from wastewater treatment in anaerobic conditions make up to 11% of global anthropogenic waste.

If precautionary measures are not taken to prevent uncontrolled waste or its migration to surrounding areas, the methane component of solid waste landfills can pose a threat to the environment. It is estimated that methane production from anaerobic wastewater treatment accounts for up to 11% of global anthropogenic waste.

As a result of microflora effect, the biothermal anaerobic process of decomposition of organic constituents contained in solid domestic waste disposed in the landfills, occurs. From this process, biogas is formed, and the main part of this gas is methane and carbon dioxide. In addition to these components, biogas contains water vapor, carbon monoxide, nitrogen oxides, ammonia, hydrocarbons, hydrogen sulfide, phenol, and other substances that are less harmful to the human health and environment.

Quantitative and qualitative composition of biogas depends on climatic and geological conditions of landfill, morphological and chemical composition of waste, disposal conditions (area, volume, density), humidity, density and many factors. Gas emissions generated in the landfills are the product of the biological separation of organic fraction of waste. The biogas source is on average biodegradable waste fractions of 60 to 80% of solid waste, including garbage, gardens and parks waste, waste paper and other cellulose waste.

In the IPCC 2006 methodology, the following categories of Waste sector are reviewed:

4A. Solid waste disposal;
4B. Biological treatment of solid waste;
4C. Incineration and open burning of waste;
4D. Wastewater treatment and discharge;
4E. Other.

2.1.4.1. Solid waste disposal (4.A.)

The structure of the living environment necessary for human life is mainly comprised of social and living conditions. The most important and creative component of social and living conditions is the population, which is a consumer of food production activities, as well as a carrier of various intangible needs, which directly or indirectly pollutes the environment with household waste from multifaceted activities. Areas such as intra-city roads, streets, squares, palaces of culture, gardens, boulevards, public buildings and structures, settlements, etc. are considered to be the main source of household waste released into the environment. Solid household waste is a major type of waste that pollutes the environment.

The report is based on the “Tier Two Default” principle contained in the 2006 GHG Inventory Guidelines. The IPCC Waste Model (MS Excel) was used to calculate methane emissions.

The process of organized management of landfills in the country has started since 1950s.

“Tamiz Shahar” OJSC conducted an Environmental Assessment during the implementation of the Sorting Line Project and identified the composition of household waste generated in Azerbaijan, including the agencies involved in the disposal process. The analysis is shown in Table 2-28.

	winter	spring	summer	autumn	average annual
Paper and paperboard	14	19	18	21	**18**
glass	7	7	6	6	**6.5**
metal	1	2	1	2	**1.5**
plastic	12	9	10	10	**10.25**
textile	4	4	5	5	**4.5**
organic/food wastes	45	42	39	41	**41.75**
small hazardous wastes	1	1	6	1	**2.25**
diapers	9	9	3	7	**7**
other	6	7	11	9	**8.25**

Table 2-28. Average indicators determined from studies conducted in Baku (in%) (Source: http://tamizshahar.az/?/az/)

The ‘other’ include mainly timber and wood waste and up to 2% medical waste.

In addition, data provided by the State Statistics Committee were used in the calculations.

Type of waste \ years	2010	2011	2012	2013	2014	2015	2016	2017	2018
Solid domestic waste by types of economic activity (thousand t):									
amount of waste generated	672.2	1009.1	1449.6	904.7	1031.1	886.5	1429.6	1178.3	1140
Amount of waste used, utilized	476.1	572.3	665	537.2	497.3	771.2	796.6	767.3	848.3
Solid domestic waste (SDW) (thousand t)	**1609.3**	**1780.5**	**1647.1**	**1670.9**	**1354.9**	**1534.7**	**1590.1**	**1576.2**	**1756.1**
Solid domestic waste per capita (kg)	**178.9**	**195.4**	**178.4**	**178.6**	**143.0**	**160.0**	**163.8**	**160.7**	**177.4**

Table 2-29. Solid domestic waste generated, used and utilized, by type of economic activity

The amount of methane emissions from open landfills has been calculated and given in the table below.

Emissions from methane gas (thousand tons)								
Years	organic/food waste	paper and cardboard	timber	textile	diapers	industrial	methane emissions	CO_2 equivalent
1990	13.7	12.6	4.5	4.6	0.0	0.3	35.6	748.6
1995	14.7	13.9	5.1	5.1	0.0	0.3	39.1	820.9
2000	15.7	15.2	5.6	5.4	0.3	0.4	42.7	895.8
2005	16.6	16.4	6.2	5.2	1.2	0.7	46.3	972.2
2010	17.6	17.5	6.8	4.7	2.5	2.6	51.7	1085.3
2011	17.8	17.8	6.9	4.6	2.7	3.0	52.8	1107.8
2012	18.2	18.1	7.0	4.6	3.0	4.1	55.0	1155.4
2013	18.4	18.3	7.1	4.5	3.2	6.1	57.7	1211.5
2014	18.6	18.6	7.3	4.4	3.4	6.8	59.0	1238.2
2015	18.1	18.5	7.3	4.3	3.5	7.8	59.6	1250.8
2016	17.6	18.5	7.3	4.2	3.5	7.5	58.7	1233.4
2017	17.6	18.6	7.4	4.2	3.6	8.8	60.2	1263.5
2018	17.4	18.6	7.5	4.1	3.7	9.3	60.6	1272.7

Table 2-30. Methane emissions by the type of waste

The methane gas emissions estimated by years are given in the chart below.

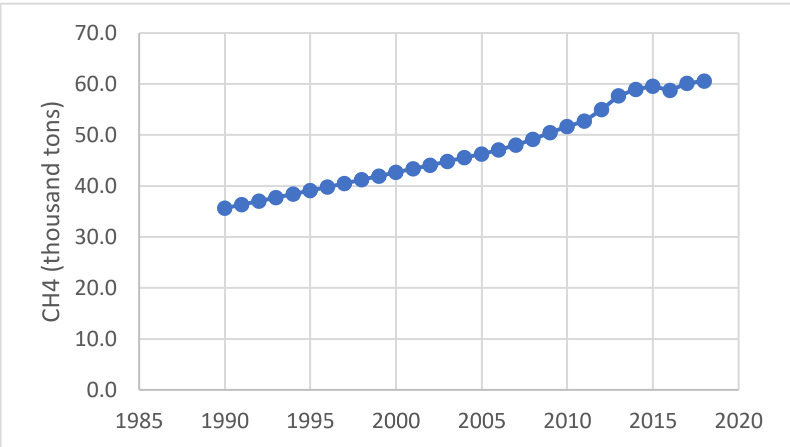


Chart 2-31. Methane emissions from solid domestic wastes, by years

2.1.4.2. Biological Treatment of Solid Waste (4.B.)

In Azerbaijan, anaerobic treatment of waste to produce electricity is made only at the Balakhani landfill. Due to the very small amount of biogas produced in the process, the amount of electricity generated is quite small and is shown in the table below.

Years	Electricity from biogas combustion (million kWh)
2015	0.0005
2016	0.0002
2017	0.0004
2018	0.0006

Table 2-31. Use of biogas in Azerbaijan

It is to note that, according to the 2006 IPCC Guidelines, anaerobic treatment of organic waste accelerates the natural decomposition of organic matter without oxygen by keeping the temperature, humidity, and pH close to optimal levels. The generated methane gas can be used to produce heat and/or electricity, and information on emissions from the process is usually provided in the Energy Sector. Emissions of methane and carbon dioxide from the process are of biogenic origin and are reported only in the Energy Sector as a unit of information.

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

The construction of waste incineration factory was carried out under “Complex Action Plan on improving environmental situation in the Republic of Azerbaijan in 2006-2010” approved under the Decree dated September 28, 2006, by the President of the Republic of Azerbaijan was decided. The Ministry of Economic Development held an open tender to select a contractor, and the winner of the tender was the French “Constructions Industrielles de la Méditerranée S.A”. As a result of negotiations with “CNIM S.A.”, an agreement was signed on December 15, 2008, for the design, construction, operation and maintenance of the Baku Solid Waste Incineration Plant. The contract was ‘turnkey’ and was implemented with the principle of “Design/Build/Operate”. Thus, the design, construction and operation of the plant were carried out entirely by “CNIM S.A”.

The total amount of design and construction work of the Plant amounted to 346 million euros. The plant, installed on a 20-hectare area in Balakhani settlement with an annual capacity of 500,000 tons, is planned to be operated by “CNIM S.A.” for 20 years. The Balakhani solid waste incineration plant consists of two lines, each with capacity of 250,000 tons, and a turbine that generates electricity. Through the waste incineration process, it has the capacity to generate 231.5 million kWh of electricity per year. The electricity to be produced annually at the Plant will enable to fully supply the city with a population of 300,000.

The President of the Republic of Azerbaijan laid the foundation of the Solid Waste Incineration Plant on November 3, 2009, and inaugurated the plant on December 19, 2012.

For production capacity, the Plant is the largest of its kind in Eastern Europe and the CIS. Constructed using fourth generation (4G) technology, this state-of-the-art Plant fully meets the EU’s most stringent environmental standards. Ash fractions from combustion products is captured by special filters and does not pollute the environment. Bottom ash, which is heavier and less harmful, can be used in road construction materials. In addition, the supply water used for cooling during waste incineration is diverted to wastewater only after treatment. The Plant’s waste levels are monitored and controlled on daily basis. Prior to the construction of the Plant, an Environmental Impact Assessment document was prepared and submitted for different public discussions. France’s “CNIM S.A.” is one of the world’s main and leading companies in this area. With 50 years of experience, “CNIM S.A.” has built more than 120 such plants in many countries around the world, especially in Europe. The company has extensive experience as a designer and main contractor for such type of plant.

Emissions from waste incineration were taken into account in the energy sector (2013-2016). It is to note that the Solid Waste Incineration Plant construction project has been registered under the TIM, but no Certified Emission Reductions (CERs) has been obtained.

2.1.4.4. Wastewater Treatment and Discharge (4.D)

Wastewater can be a source of methane (CH_4) when treated or disposed of anaerobically. They can also be a source of nitric oxide emissions (N_2O). Carbon dioxide (CO_2) emissions from wastewater are not considered in the IPCC Guidelines because they are of biogenic origin and should not be included in general emissions on national scale.

Domestic wastewater (4.D.1) is defined as wastewater generated from the use of domestic water, and industrial wastewater (4.D.2) is defined only as wastewater generated from industrial activities. Treatment and discharge systems can vary greatly from country to country. Also, treatment and discharge systems designed for rural and urban users, as well as high-income and low-income urban users, may be different.

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

Liquid domestic waste or wastewater is removed from houses through special pipes and then discharged to sewer network, but unfortunately, in many settlements, sewage pipes are discharged into rivers, ravines, lakes, seas, etc. directly, which prevents the development of technological, especially environmental, methods for the recycling of liquid waste. The development of an ecological method for storage and recycling of liquid waste is very challenging, as the physical, chemical and biological pollution in the wastewater directly contaminates natural resources, which endangers not only the health of organisms in the region, but also all living things.

In Baku and other major cities and districts of Azerbaijan, sewers are usually closed and underground. Closed, underground sewers are not considered to be a significant source of CH4 emissions.

Nitric oxide (N_2O) is associated with the breakdown of nitrogen components in wastewater, such as urine, nitrate, and protein. Domestic wastewater includes wastewater generated by human activities and mixed with other domestic wastewater, such as wastewater from showers, washbasins, and washing machines. Centralized wastewater treatment systems can include a variety of processes, ranging from discharge into the gutters to modern tertiary treatment technologies to remove nitrogen compounds. Wastewater after treatment is usually discharged into the receiving water environment (e.g., river, lake, river delta, etc.). Direct N_2O emissions can be generated from nitrification and denitrification of existing nitrogen. Both processes can take place in the facility and in the wastewater receiving water basin.

In Azerbaijan, this work is maintained by Hovsan Aeration Station, the largest treatment plant in the South Caucasus, with a new generation (4G) environmentally friendly technology.

In general, the list of facilities in the country that treat and recycle domestic wastewater by technological and ecological methods is as follows:

- Hovsan biological treatment plants - capacity 640 thousand cubic meters/day;
- Coastal biological treatment plants - capacity 17.5 thousand cubic meters/day;
- Buzovna biological treatment plants - capacity 10 thousand cubic meters/day;
- Zigh mechanical treatment plants - capacity 70 thousand cubic meters/day;
- Haji-Hasan mechanical treatment plants - capacity 18.6 thousand cubic meters/day;
- Mardakan-Shuvalan mechanical treatment plants - capacity 18.6 thousand cubic meters/day.

Thus, within the framework of the “State Program on socio-economic development of Baku and its settlements in 2011-2013”, a 200-kilometer-long sewer network was constructed, the 225-kilometer-long sewer collector and network, which had filled with sludge for many years and lost up to 50 percent of its capacity, has been washed and cleaned by special machines. 6,000 meters of sewerage lines in the basements of 1220 buildings with 320,000 residents, were renewed or restored, as a result of which the sanitary and hygienic condition of the basements of those buildings improved.

Within the framework of the “State Program on socio-economic development of Baku and its settlements in 2014-2016”, the national water supply and sewerage project is underway in 6 districts of Azerbaijan. Reconstruction of water supply and sewerage infrastructure in Astara, Dashkasan, Gadabay, Tartar and Gazakh districts within the framework of the “National Water Supply and Sewerage Project in 6 Regions of Azerbaijan” co-financed by “Azersu” Open Joint Stock Company and the Islamic Development Bank is in the implementation stage. In April 2011, the Government of the Republic of Azerbaijan formally applied to the Islamic Development Bank (IDB) for financing the project. In December 2011, the Exception Agreement and the Agency Agreement were submitted by the IDB to the Government of Azerbaijan. Both agreements were signed by the Government of Azerbaijan and the Islamic Development Bank in April 2012 and entered into force on 25 August.

Gadabay District




The "Project of reconstruction of water supply and sewerage systems in Gadabay district" is implemented within the framework of the "National Water Supply and Sewerage Program in 6 Regions of Azerbaijan" jointly funded by Azerbaijan Government and Islamic Development Bank. The project is designed to develop 12000 people's water supply and sewerage systems taking account perspective development as of 2035.

Implementation of the "Reconstruction of drinking water supply and sewerage systems in Gadabay" project started in 2014. Sewerage system was constructed in the district for the first time, and 47.6 km of sewerage network and 1.5 km of sewerage collector were built.

The construction of treatment plant with capacity of 3,500 cubic meters per day in order to treat wastewater in Gadabay is in completion stage.

Astara District



In 2015, the "Reconstruction of drinking water supply and sewerage systems in Astara district" project was started. The project is designed to improve access to drinking water and sewage services for 28.5 thousand people in Astara by 2035, taking into account the perspective development. In the future, the project will provide drinking water to 27 villages with a population of 73,000 people. In total, 102,000 residents will benefit from this project.

In order to construct sewerage network in Astara, 70.5 km long sewerage network, 8 km tunnel-type sewerage collector, 2 sewerage pumping stations and wastewater treatment plant with capacity of 6,000 cubic meters per day have been designed. Sewerage infrastructure will be established in the next stage of the project.

Tartar District

The "Reconstruction of drinking water supply and sewerage systems in Tartar district" project is designed to improve the use of drinking water supply and sewerage services for 26,000 people in Tartar by 2035, taking into account the perspective development.

The project was started in May 2015. Within the framework of the project, 91 km of drinking water, 75 km of sewerage network, 3.4 km of sewerage collector were constructed in Tartar, connections and meters were provided to each address.

To treat and discharge wastewater generated in the district, the construction of treatment plant with capacity of 7,500 cubic meters per day will be completed by 2020.

Dashkasan district

The "Reconstruction of drinking water supply and sewerage systems of Dashkesan district" project is implemented within the framework of the "National Water Supply and Sewerage Program". The project is designed to improve access to drinking water and sewage services for 12,000 people in Dashkesan by 2035, taking into account the perspective development.

Construction of 11.5 km sewerage network has been completed in Dashkesan. The district's wastewater will be treated and discharged by wastewater treatment plant currently under construction with a daily capacity of 3,500 cubic meters.

The project also envisages the supply of drinking water to Alunitdag and Madanchilar settlements with population of 1,500. Water has already been supplied to Alunitdag settlement, and water will be provided to Madanchilar settlement.

Agjabadi district

"Reconstruction of drinking water supply and sewerage system in Agjabadi" project is designed to improve access to drinking water and sewerage services for 45,000 people by 2035, taking into account the perspective development.

The project was launched in 2016. 205 km sewerage network has been built in Agjabadi. In order to treat wastewater generated in the district, the construction of treatment plant with capacity of 10,000 cubic meters per day is in completion stage.

It is to note that, "Azersu" Open Joint Stock Company is a centralized supplier of drinking water and sewerage services to consumers in Azerbaijan. The Joint Stock Company arranges the collection, processing, transportation and sale of water from sources, and conducts wastewater treatment. The OJSC is engaged in the design, construction, operation and maintenance of water treatment plants, reservoirs, pumping stations, water pipelines, sewerage collectors.

The company has 20,000 km of water, 6,000 km of sewage and rainwater lines in its balance.

Taking into account the above and the information in Table 6.1 of the IPCC 2006 Regulations on "CH4 and N2O Emission Potentials for Wastewater and Sludge Treatment and Discharge Systems", methane and nitrogen oxide emissions are not considered as source as sewage collectors are closed and underground in Azerbaijan.

Industrial Wastewater Treatment and Discharge (4.D.2)

The annual production of relevant production areas in Azerbaijan was studied in order to calculate the methane gas emitted into the atmosphere from wastewater generated as a result of industrial activities within this category. All information was taken from the State Statistics Committee website.

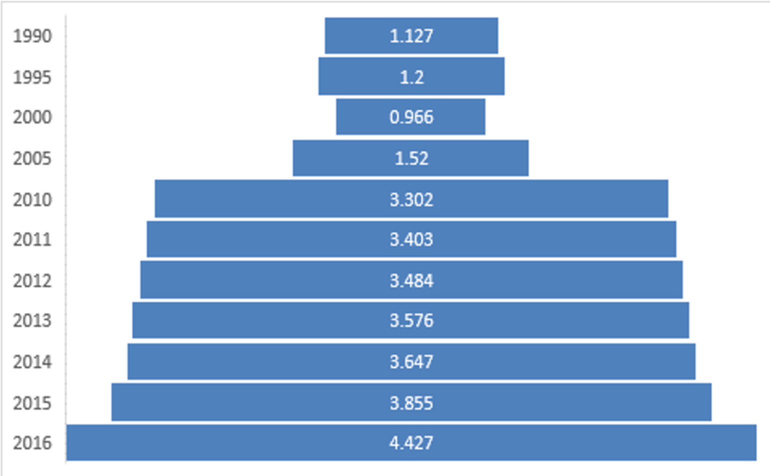


Chart 2-32. Amount of methane gas emitted from industrial wastewater treatment and discharge (thousand tons)

It is worth mentioning that the calculations were performed in accordance with Tier 1 and the "Sea, River and Lake Discharge" factor (0.025 kg CH4/kg COD) was used. In order to more accurately calculate emissions within this category, it is desirable to collect information on wastewater treatment and discharge, depending on the type of industry.

CHAPTER 3. CLIMATE CHANGE MITIGATION POLICIES AND MEASURES

The Republic of Azerbaijan ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and the Kyoto Protocol in 2000. Meanwhile, as a non-Annex 1 country to the Convention, Azerbaijan has made significant efforts to mitigate the effects of greenhouse gases by supporting international initiatives and efforts to combat climate change, although it has not made quantitative greenhouse gas emissions (GHGs) reduction commitments. Meanwhile, the Republic of Azerbaijan signed the Paris Agreement in April 2016 and ratified it on October 28, 2016. In line with the Paris Agreement, the Republic of Azerbaijan submitted its Nationally Defined Contributions (NDC) document to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) in October 2015 and as a contribution to global climate change prevention initiatives, has targeted to achieve 20% reduction in the greenhouse gas emissions (GHG) level by 2030 compared to the 1990 base year.

At present, the obligations of the Republic of Azerbaijan arising from the Paris Agreement of the UN Framework Convention on Climate Change and the fulfillment of these obligations are among the priorities for the Government of the Republic of Azerbaijan. In general, the main goal of the responses taken by countries within the Paris Agreement is to keep the average value of global temperature rise well below 2°C for the next 100 years.

As noted, the country has adopted a Nationally Defined Contribution to achieve 35% reduction in the greenhouse gas emissions (GHG) level by 2030 compared to the 1990 base year (net, including removals).

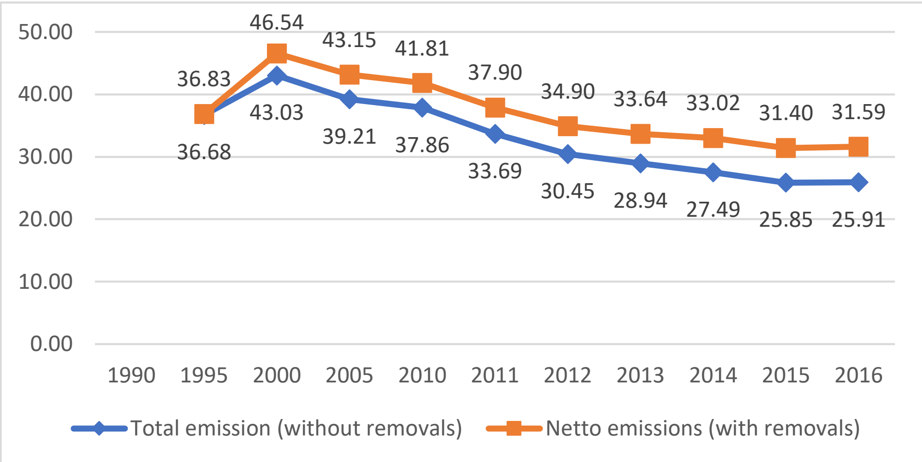


Chart 3-1. Year-by-year decline trend in GHG level compared to the net indicator of 1990 (in %)

As can be seen from chart 3-1, which is based on the relevant inventory data, the downward trend in the GHG level compared to the 1990 net indicator has decreased since 2000 and varied between 46.54% and 31.59% in 2016. Below, the declining trends in GHG levels for individual sectors over the years will be compared with the overall trend (without removals) in chart 3-1, and the share of sectors in GHGs and the role of appropriate mitigation actions in their change trend over the years will be analyzed.

In general, environmental protection issues, including climate change, are reflected in a number of important development priorities and strategies of the Republic of Azerbaijan. For example, a section of the “Azerbaijan 2020: Outlook for the Future Development Concept”[17] that sets out the country’s development priorities until 2020 is entirely devoted to environmental issues. Specifically, Section 11 of the document approved by the Decree of the President of the Republic of Azerbaijan dated December 29, 2012, i.e., in the “Environmental protection and ecological matters” section states: “...The establishment and restoration of forests will increase the share of forests in the total territory of the country, roadside areas and atmospheric air will be protected and trees planted to reduce the noise generated by transport vehicles. The national

[17] https://president.az/files/future_az.pdf

standards on hazardous environmental emissions will be aligned with European standards. The volume of energy consumption and carbon dioxide emissions required to produce an item of the GDP in Azerbaijan will be brought close to Organization for Economic Cooperation and Development requirements, which is important to the implementation of millennium development goals**.** Necessary work will be done to recycle, decontaminate and dispose wastes in order to save on raw materials, use natural resources rationally and protect the environment. Also, law-waste or waste-free technologies will be applied. Progressive waste management techniques will be used, and enterprises established to dispose of industrial and domestic wastes....” The document further states that the country will upgrade the heat supply system: “... A new heat supply system will be established, its coverage area expanded, and new heat supply sources built, which will make the unprofitable boiler shops unnecessary...”

Meanwhile, climate change mitigation issues are reflected in many legal acts. These include the laws of the Republic of Azerbaijan “On the use of energy resources”, “On electricity”, “On energy”, “On electric and thermal power plants”, “State Program on the use of alternative and renewable energy sources in the Republic of Azerbaijan” (October 21, 2004 № 462), State Program on Social and economic Development of the Regions of the Republic of Azerbaijan for 2009-2013, State Program on Social and economic Development of the Regions of the Republic of Azerbaijan for 2014-2018, “State Program on Industrial Development in the Republic of Azerbaijan for 2015-2020”, as well as “State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015”, “Comprehensive Action Plan for Improving the Environmental Situation in the Republic of Azerbaijan for 2006-2010”, “State Program on Social and economic Development of Baku city and its settlements in 2011-2013”, “State Program on Social and economic Development of Baku city and its settlements in 2014-2016”,“ State Program on Development of Fuel and Energy Sector (2005-2015)”, “Transport Sector Development Strategy” (2005), “National Program on Rehabilitation and Enlargement of Forests in the Republic of Azerbaijan, “Development of Alternative and Renewable Energy Sources for 2015-2020”, “State Program on Development of Viticulture in the Republic of Azerbaijan for 2012-2020” and others.

Meanwhile, the climate change mitigation and adaptation issues are reflected in the sectoral strategic roadmaps prepared for the National Economy and key sectors of the Economy and approved by Presidential Decree No. 1138 of 6 December 2016. Specifically, “Strategic Roadmap for the Development of the Oil and Gas Industry (including Chemical Products) in the Republic of Azerbaijan”, “Strategic Roadmap for the Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan”, “Strategic Roadmap for the Development of Utilities (electricity and heat, water and gas) in the Republic of Azerbaijan” and “Strategic Roadmap for the Production and Processing of Agricultural Products in the Republic of Azerbaijan” focus on climate change mitigation issues and envisage specific measures for the period up to 2025 and beyond.

Meanwhile, in September 2015, the Republic of Azerbaijan joined the “Sustainable Development Agenda for 2016-2030”, which was approved at the UN Summit on Sustainable Development in New York and launched the enforcement process for Sustainable Development Goals (SDGs) (17 SDGs, 169 targets and 232 indicators). Seven of the SDGs, namely the SDG 6, SDG 7, SDG 11, SDG 12, SDG 13, SDG 14, SDG 15 directly deal with mitigation of environmental and climate change and other issues, and SDG 8 and SDG 9 touched upon the topic indirectly. For example, the Sustainable Development Goal 13 calls for taking urgent action to combat climate change and its impacts. It is noted in the relevant targets that the development and implementation of new innovative technologies to explore the potential of the green economy and expand its application in all countries is of great importance. The SDG 7 is about ensuring access to affordable, reliable, sustainable, and modern energy for all. Target 7.2 envisages substantial increase in the share of renewable energy in the global energy mix by 2030. Meanwhile, Goal 7.3 calls for doubling the global rate of improvement in energy efficiency by 2030. Target 7.a. envisages enhancing international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology by 2030.

In this regard, the Republic of Azerbaijan is now consistently working to fulfill its commitments to achieve the Sustainable Development Goals. In fact, the Republic of Azerbaijan has concentrated on implementation of 17 Sustainable Development Goals, 107 out of 169 targets and 150 out of 232 indicators. In accordance with the Decree **No.1066 dated 6 October 2016** of the President of the Republic of Azerbaijan, the National Coordination Council for Sustainable Development of the Republic of Azerbaijan[18], in which the leaderships of the relevant state agencies (including the State Statistical Committee) are represented, was set up under the chairmanship of Deputy Prime Minister, its activities were organized efficiently, the tasks lying ahead in this area were specified, national priorities and their indicators that correspond to the global goals and targets and are of importance to Azerbaijan until 2030 were defined, an implementation and reporting mechanism on achieving SDGs at national level was established, and the state programs and strategies covering social and economic areas in the country were brought in line with SDGs.

Meanwhile, in order to obtain updated information on the application of innovative technologies in the country, each government agency prepares a report twice a year in accordance with inquiry forms received from the Cabinet of Ministers in accordance with the relevant decree of the President of the Republic of Azerbaijan.

An important institutional measure to mitigate climate change impacts in the Republic of Azerbaijan is the establishment of the State Agency for Alternative and Renewable Energy Sources (SAARES) by the Decree of the President of the Republic of Azerbaijan dated February 1, 2013. The State Agency on Alternative and Renewable Energy Sources initiated the development of National Strategy on the use of alternative and renewable energy sources in the Republic of Azerbaijan for the 2012–2020 to improve the management system in the alternative and renewable energy in the country. The main goal of the strategy is to produce electricity and heat through the wide-scale use of alternative and renewable energy sources, energy efficiency, increase energy efficiency and ensure sustainable and green energy supply to consumers. Meanwhile, the Agency has prepared “ARES Development Map of the Republic of Azerbaijan for 2020”, “ARES Development Maps of cities and districts of the Republic of Azerbaijan until 2020” and “ARES Management scheme of the Republic of Azerbaijan”.

Meanwhile, the “National Strategy for Improving Solid Waste Management in the Republic of Azerbaijan for 2018-2022” was adopted on November 1, 2018, and internal procedures for the discussion of a number of other documents are underway. Meanwhile, it is to note that the “National Strategy for Low Carbon Development” is currently being developed at the initiative of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan and on the instructions of the Cabinet of Ministers. In general, the use of alternative energy has been identified as a priority for low-carbon measures in the commercial and residential sectors.

It is to note that an important institutional step was made towards achieving the target mentioned in the document of the Republic of Azerbaijan on “Nationally Determined Contributions” (NDC), i.e., 35% reduction in the level of greenhouse gas emissions compared to 1990/base year by 2030, by the Decree of the President of the Republic of Azerbaijan on Amendments to the Decree No. 560 of the President of the Republic of Azerbaijan dated April 30, 1997 “On measures to ensure the implementation of the commitments made by the Republic of Azerbaijan in accordance with the United Nations Framework Convention on Climate Change approved by the Republic of Azerbaijan on 11.03.2020” [19]. In fact, in order to fulfill the obligations of the Republic of Azerbaijan as a party to the UN Framework Convention on Climate Change and other relevant international documents, as well as to achieve the goals of the NDC, a new composition of the relevant State Commission was established in early 2020. Later, an effective working group consisting of specialists from relevant government agencies was established to organize the activities of the State Commission chaired by Deputy Prime Minister. In fact, along with the MENR, relevant specialists from the Ministry of Economy, the Ministry of Energy, the Ministry of

[18] http://sdg.az/
[19] https://president.az/articles/36144

Agriculture, the State Statistics Committee, and other government agencies were involved in the Working Group, and relevant Action Plan was prepared by the Working Group, approved by the Cabinet of Ministers of the Republic of Azerbaijan, and submitted to the relevant government agencies for execution. The first meeting of the State Committee was held on 23.07.2020 and a number of important decisions were made during the meeting, and the State Commission has identified the Ministry of Ecology and Natural Resources as the designated national authority and coordinating body to report the Commission on the actions implemented in regular basis.

Legal framework for measures to reduce GHG emissions

"Although Azerbaijan, as an oil and gas producing country, can continue to live on natural resources, the country's leadership prefers to develop low-carbon production, not in words but in deeds" (Climate Action Network). The country recently adopted legal documents for the development of low-carbon production envisage the following measures as part of sustainable development:

State programs	Actions
"Azerbaijan 2020-Outlook for Future" Development Concept	- Bring the volume of energy consumption and carbon dioxide emissions required to produce an item of the GDP in Azerbaijan close to Economic Cooperation and Development Organization (OECD) requirements; - Build oil, gas and petrochemical complex; - Establishment of technological and industrial parks in the field of industry; - Development of metal industry, aluminum and cement production sectors.
State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015	- Decrease by 20% the conditional fuel used for 1 kw of energy for reducing green-house emissions in the energy sector by 2015; - Increase the proportion of forest areas to total land area to 12.5% by 2015; - Increase the share of protected land area in the total surface area to 12% by 2015; - Achieve treatment of 100% of sewage in the country by 2015; - Achieve 80% recycling and neutralization of solid household wastes in the large cities by 2015; - Capacity building on alternative and renewable energy sources; - minimize any negative impact on the environment from the development of fuel-energy complex; - develop action plan to reduce the amount of greenhouse gases emitted from fuel, energy and heat supply systems; - conduct assessment of the climate change impact, reduce the negative impact of climate change on the ecosystem and the economy; - Installation of gas analyzers in intensive traffic flow areas in order to prevent air pollution by vehicles in Baku and other major cities; - Assess climate change impacts; - Modernize monitoring and early warning systems to reduce the impact of disasters that may be caused by climate change; - Create waste database; - Adapt of the legislative and regulatory framework that regulates the protection of the environment to the requirements of international norms and standards and international agreements to which the Republic of Azerbaijan is a party; - Establish Carbon Fund to finance greenhouse gas reduction measures.
State Program on social and economic development of Baku and its settlements in 2011-2013	- Construction of new power plants, ensure infrastructure changes in the energy sector; - Reconstruction and modernization of existing heating centers; - Development of road transport complexes.
State Program of social and economic development of the regions of the Republic of Azerbaijan in 2009-2013	- Take actions to reduce emissions from industrial enterprises; - Reconstruction of oil and gas production, transportation and processing infrastructure; - Reduce the use of alternative energy sources; - Construction and reconstruction of new types of power plants; - Renovation of distribution and transmission lines and substations; - Take actions to prevent emissions from transport sector.
National Program for	- Application of high efficiency technology at TPP;

Environmentally Sustainable Social and Economic Development in 2003-2010	- Application of modern energy-saving technologies (for production and consumption); - Improve the use of renewable energy sources in rural areas.
State Program on Development of Fuel and Energy Sector in the Republic of Azerbaijan (2005-2015)	- The power delivery network capacity will reach 6,500-7,000 MW by 2015; - Fuel consumption in the thermal power stations will reach 260 g / kWh; - Bring the State share in energy production to 82.3% and the private share to 11.7%; - Reconstruction and construction of thermal power stations; - Use of renewable energy sources.
Transport sector development strategy	- Railway transport - reconstruction of old transport sector in order to increase its capacity, modernization of the existing road and rail infrastructure; - Maritime transport - the expansion of port complex in compliance with the upcoming foreign trade development scenarios, increase the handling capacity in order to provide the export of liquid and container cargo; - Road transport - reconstruction of roads on the transport corridors passing through the country, modernization of regional roads, improving traffic management and control systems, modernization of technical and environmental requirements of the vehicles in accordance with the international standards, development and implementation of standardization and certification systems for cars and urban passenger transports. - Air transport - optimizing the number of international airports, transition of support airports to a single system, technical modernization of air traffic management system in line with modern international standards; - Renewal of transport infrastructure in Baku and other cities - reconstruction and expansion of the roads at the national level, construction of new roads, bridges, road sensors, underpasses, multi-storied and underground parking lots, replacement of small capacity buses with large ones.
National program on restoration and expansion of forests in the Azerbaijan Republic	- Assessment of the current state of forests and reforestation; - Identification of promising areas for new forest gardens; - Identification of fast-growing and quality tree species to be grown in different regions.
State Program for the Development of Industry in the Republic of Azerbaijan for 2015-2020	- Preparation of proposals on the promotion of efficient and environmentally friendly energy technologies. - Expansion of the production of alternative energy installations and equipment; - Realization of necessary measures in order to increase production capacity of Ganja Aluminum Complex; - Construction and commissioning of the production process of iron ore and steel at Azerbaijan Steel Production Complex; - Realization of necessary measures in order to establish a polymer plant at the Sumgayit Chemical Industrial Park; - Commissioning of Urea Plant in Sumgayit; - Development of factories for waste sorting, transporting, and processing; - Completion of infrastructure works in Sumgait Chemical Industrial Park, improvement of the park performance; - Completion of infrastructure works in Balakhani Industrial Park, improvement of the park functioning; - Infrastructure design of High-Tech Park and its functioning; - Creation of industrial park in Ganja, infrastructure design and its functioning; - Creation of industrial park in Mingachevir infrastructure design and its functioning; - Preparation of proposals for the establishment of industrial clusters and implementation of appropriate measures; - Implementation of appropriate measures for the creation of industrial districts.

3.1. Economic instruments

Against the background of falling prices for hydrocarbon resources, which resulted from known fluctuations in the world economy, including in the energy market in 2014-2015, the Republic of Azerbaijan experienced two consecutive devaluations in 2015 and the first-time economic recession in 20 years. Specifically, in 2016, the economic decline was 3.1%. Meanwhile, after several years of economic hardship, the growth rate of the Azerbaijani economy in 2018 reached 1.4%.

Resulted from partial increase in oil production and oil exports, the oil sector increased by 0.6% after a four-year decline. Meanwhile, although the non-oil sector increased by 1.8%, its share in GDP decreased in 2018 compared to 65.8% in 2016 and amounted to 58.5%.

The industrial sector grew by 1.5% after 4.2% decline in 2017. This increase is mainly due to growth in the mining (0.4%) and manufacturing (7.9%) sectors. The launch of the “ShahDeniz” 2 project has led to a 7% increase in gas production. The 4.4% decrease in capital investment in 2018 increased the decline in the construction sector (from 1.5% in 2017) to 9%. However, the growth trend in the agriculture (4.6%), tourism (7.6%) and transport (7.8%) sectors fully compensated for this decline in construction.[20]

In the context of the mentioned, given that the main sources of GHG emissions in the Republic of Azerbaijan are Energy, IPPU, AFOLU sectors, the application of fiscal (tax, customs, etc.) instruments in these sectors is one of the most effective economic tools to reduce GHG.

Wide-scale use of these tools in recent years in the Republic of Azerbaijan to mitigate the climate change impacts and actions taken to stimulate innovative investment in our country, including for stimulating the import of new green technologies, should be commended. Likewise, for example, the official launch of Balakhani Industrial Park with the participation of the President of the Republic of Azerbaijan on 22.09.2017, which was established by the Decree of the President of the Republic of Azerbaijan on 28.12.2011, should be considered an important event in increasing investment in green technologies in the country. Balakhani Industrial Park aims to expand the production of competitive high-tech industrial products in the country, develop the non-oil sector, including the “green economy”, increase employment in the manufacturing sector, improve the ecological situation in Baku and surrounding settlements. The residents of the park, as well as residents of other industrial parks, have been granted a number of benefits by the State. In fact, they are exempt from profit, land, and property taxes for 7 years, machinery, technological equipment and facilities imported for construction of production site and production in the industrial park are exempt from VAT and import duty.[21]

Meanwhile, Sumgayit Chemical Industrial Park (established in 2011), Balakhani Eco-Industrial Park (established in 2011), High Technology Park (established in 2012), Mingachevir High Technology Park (established in 2015) Garadagh Industrial Park (established in 2015), Mingachevir Industrial Park (established in 2015), Pirallahi Industrial District (established in 2016), Neftchala Industrial District (established in 2015), Masalli Industrial District (established in 2016) are other important economic zones where the customs incentives are applied for the private sector. Along with all necessary conditions created for cluster-type economic management activities, business entities are exempt from property, land, corporate income taxes, as well as VAT and customs duties on imported equipment for a period of seven years.[22] Given the current efficiency of new technologies in the world, especially equipment and technological devices imported from Western countries in terms of energy efficiency and low carbon content, the establishment of such economic zones with fiscal incentives can be considered as an economic tool to mitigate the climate change impacts. Also, it would be more effective in terms of mitigating the climate change impacts by offering more favorable conditions for the import of green technologies in these economic zones in the future, for example, the opportunity to benefit from these fiscal benefits for at least 15 years instead of 7 years. In general, the reduction of tax and customs burdens and other incentives are important for new types of entrepreneurships in the Republic of Azerbaijan, including innovative entrepreneurship based on green technologies, and for appropriate investments in the production and export of science-based technologies.[23]

Meanwhile, due to the transition to Euro-4 standards in the Republic of Azerbaijan from 01.04.2014, the banning the import of cars manufactured in the country before 2005 can be considered as a more important economic measure in terms of mitigating the climate change impacts. If, the amount of

[20] https://www.stat.gov.az/
[21] http://www.azerbaijan-news.az/view-131515/yasil-iqtisadiyyat-in-yukselisi
[22] http://www.azpromo.az/investments/industrial-parks
[23] http://customs.gov.az/modules/pdf/pdffolder/42/FILE_A670E1-144B5A-A31A69-BF4041-B615A3-44655D.pdf

carbon monoxide (CO) emitted by cars to travel per kilometer was 2 grams in the Euro 3 standard, in the new standard it is only 1 gram. These economic mechanisms will be discussed in detail in separate sections of the report.

3.2. Sectoral policies to mitigate climate change impacts

3.2.1. Energy sector

Azerbaijan as an oil and gas country has produced oil and gas in industrial way for more than 170 years. In this sense, when talking about mitigation policies and measures in the energy sector, it is necessary to take into account, first, the strategic importance of this sector in the country economy, in the production of GDP.[24] In fact, according to 2017 statistics, the share of the mining industry (mainly the oil industry) in GDP is about 30 percent, and the share of the refining industry is about 12 percent. In this sense, according to the current GHG emissions inventory, the energy sector accounted for about 78.04% of the country's total emissions (without removals) in 2014, compared to 77.73% in 2015 and approximately 78.57% in 2016 (Chart 3-2). This emphasizes the importance of climate change mitigation actions in the energy sector.

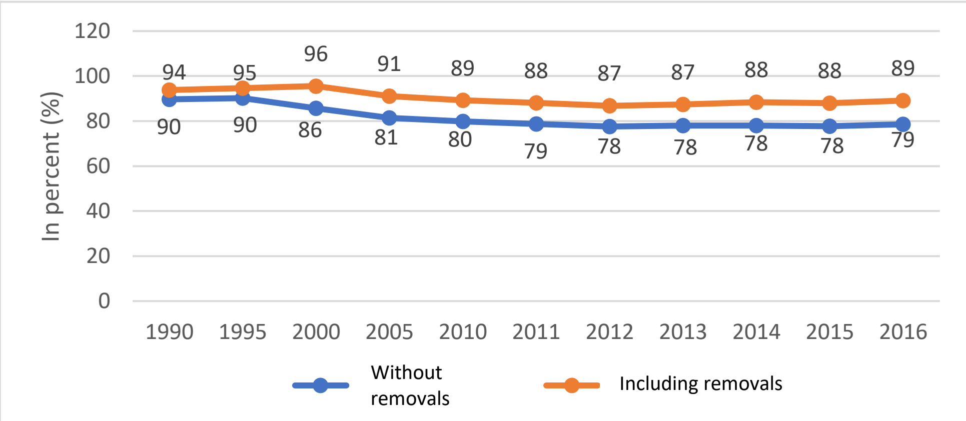


Chart 3-2. Annual trend of the energy sector share in the total GHG volume, in%

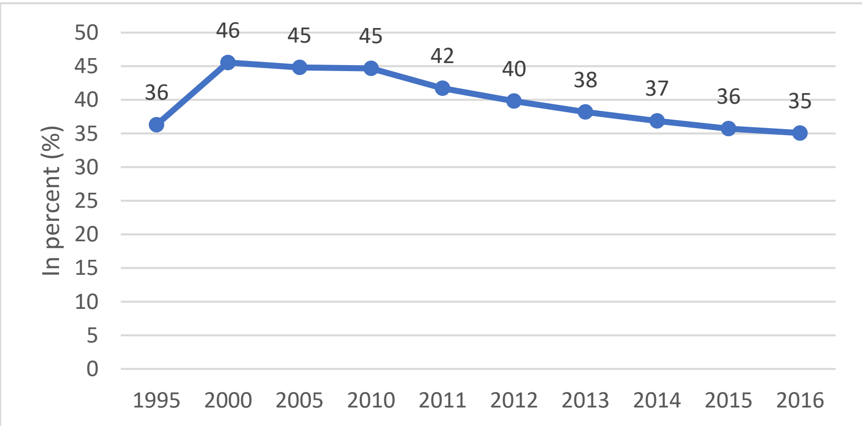


Chart 3-3. GHG emission reduction trend in the energy sector compared to 1990 (without removals), in%

Chart 3-2, prepared in accordance with relevant inventory data, shows annual comparative analysis of the netto (with removals) GHG volume indicator in the country's energy sector compared to the 1990 indicator. In fact, if the decrease in the GHG volume in 1990-2000 was due to the oil production level in the country and the reduction of oil products use for energy purposes, in subsequent years, along with the increase in production, activities related to new technologies applied and technological innovations applied to the collection of associated gas in the oil and gas industry, as well as the transition to the natural gas use instead of fuel oil in thermal power plants and other measures to mitigate the climate

[24] https://elsenbagirzade.files.wordpress.com/2018/03/3-ders-azerbaycan-iqtisadiyyati1.pdf http://www.iqtisadiislahat.org/store//media/ekspert_yazilari/DB_PRESENTATION_FULL_ENG_opt.pdf

change impacts led to certain reductions in emissions. As can be seen from chart 3-3, the 2016 GHG decrease in the energy sector (compared to the 1990 GHG indicator) was 35 percent, while in the same year the overall decrease in all sectors (excluding removals) was 25,91 percent. On the other hand, as shown in chart 3-2, the share of GHG emissions from energy sector in total GHG volume is high. For example, in 2016, this figure was 78.6%. These two points reemphasize the importance of measures to reduce GHG emissions in the energy sector.

In fact, the analysis of chart 3-3 shows that in this sector in 2010-2016, GHG emissions are declining year by year in a downward trend compared to the 1990 figure (without removals). So, for example, if in 2013 this decline was 38% compared to 1990, it further declined year by year to 35% in 2016. The analysis of projections of GHG emission reduction actions in the next chapter shows that the downward trend will further decline.

In general, the fuel and energy sector in the economy of the Republic of Azerbaijan is regulated by the Law of the Republic of Azerbaijan "On Energy" (Baku, November 24, 1998, № 541-IQ) and other legal acts. The Ministry of Energy is the central executive body implementing state policy and regulations in this area and is guided by the Constitution the Republic of Azerbaijan, sectoral laws, decrees and orders of the President of the Republic of Azerbaijan, decisions and orders of the Cabinet of Ministers, and international agreements to which the Republic of Azerbaijan is a party.

Legislative acts of the fuel and energy sector of the Republic of Azerbaijan consist of the following:

- Law No. 439-IQ "On Subsoil Reserves" (February 13, 1998);
- Law No. 541-IQ2 "On Energy" (November 24, 1998);
- Law No. 513-IQ3 "On Gas Supply" (June 30, 1998);
- Law No. 94-IQ "On the use of energy resources" (May 30, 1996);
- Law No. 766-IIIQ "On special economic regime to export oil and gas activities" (February 2, 2009);
- "Rules of gas utilization" (Resolution No. 804 of the Cabinet of Ministers of the Republic of Azerbaijan dated May 12, 2011);
- "General gas supply conditions for gas distributors" (Resolution No. 875 of the Cabinet of Ministers of the Republic of Azerbaijan, May 31, 1999);
- "Rules on protection zones and security measures in gas supply" (Resolution No. 103 of the Cabinet of Ministers of the Republic of Azerbaijan, June 21, 1999)

The Ministry of Energy of the Republic of Azerbaijan is liable to determine the development areas in the energy sector, prepare and implement state programs, develop, and implement concepts, energy security and energy efficiency measures, as well as protect state interests in the relevant field, prepare forecast indicators of production and consumption of individual energy carriers, take appropriate steps to create competitive environment, etc. The Ministry coordinates the activities of state-owned enterprises, as well as organizations that are fully or partially state-owned.

Meanwhile, the Energy Regulatory Agency was established under the Ministry of Energy by the Decree No. 1750 of the President of the Republic of Azerbaijan dated December 22, 2017. The Energy Regulatory Agency, by participating in the development and implementation of legislation, development concepts, target programs in the relevant field, analyzes the proposals received on the prices (tariffs) of electricity and heat, as well as gas and makes proposals on state regulation of those prices (tariffs). Meanwhile, the Agency issues commissioning acts to approve the access of new facilities to the electricity network, sets limits on power outages for consumers, develops mechanisms for compensating consumers by supply company for exceeding the cut-off limits and applies them after approval.

The State Oil Company of the Republic of Azerbaijan (SOCAR) deals with prospecting, exploration and development of oil and gas fields in Azerbaijan, production, processing and transportation of oil, gas and gas condensate, sale of oil and petrochemical products and gas in domestic and foreign markets, as well as natural gas supply to the industry and population. SOCAR has 3 production units, 1 oil and gas refinery, Deepwater Jackets Plant, 2 trusts, 23 entities with the status of legal entities, including 1 institute, and 4 entities with the status of non-legal entities.

In the first years after the independence of the Republic of Azerbaijan in 1991, there was a decline in production due to general technological and economic backwardness, however after the the "Agreement on joint development and production sharing for the Azeri and Chirag fields and the Deep Water Portion of the Gunashli field located in the Azerbaijani sector of the Caspian Sea" ("Contract of the Century") was signed on September 20, 1994 for a period of 30 years, the oil and gas sector started to develop rapidly.[25] This agreement opened up vast opportunities for foreign companies to fully develop these fields in the Republic of Azerbaijan. So far 3.2 billion barrels (approximately 440 million tons) of oil have been extracted from ACG and $ 33 billion has been invested in the project since the agreement was signed. Since 1994, the State Oil Company of the Republic of Azerbaijan (SOCAR) and foreign oil companies have signed in total of 27 agreements on the principle of exploration, production and production sharing of hydrocarbons.

It is to note that on 14.09.2017, an agreement to extend the Production Sharing Agreement for the development of the Azeri-Chirag-Guneshli block until 2050 was signed. As part of the new agreement, SOCAR raised its share in ACG from 11.65% to 25%. In parallel, according to the agreement, international co-venturers will pay a bonus of $ 3.6 billion to the State Oil Fund of the Republic of Azerbaijan (SOFAZ). More than $ 40 billion is expected to be invested in ACG over the next 32 years.

After the discovery of the Shah Deniz gas field in the Caspian Sea in 1999 and the start of production, Azerbaijan for the first time in its history started exporting gas along with full supply of the country's domestic demand for gas. From the Shah Deniz first phase development in 2006, the export of natural gas via the Baku-Tbilisi-Erzurum route (via the South Caucasus Gas Pipeline) to the Georgian and Turkish markets opened a new page in the history of Azerbaijan's energy industry. The final investment decision on the second phase of development of the Shah Deniz field, signed in Baku in 2014, was an important event in Azerbaijan's energy policy as the "Contract of the Century". The second stage of development of the Shah Deniz field (gas reserves are estimated at 1.2 trillion cubic meters) and the Southern Gas Corridor project are considered one of the largest infrastructure projects in the world's oil and gas industry. In fact, as the result of the launch of the Southern Gas Corridor, the Republic of Azerbaijan will closely participate in the diversification of Europe's energy supply. Through the corridor Azerbaijan gas will be transported to the center of Europe for the first time, passing through Turkey, Greece and Albania, covering thousands of kilometers, and will bring some positive changes to the world's energy map. The "Umid" field, discovered by Azerbaijani specialists in 2010, should be considered an important event in terms of presenting Azerbaijan's gas potential to world markets.[26] According to 2016 statistics, the country produced 18.718 trillion m^3 of gas.

As regards with all these energy projects and their impact on the country's environmental security, in 2003 Azerbaijan adopted a National Program for Sustainable Social and economic Development. According to the Action Plan for Ensuring Environmental Sustainability, one of the Millennium Development Goals, the principles of sustainable development have been integrated into public policies and programs.[27]

As an important step towards the development of this sector, relevant work has been done to implement the "**Strategic Roadmap for the development of utilities (electricity and heat, water and gas) in the Republic of Azerbaijan**"[28] approved by the Decree No. 1138 of the President of the Republic of Azerbaijan dated December 6, 2016, "**Strategic Roadmap for the development of the oil and gas**

[25] http://files.preslib.az/site/10il/gl1.pdf

[26] http://files.preslib.az/site/10il/gl1.pdf

[27] http://eco.gov.az/az/1183-azerbaycan-respublikasinda-etraf-muhitin-muhafizesi-istiqametinde-heyata-kecirilmis-tedbirler

[28] http://www.iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf

industry (including chemical products) in the Republic of Azerbaijan" [29] and "**Azerbaijan 2020: Outlook for the Future. Development Concept**".

In fact, within the development of Action 4.1.1 Detailed assessment and preparation development plan for the existing network of the "**Strategic Roadmap for the development of utilities (electricity and heat, water, and gas) in the Republic of Azerbaijan**", "General assessment of existing network. Development Plan" (General Plan) was prepared by "Azerigas" Production Unit and submitted to the Ministry of Energy and the Ministry of Economy of the Republic of Azerbaijan ("General assessment of the existing network. Development Plan"). In order to reduce the negative impact on the technical condition of the gas distribution system and increase consumer satisfaction, the "Gas Export" Department has prepared a relevant **"Action Plan"** on treatment of natural gas supplied to the network **consisting of 19 items covering the years 2017-2020**. The main goal of measures 4.1.2 and 4.1.3 **in the mentioned document** is to bring the level of gas losses to the required minimum, to conduct major reconstruction in the gas distribution network. According to preliminary estimates, for the major reconstruction of gas supply systems in Baku and Absheron district (Project 1) - 3.67 billion manat, and in 22 cities and district centers with the highest gas loss (Project 2) 1,2 billion manat investment will be required.

The Republic of Azerbaijan has identified its national development priorities and strategies for the implementation of measures in 2018 within the framework of the "**Azerbaijan 2020: Outlook for the Future**" Development Concept and has addressed the issue of environmental protection as one of the main priorities. In fact, one section in the "Azerbaijan 2020: Outlook for the Future" Development Concept, which defines the country's development priorities until 2020, is devoted separately to environmental issues. The concept document states: "During the period covered by the concept, it is planned to bring the amount of energy used for the production of one unit of GDP and the amount of carbon dioxide in line with the appropriate indicator of member countries of the Organization for Economic Cooperation and Development, and this is important in terms of implementing the development goals of the millennium."

Within the framework of the Eastern Europe Energy Efficiency and Environment Partnership, meetings were held with representatives of the E5P Foundation, the Swedish Embassy, the European Bank for Reconstruction and Development and the European Union to discuss cooperation opportunities in investing in energy efficiency and climate change mitigation.

The project document prepared jointly with 'Gazprom Germany' for the implementation of the Low Pressure associated Gas Utilization Project in the Oil Rocks OGPD within the CDM (Clean Development Mechanism) has been submitted to the Kyoto Protocol Executive Board for registration and is currently under review. Upon completion of the installation works, 200 million cubic meters of associated gas will be prevented from being released into the atmosphere. In order to implement the project "Replacement of incandescent lamps in SOCAR's lighting system with energy-efficient lamps", an inventory was conducted, and the project document was registered with the Ministry of Ecology and Natural Resources. Discussions are underway with foreign partners to register the document with the UN Executive Council as a CDM project. Implementation of this project will lead to reduction of 34,000 tons of carbon dioxide per year in SOCAR. Participation in the CDM mechanism and detailed information on NAMA projects will be provided in the following sections.

Significant work is underway at SOCAR's processing plants to implement measures to accelerate the transition to Euro-4 standards in order to improve the environmental situation in the country. As part of the reconstruction of the Baku Heydar Aliyev Oil Refinery, the implementation of projects aimed to upgrade existing technological facilities, increase production capacity, and improve the environment has been accelerated and several projects have been launched. In order to accelerate SOCAR's works to reduce the impact of climate change on in 2010, the "Associated gas reduction plan for SOCAR,

[29] http://www.e-qanun.az/framework/34254

Operating Companies and Joint Ventures" for 2010-2015 and the "SOCAR Climate Reduction Plan" for 2010-2020 have been prepared. The strategy document envisages activities to reduce the release of low-pressure associated gases into the atmosphere, increase energy efficiency in technological processes, make transition to low-carbon energy, implement greenery measures, use alternative and renewable energy, etc.

The Ministry of Energy undertakes measures to ensure environmental safety and environmental protection in the field of fuel and energy in a planned and coordinated manner with the Ministry of Ecology and Natural Resources and government agencies participating in the complex. To increase the effectiveness of measures, the joint activities of all relevant government agencies are provided.[30]

Meanwhile, the following actions were undertaken in 2017 within the "Strategic Roadmap for the development of utilities (electricity and heat, water, and gas) in the Republic of Azerbaijan", which were approved on 06.12.2016.

Participation in the CDM mechanism

Azerbaijan approved the United Nations Framework Convention on Climate Change (UNFCCC) in 1995, and the Kyoto Protocol in 2000. As non-ANNEX 1 country Azerbaijan did not have quantitative commitments to reduce greenhouse gases, but as developing country participated in the Clean Development Mechanism of the Kyoto Protocol. For the improving of the institutional structure the State Commission on Climate Change, Center for Climate Change in MENR and Designed National Authority (DNA) on the Kyoto Protocol were established. Currently, 6 CDM projects in the Energy and Waste sectors have been registered by the CDM Board. Two projects passed the validation process (oil and gas sector) and around 40 Project Idea Notes (PIN) covering different areas of the economy have been prepared. Approximately 19 million tons of CO_2-eq of emission reduction annually is expected through these projects.

The registered projects are given in the following table:

Projects	Registered
"Yeni Yashma Wind Park" №4822/	23.05.2011
"AZDRES Energy Efficiency" №5574	20.08.2012
"Baku - From Waste to Energy" №7658	10.10.2012
"Balakhanı Dump" №8181	12.11.2012
" United Periodic Energy Station - South" №4884	23.12.2012
"Sumgayit Periodic Energy Station" №3836	16.02.2013

Table 3-1.

Implementation of NAMA project

The GEF-supported Nationally Appropriate Mitigation Action on the low-carbon end-user sectors in Azerbaijan has three sub-components:

(a) Green Building Program;

(b) Sustainable Transport Program;

(c) Associated Gas Collection Program.

[30] http://minenergy.gov.az/index.php/az/10/nazirliyin_aparati.html

The development of this project was funded by the Global Environment Facility. However, SOCAR has spent about $ 35 million on the project.

Picture 3-1.

The project helps implement SOCAR's Climate Change Reduction Strategy and expand GHG reduction measures in three areas.

In fact, as the result of joint activities, the administrative area of the project under the (a) Green Building Program component with a total area of 10,000 m^2 was equipped with energy-efficient equipment and environmental facilities, including energy-efficient windows, underfloor heating, ventilation, and thermal insulation systems. The audit results in buildings showed that the measures taken led to reduction in carbon dioxide emissions in buildings by 200 tons and a 35% reduction in energy consumption. It is to note that a total of 2,500 people is expected to benefit from these buildings each year.

The international consultant on Project component (b) worked closely with Local Experts and the Project Team in general to apply new methods to modernize SOCAR's Transport Fleet. As the result, hybrid cars were presented to SOCAR's Transport Park. On 02.03.2017, 4 (four) hybrid cars were presented to SOCAR by UNDP within the NAMA project. The engines of these cars convert the energy produced by combustion into electrical energy. As the result of the use of such cars, fuel consumption and environmental pollution are much lower than conventional vehicles. As continuation of this work, the procedures for obtaining an "Eco-driving Simulator" to train drivers of SOCAR's Transport Park are close to completion stage. It is planned to be used as an example to the private sector, as well as a pilot for the Energy Efficiency Strategy.

Picture 3-2.

Meanwhile, Eco-driving training was conducted by an International Consultant for 12 selected SOCAR drivers. Local Experts also continue to train drivers, and to date, more than 80 drivers have been trained. It is to note that as the result of the activities, 10-15% savings in fuel consumption are expected, and up to 1,200 drivers will be trained annually in environmentally friendly driving.

Meanwhile, under the third component of the Project, from the collection of associated gas released into the atmosphere during SOCAR's oil and gas production, about 600 households with a population of 2,500 people in about 12 villages of Siyazan district will be provided with clean gas. In fact, activities on the collection and processing of associated gas in 63 wells in the Zagli-Zeyva field of the Siyazanneft OGPD have been started, and the project envisages the collection of 6.8 million cubic meters of associated gas per year.

Electricity generation

The volume of electricity generation capacity in the country in 2014 was 7348 MW, in 2015, as the result of the partial closure of the Shirvan power plant, this figure decreased by 600 MW. On average, more than 18 billion kWh of electricity is generated annually, of which 90% fell to thermal power plants and 10% to hydropower plants. At the end of 2018, the total capacity of the electricity system of Azerbaijan was 7141 MW. As of 2019, the total capacity of the electric power system was 7546,565 MW, and the capacity in the country is shown in the following table:

Electricity generation	MW	%
AzerEnerji OJSC	6453.3	85.51
Independent	849.365	11.25
Nakhchivan AR	243.9	3.23
Total	**7546.565**	**100.0**

Table 3-2.

Electricity generation plants	%	MW
Thermal Power Stations	83.1	6270.9
Large Hydroelectric Power Stations	14.7	1109.5
Small Hydroelectric Power Stations	0.3	24.960
Wind Power Stations	0.9	66.040
Solar Power Stations	0.5	37.165
Bio Energy Stations	0.5	38.000
Total	**100.0**	**7546.565**

Table 3-3.

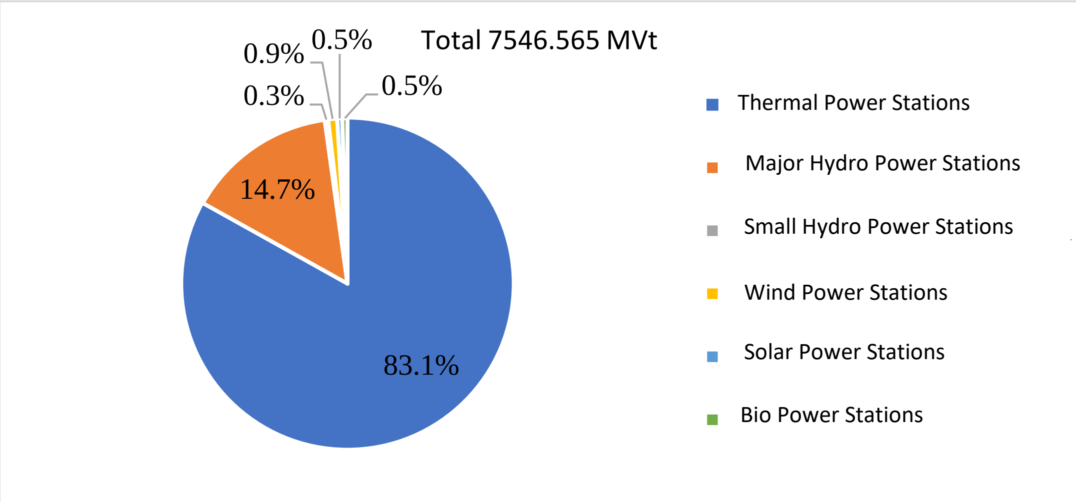


Chart 3-4. Electric power systems installed capacities in the Republic of Azerbaijan (data for 2019)

There are 14 thermal power plants with a total installed capacity of 6270.9 MW (83% of the total power system capacity), 20 hydropower plants with a total capacity of 1134.46 MW (15% of the total power system capacity) (10 of them are small hydroelectric power stations). Alternative and renewable energy sources will be discussed in a separate section below.

The following measures taken in the electricity sector over the past period have given impetus to the emergence of low-waste production:

1. Rehabilitation of obsolete power plants;
1 Construction of new high energy efficiency stations;
2 Reconstruction of transmission and distribution networks;
3 Improving energy efficiency in the demand sector;
4 Construction of power plants based on renewable energy sources;
5 Improving tariff policy.

Promising development areas of this field, including policy and strategic goals, indicators and conditions for their implementation leading to reduction of GHG emissions from existing sources are included in the "**Strategic Roadmap for the Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan**" (Presidential Decree dated 06.12.2016 approved by).[31/32]

Due to the obsolescence of existing stations and infrastructure, it's necessary to upgrade them and expand the construction of modern low-intensity GHG stations, as well as alternative and renewable energy stations. In fact, the average service life of a natural gas plant is about 25 years. For example, in 2014, 56% of the electricity production of the Republic of Azerbaijan was provided from stations operating for more than 30 years. 14% of the production capacity was produced at the stations with a service life of 10-30 years. This makes it necessary to invest in some of these facilities in the coming

[31] http://iqtisadiislahat.org/store//media/documents/SYX/_A%C4%9F%C4%B1r_senaye_ve_ma%C5%9F%C4%B1nqay%C4%B1rman%C4%B1n_inki%C5%9Faf%C4%B1na_dair_strateji_yol_xeritesi.pdf
[32] http://iqtisadiislahat.org/store//media/documents/SYX/_A%C4%9F%C4%B1r_senaye_ve_ma%C5%9F%C4%B1nqay%C4%B1rman%C4%B1n_inki%C5%9Faf%C4%B1na_dair_strateji_yol_xeritesi.pdf

years. Reconstruction and modernization can extend the life of these stations. In fact, the Azerbaijan Thermal Power Plant, with a capacity of 2,400 MW or about one third of its production capacity, has recently been modernized. In this regard, the “Rehabilitation Program” was adopted in autumn of 2018. Within the framework of this program, AzerEnergy OJSC implemented repair and restoration works at the Baku power plant with a capacity of 104.4 megawatts at the end of 2019, as well as in the regions, to restore the “lost” 20 MW of power and increase reliability and sustainability. Along with the production of energy at the station, complex work has been carried out concerning the transmission of power and problems have been eliminated in four 110-kilovolt high-voltage overhead lines from the station.[33] Meanwhile, 2 out of 10 units at the Sheki Power Station did not work at all due to the collapse of their body, and the remaining 8 units operated with deficit. Consequently, despite the fact that the installed capacity of the Sheki Power Plant is 87 megawatts, it operated with only 40 megawatts of power and with frequent stops. 10 units, including 2 units with collapsed bodies were repaired, and after the replacement of spare parts, the station now operates at a capacity of more than 80 megawatts.

It is to note that, “AzerEnergy” OJSC, along with “Baku” and “Sheki” power plants, conducts reconstruction and repair work in 12 electric power plants, including 4 other modular power plants (“Sangachal”, “Khachmaz”, “Astara” and “Shahdag”) to restore the “lost” power. So far, totally 485 megawatts of “lost” power have been restored. As part of the rehabilitation program, which cover 2018-2021, totally about 1,000 MW of “lost” power is planned to be restored.[34]

For regulation of relations among producers, transmitters, distributors, suppliers and consumers in the field of electricity and heat energy, as well as gas supply in the Republic of Azerbaijan, analysis of enterprises, submission of proposals on restructuring measures, development of incentives for investment, engineering and communication systems and services and in order to organize the control over the observance of quality requirements, the “Energy Regulatory Agency” with the status of a public legal entity was established under the Ministry of Energy of the Republic of Azerbaijan by the Decree of the President of the Republic of Azerbaijan dated December 22, 2017. The Energy Regulatory Agency, participate in the preparation and implementation of legislation, development concepts, target programs in the relevant field, analyzes the proposals received on the prices (tariffs) of electricity and heat, as well as gas and makes proposals on state regulation of those prices (tariffs). Meanwhile, the Agency issues commissioning acts to approve the access of new facilities to the electricity network, determines the limits on power outages, develops compensation mechanisms for consumers to exceed the cut-off limits of the supply company and applies them after approval. It takes measures to ensure quality and efficient service to consumers.

In 2015, the generating capacity of power plants was about 6,748 MW, and the reserve capacity was about 34 percent[35] (chart 3-5). Meanwhile to the planned investments to provide sufficient electricity supply over the next 5-10 years, investments will be made to increase production to 1,000 MW. By these investments, the existing production capacity is expected to increase by 19 percent between 2015 and 2020, which is a level that will ensure safe reserve capacity[36] (if there is a steady growth in consumption).

[33] https://azertag.az/xeber/Baki_elektrik_stansiyasinda_temir_berpa_isleri_aparilir-1348875
[34] https://report.az/enerji/azerEnerji-seki-elektrik-stansiyasinin-itirilmis-gucunu-berpa-e/
[35] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf
[36] see, previous reference

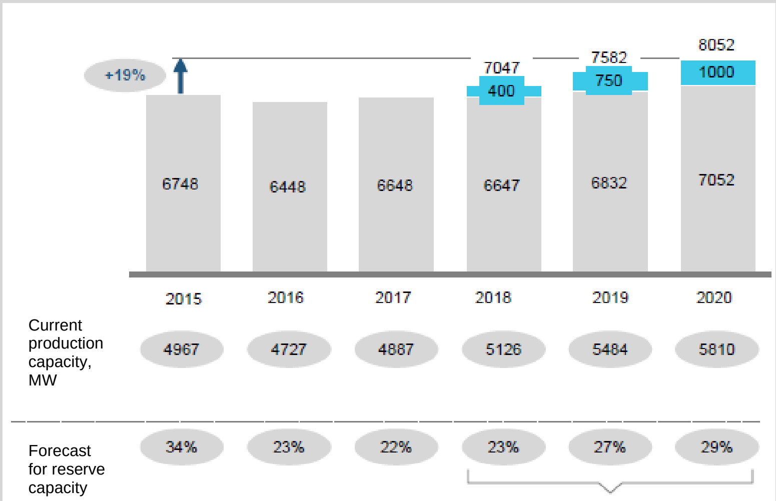


Chart 3-5. Attracting new investment to build production capacity of 1000 MW
(Source: State Statistics Committee, "AzerEnergy" OJSC, World Bank)

In recent years, the country's economic development level and electricity consumption have lagged behind the increase in electricity production. During 2010-2014, the country's GDP amounted to 75.2 billion US dollars, an annual increase of 9.2 percent. During this period, electricity consumption increased by 7.8 percent per year, but the increase in production in the initial designed volume was 2.8 percent, i.e., at low rate. In other developing countries, however, the growth rate of electricity consumption is largely in line with the increase in production, far exceeding GDP growth.

At present, the reserve capacity of the total electricity production in the Republic of Azerbaijan is quite high compared to other countries. The current volume has increased by 1 percent[37] per year (chart 3-6). However, electricity consumption is expected to increase significantly in the coming years due to the high rate of overload at peak times since 2009. Consequently, given that the reserve capacity decreased from 46 percent in 2009 to 34 percent in 2015, the reserve capacity is projected to decrease to 14 percent by 2020. This is below the internationally accepted 25 percent security level.[38]

Chart 3-6. Existing potential defined as increasing initial capacity due to specific load factors
(Source: State Statistics Committee of the Republic of Azerbaijan, "AzerEnergy" OJSC)

The downward trend in electricity generation capacity, in particular the fact that production volumes and electricity consumption during peak hours remained at the same level, was due to a lack of investment. In fact, in 2014, compared to 2011, the volume of annual public investment in electricity production (production, transmission and distribution of electricity) decreased by 42 percent.

[37] see, previous reference.
[38] see, previous reference.

Despite the fact that electricity production requires significant capital investments, the volume of investments in energy production decreased during this period and amounted to 5.6% of total investments. The investments decreased, especially in 2015-2016.

The obsolescence of existing stations and infrastructure has increased the need for reconstruction works and construction of new stations. Although the average service life of the natural gas station is 25 years, in 2014, 56% of the electricity production of the Republic of Azerbaijan was achieved at the stations operating for more than 30 years. 14% of the production capacity was produced at the stations with a service life of 10-30 years. This makes it necessary to invest in some of these facilities in the coming years. Reconstruction and modernization can extend the life of these stations. In fact, the Azerbaijan Thermal Power Plant with a capacity of 2,400 MW, which uses about a third of its production capacity, has recently been modernized. However, experts predict that there will be a need for additional modernization over the next five years.

Meanwhile, the year of 2017 was declared the year of restoration of 0.4 kV network and accounting by "Azerishig" OJSC. Work in this regard is underway in 181 villages and settlements of 51 districts in the country and has been completed in 29 villages. The electricity registration system of 16,600 subscribers has been reconstructed. For this purpose, more than 1000 km of self-supporting insulated wires were installed. These measures, funded by the Asian Development Bank, are still ongoing. 2313 km of self-supporting insulated wires were installed in 142 villages of 13 districts in the country, and the registration system of 58900 subscribers was restored. In order to reduce losses, technical and organizational measures were undertaken, first of all, networks with the highest electricity losses were selected and designed, power centers in accordance with the voltage limits, and distances of power transmission lines were built in accordance with standards. Measures have been undertaken to distribute the loads symmetrically, and the voltage type of the electric networks has been changed in accordance with the required loads. Work is underway in this area (2017-2020). Meanwhile, in many countries around the world, changing the price of electricity in the utilities sector to meet demand is a standard practice that reduces the level of consumption. Non-differentiation of prices during the day in the Republic of Azerbaijan results in inefficient balance of supply and demand (chart 3-7). Adjusting prices for different times of the day regulates the daily load schedule, as well as stimulates the use of electricity when prices are low, making peak load levels low and reducing the need to invest in additional volume. In this regard, it is advisable to apply different electricity tariffs to different times of the day (night and day) to reduce overload during peak hours.[39]

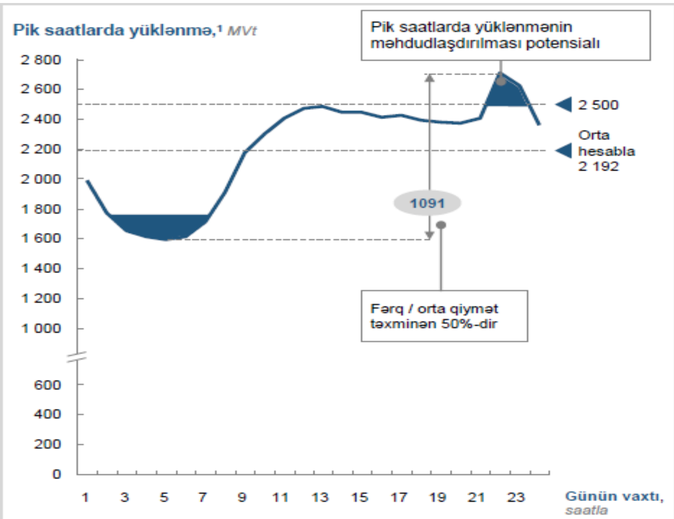


Chart 3-7. Influence of day and night tariffs on daily load indicators (Load indicator at peak hours as of June 17, 2015) (Source: "AzerEnergy" OJSC)

[39] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf

Many developed countries and others apply different tariffs to different times of the day to save electricity and minimize overload. In fact, electricity is supplied to consumers at an average price at midnight, and at the highest price during "peak load" hours (approximately at 17:00-22:00) [40]. The following chart 3-8 shows the historical, base, high and low power demand forecast scenarios for peak power consumption in the country and presents their comparative analysis:

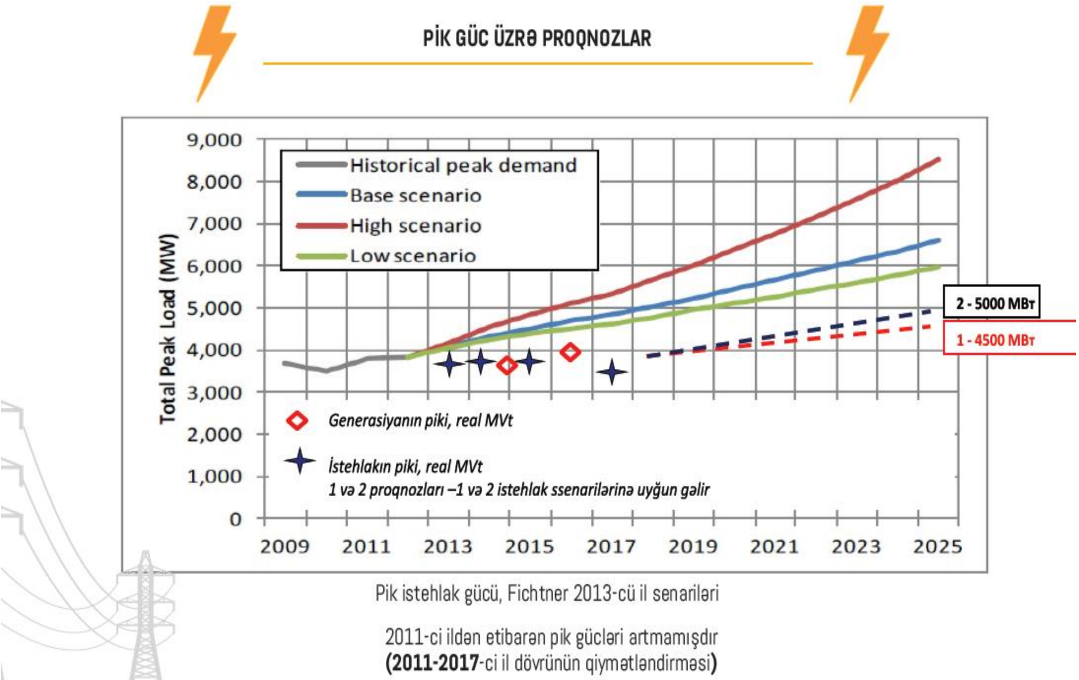


Chart 3-8. Forecast scenarios for peak loads

Meanwhile, the **household's** electricity consumption in the Republic of Azerbaijan raised from 5,755 million kWh in 2010 to 7,292 million kWh in 2014 (7,938 million kWh in 2015), which means 6 percent annual increase. However, the total number of households increased slightly, i.e., about 1.3 percent per year (chart 3-9).

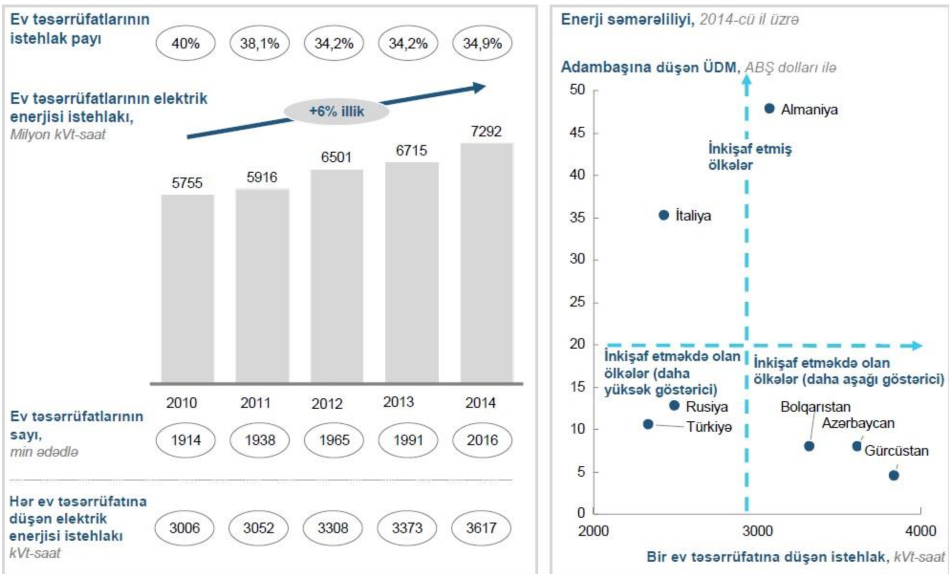


Chart 3-9. Households' electricity consumption and energy efficiency trend

[40] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf

In general, the volume of electricity consumption of the population in the Republic of Azerbaijan is high compared to both developing and developed countries. The following chart shows the scenarios for the use of electricity in the country:

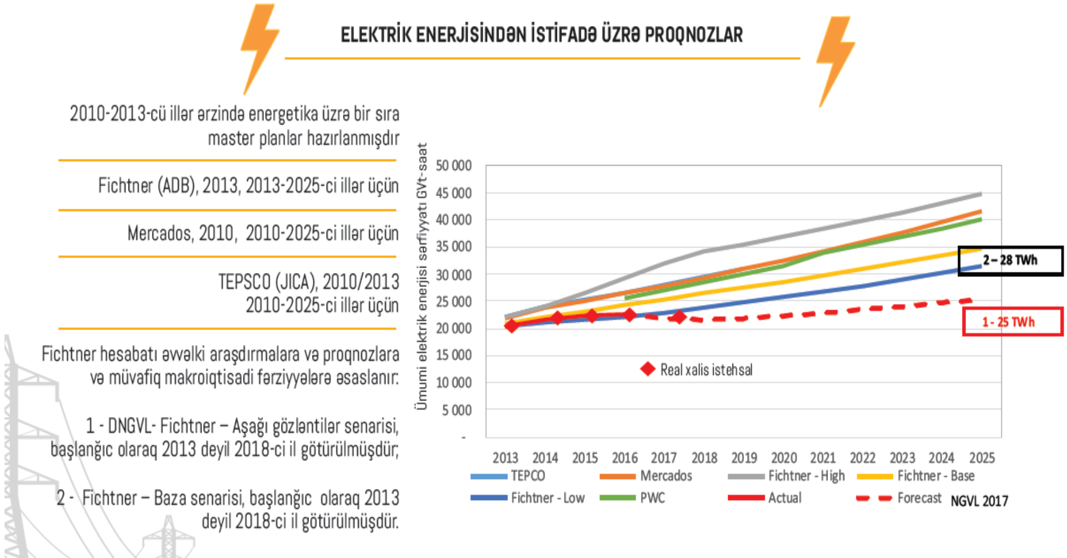


Chart 3-10. Forecast scenarios on use of electricity

Also, the industrial sector is one of the most intensive areas of energy consumption. According to different international classifications, the industrial sector in the world includes more than 300 industries and sub-sectors, and the share of industry in the world economy is about 30 percent, and 40 percent of world **energy consumption** falls on this sector.[41] Electricity prices in the Republic of Azerbaijan are lower than in comparable countries, as well as in a number of **industrial enterprises** (steel and aluminum production), as well as in households (population groups). In fact, the price paid by industrial enterprises for electricity in the Republic of Azerbaijan is 73 percent lower than the price in Turkey and about 50 percent lower than in Russia (based on electricity prices for the Republic of Azerbaijan as of December 1, 2016).[42]

Meanwhile, Priority 7.1.2 of the "**Strategic Roadmap for the Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan**" (approved by the Decree of the President of the Republic of Azerbaijan dated 06.12.2016) states that 'Azerbaijan has the most competitive energy prices in the region, which opens up broad opportunities for its heavy industry and machine manufacturing sector. To manage Azerbaijan's energy sector so as not to invest excessively, the most suitable method is to ensure correct peak energy management and projection.'[43]

Meanwhile, the document states that 'use of energy at peak and non-peak hours is not at an optimal level'. In 2015, the industry electricity price in Azerbaijan was USD 3.1 kopek per kilowatt hour (**in chemical and aluminum industry enterprises, iron-ore based steel factories which have energy supply through 35 and 110 kilowatt electrical cables, with stable daily energy demand and average monthly energy consumption not less than 5 million kilowatt per hour**). This indicator is 2-3 times higher in other regional countries. There are multiple considerations related to Azerbaijan's energy price structure for the energy-intensive industries of the heavy industry and machinery-manufacturing sector. Tariffs that are fixed based on the capacity allocation of the enterprise enable equitable pricing. The reason is that the price is determined based on total capacity needed to operate. It is worth noting that the goal of tariff review should not be to 7 increase prices but to ensure that energy producers and consumers can use non-peak time options more efficiently and to investigate the opportunities of applying flexible and differentiated pricing at peak and non-peak times.

[41] http://iqtisadiislahat.org/store//media/documents/SYX/_A%C4%9F%C4%B1r_senaye_ve_ma%C5%9F%C4%B1nqay%C4%B1rman%C4%B1n_inki%C5%9Faf%C4%B1na_dair_strateji_yol_xeritesi.pdf
[42] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf
[43] http://iqtisadiislahat.org/store//media/documents/SYX/_A%C4%9F%C4%B1r_senaye_ve_ma%C5%9F%C4%B1nqay%C4%B1rman%C4%B1n_inki%C5%9Faf%C4%B1na_dair_strateji_yol_xeritesi.pdf

In fact, given that natural gas is used as the main raw material for electricity generation in the country, the issue of proper management of electricity during peak hours can ultimately significantly reduce GHG emissions.

In terms of cost-benefit analysis, the power management method can be applied in power plants during peak hours and can change the production cycle from peak hours to non-peak hours in exchange for additional discounts. The arrangement of works in this form will be mutually beneficial, which will significantly reduce the financial costs of electricity infrastructure.

For example, Action 1.2.2: Stimulate energy use at non-peak times states that ‘In order to direct industries to use of energy at non-peak times, proposals on different incentives and privileges will be developed’.[44]

Heat supply

In accordance with the Order of the President of the Republic of Azerbaijan No. 847 dated June 8, 2005 “On improving the management in the field of heat supply in the Republic of Azerbaijan”, “Azeristiliktechizat” OJSC was established [45]. The company is working to identify measures to stimulate the expansion of the application of technologies that allow to save energy and increase energy efficiency in the heating system of residential houses and buildings, educational and health facilities and other social facilities in Baku and the regions of the country. As mentioned in the “**Strategic Roadmap for the Development of Utilities (Electricity and Heat, Water and Gas) in the Republic of Azerbaijan**”[46], ‘Modern boiler and heating network equipment, manufactured in European countries and fully meeting energy-saving and environmental requirements, were installed in newly built and modernized boiler houses. These boiler houses substantially surpass their predecessors in terms of reliability and safety requirements, and they are fully automated.’[47]

Since the establishment of "Azeristiliktejhizat” OJSC, as the result of the public investments in the restoration and refurbishment of heat supply systems,166 new heat supply sources were created, 108 obsolete boilers were upgraded by installing modern equipment, 57 heating stations fed from district boiler houses were refurbished and transformed into modern boiler houses, 271 gas service installation projects were implemented, and heating systems of more than 350 educational and healthcare institutions were refurbished and restored in Baku city and regions of the Republic.

Currently, due to operating 531 boiler houses in heating enterprises, 3568 residential buildings, 276 schools, 154 kindergartens, 151 healthcare institutions, and 603 other social facilities are supplied with heat, which has enabled to increase the number of heating sources by 365 pcs or 3,2 times, heat supplied residential buildings by 2580 pcs or 3,6 times, schools by 130 pcs or 1,9 times, kindergartens by 70 pcs or 1,8 times, healthcare institutions by 90 pcs or 2,4 times, other facilities by 512 pcs or 6,6 times as compared to 2004-2005.

The development trends of centralized heating system can be clearly seen in the table below[48]:

[44] http://iqtisadiislahat.org/store//media/documents/SYX/_A%C4%9F%C4%B1r_senaye_ve_ma%C5%9F%C4%B1nqay%C4%B1rman%C4%B1n_inki%C5%9Faf%C4%B1na_dair_strateji_yol_xeritesi.pdf
[45] http://azeristilik.gov.az/content/az/30
[46] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf
[47] see, previous reference
[48] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf

Indicators	Season	Boiler houses	Residential buildings	Schools	Kindergartens	Healthcare institutions	Other facilities
Number of consumers supplied with heat, pcs	2004-2005	166	988	146	84	61	91
	2005-2006	202	1519	176	111	70	112
	2006-2007	234	1750	218	124	97	131
	2007-2008	312	1933	277	123	127	203
	2008-2009	310	2072	242	141	126	225
	2009-2010	329	2187	244	153	133	265
	2010-2011	352	2305	262	164	142	270
	2011-2012	362	2561	266	158	131	310
	2012-2013	436	2819	268	145	135	363
	2013-2014	508	3142	275	156	147	421
	2014-2015	525	3450	286	160	157	553
	2015-2016	531	3568	276	154	151	603
Difference from 2004-2005		3,2 times	3,6 times	1,9 times	1,8 times	2,4 times	6,6 times

Table 3-4. Development dynamics of centralized heat supply system (Source: "Azeristiliktechizat" OJSC)

Modern boiler and heating network equipment, manufactured in European countries and fully meeting energy-saving and environmental requirements, were installed in newly built and modernized boiler houses.

Company experts conducted a feasibility study relating to the application of "Module" type portable boiler house, Portable Cascade Type Boiler House (PCBH), and "Kombi" type heating systems and, after obtaining all approvals in compliance with the legislation, launched its application based on a certificate of conformity issued by the State Committee of Standardization, Metrology, and Patents of the Republic of Azerbaijan. These boiler houses also play a crucial role in solving heat supply problem of the medium and small size residential buildings, healthcare, and education institutions. Thanks to the measures taken, heat was provided to 3,800 residential buildings, 291 schools, 150 kindergartens, 159 healthcare facilities and 1,300 other social facilities by 550 boiler houses, which means 384- or 3.3-times increased heat sources, 2812 or 3.8 times more residential buildings, 145 or 2 times more schools, 66 or 1.8 times more kindergartens, 98 or 2.6 times more healthcare facilities, and 1209 or 14.3 times more other facilities in 2018-2019 compared to 2004-2005.

Energy efficiency and use of renewable energy sources

The development trends of this important area are reflected in a number of strategic documents, including the "Azerbaijan 2020: Outlook for the future" Development Concept[49]. In fact, the document states the necessity in modernization of the oil-gas and petrochemical sectors, diversification and development of the non-oil industry, broader use of alternative and renewable energy. In an effort to accelerate the use of alternative (renewable) energy, stimulating measures will be taken, institutional environment developed, scientific and technical potential reinforced, personnel training continued, and awareness campaigns carried out for energy consumers. Meanwhile to state-funded projects in this area, private sector involvement will be encouraged, and flexible procedures put in place to regulate alternative energy tariffs.

It is to note that the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan (SAARES) was established by the Decree of the President of the Republic of Azerbaijan dated February 1, 2013 as a central executive body that carries out state policy and its regulation and efficient use of it in the field of alternative and renewable energy in Azerbaijan, effective organization of activities on alternative and renewable energy sources, coordination of activities in this field and state control. Its responsibilities include the implementation of tasks arising from the normative activity in the relevant field, the preparation and implementation of state programs and development concepts, the use of renewable energy resources in different zones of the Republic of Azerbaijan, as well as to

[49] https://president.az/files/future_az.pdf

determine the potential of solar, wind, biomass, thermal waters, water flows, various types of waste and other similar sources and the main directions for their use, to prepare forecast indicators of production and consumption in the relevant field, to submit them to relevant state bodies, to exercise state control view and so on.

The regulatory laws in this area are:

- Law No. 541-IQ2 “On Energy” (November 24, 1998);
- Law No. 94-IQ “On the use of energy resources” (May 30, 1996);
- Law No. 459-IQ “On Power sector” (April 3, 1998);
- Law No. 784-IQ “On Electric Power and Heat Stations” (December 28, 1999);
- Law No. 177-VQ “On implementation of investment projects on construction and infrastructure facilities on the basis of special financing” (March 15, 2016)

During the past period, important work has been done in the Republic of Azerbaijan to improve the legal framework governing the ARES field. Meanwhile, the following work has been performed to achieve energy efficiency in the production of electricity and heat and significant savings in the use of energy resources, as well as to provide consumers with reliable, safe, and sustainable electricity and heat.

In order to regulate energy efficiency measures, a draft Law of the Republic of Azerbaijan “On Rational Use of Energy Resources and Energy Efficiency” was prepared and submitted to the Government with the support of the Energy Charter within the EU4Energy Programme launched in 2016.

Relevant draft Order of the President of the Republic of Azerbaijan “On accelerating reforms in the energy sector of the Republic of Azerbaijan” was prepared in accordance with paragraph 2.8 of the Order of the President of the Republic of Azerbaijan dated December 22, 2017, No. 3535 “On additional measures in the field of alternative and renewable energy sources”.

On the basis of amendments to the Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 71 of March 2, 2018 No. 191 of December 16, 2009, preparation of documents on increasing the share of alternative and renewable energy sources in the total electricity generation capacity, as well as the improvement of the regulatory framework which governs the field of alternative and renewable energy in terms of attracting private investments, the application of preferential tariffs and other incentives has been started. For this purpose, DNV GL Energy Advisory GmbH as a consulting company won the relevant tender held;

The draft “Rules for determining the zones and connection capacity of renewable energy sources, holding tender for the use of connection capacity, signing and implementation of agreement on the use of zone, purchase and payment of electricity, protection of zones and infrastructure construction” was prepared.

The following draft legislative acts have been prepared in order to apply guaranteed tariffs and identify sources of financing for projects on the use of renewable energy sources:

1) Decree of the President of the Republic of Azerbaijan on the establishment of the Public Fund for Efficient Use of Energy of the Republic of Azerbaijan under the Ministry of Energy of the Republic of Azerbaijan;

2) Charter of the Fund for Efficient Use of Energy of the Republic of Azerbaijan; - Rules for formation and use of funds of the Fund for Efficient Use of Energy of the Republic of Azerbaijan;

3) List of energy resources, the tariffs and prices of which are intended to be transferred to the Fund, as well as additions to the tariffs and prices of energy resources for the purpose of transfer to the Fund;

4) Rules for the application of guaranteed tariff mechanism for the purchase of electricity generated from renewable energy sources.

Wind Measurement Observation Stations with 18 units of 85-meter towers and 4 units of Solar

Monitoring Stations were installed, 2 units of mobile laboratories were purchased, and several observations were carried out in 2010-2012 years by State Agency of Alternative and Renewable Energy Sources in different regions to determine the capacity of alternative and renewable energy sources in the country. The Data obtained from such stations were integrated to the online servers of Monitoring Center of State Agency. Meanwhile, Maps describing wind and solar energy potential were developed based on such data, as well as other hydro-meteorological and climate data and information obtained from satellites and of 30-year long-term meteorological re-analysis models.

In this regard, in 2018, the general and technical potential of wind and solar energy was studied through the ARCGIS (Geographic Information System - special software for mapping) geographic information database, taking into account exceptional areas. In accordance with the Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 118, dated May 1, 2014, on the approval of the "List of information systems and resources to be connected to the e-government portal" and "Technical Requirements for connection of information systems and resources, electronic services to the "E-government" portal", wind and solar atlases of Azerbaijan have been prepared on the ARCGIS online resource within the framework of the "Electronic Cadastre and Data Processing System for Alternative and Renewable Energy Sources". In particular, the data of the Measurement Observation Stations installed across the country were collected and analyzed and archived in the relevant databases. Meanwhile, location maps of wind turbines and 1000 MW wind power projects have been prepared for the purpose of power supply of different regions of the Republic with alternative and renewable energy sources (ARES).

According to the scientifically grounded results, the potential of renewable energy sources in the Republic of Azerbaijan is high. In fact, it was determined that the wind energy potential in the Republic of Azerbaijan, including in offshore zones, is more than 15,000 MW, solar energy potential is more than 20,000 MW, biomass and waste energy potential is more than 900 MW, and the energy potential of small rivers is above 650 MW.

Meanwhile, "AzalternativEnerji" LLC was established in 2013 under the State Agency for Alternative and Renewable Energy Sources to install facilities such as solar, wind and small hydropower plants across the country.

The most important project implemented by SAARES and planned to be completed in stages by 2029 is the Samukh Agroenergy Residential Complex project, which officially opened on August 19, 2017. Samukh Agroenergy Residential Complex, a multifaceted and large-scale project, which by using ARES combines agriculture, energy and residential places in a single complex. It is planned to build hybrid power plants with capacity of 31 MW (20 MW solar, 3 MW geothermal, 8 MW biomass) and thermal power plants with capacity of 48 MW. The project aims to create ecological environment, optimize the use of water resources for irrigation, to expand the role of ARES in agriculture and livestock, to ensure full energy supply of the Samukh district with ARES. The Complex' alternative and renewable energy hybrid power plant will generate more than 120 million kilowatt-hours of electricity and more than 100,000 heka calorie of heat per year, which will fully meet the district's energy demands, and save 60 million cubic meters of natural gas per year and cut the annual GHG emitted into the atmosphere **up to 90,000 tons of CO_2 equivalent**. In August 2017, the work on the first stage was completed in the Agroenergy Residential Complex, 3.8 MW solar-bioenergy (1.5 MW solar power) power plant, 1.1 MW thermal power plant, 10/0,4 kV substation was installed at the expense of the state budget.[50]

The project is aimed at reducing GHG emissions as an effective mitigation action, as well as the direct implementation of the Sustainable Development Goals 6, 7, 8, 10, 13 and others, which the Republic of Azerbaijan undertook in September 2015 to implement until 2030. In fact, the activities of the Samukh Agroenergy Residential Complex will create conditions for the production of ten thousand tons of fruits, vegetables, dairy and meat products a year, and will create more than 2,000 permanent jobs.

[50] https://apa.az/az/aqrar-senaye-kompleksi/xeber_prezident_ilham_eliyev_samux_aqroEnerji__-482685

Within the framework of the project, fruit dryers, refrigerating chambers and tourist tents with mobile solar lighting, solar-based road lighting systems manufactured at the "Azguntex" plant in the Samukh AgroEnergy Residential Complex will be arranged. For the first time in the country, an energy-efficient grape and vegetable greenhouse equipped with innovative technology and solar-powered light poles have been installed. It is planned to apply these technologies in other regions in future.

It is to note that, in order to expand the use of ARES, "**Strategic Plan** of the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan for 2015-2018" was approved by the order of the Chairman of the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan dated December 10, 2014.[51] The document states that actions will be implemented to create healthy competitive environment in the field of alternative and renewable energy and its efficient use, improve the structure of the sector, create favorable conditions for investment, increase investment, improve and rebuild infrastructure, use of renewable energy in the economy and social spheres, enhance renewable energy consumption and energy efficiency, ensure environmental security, and others. It states that, as the result of implementation of "State Program of social and economic development of the regions of the Republic of Azerbaijan in 2014-2018" and "State Program on social and economic development of Baku and its settlements in 2014-2016", as well as the Action Plan in the document, new generation capacities will be created at the expense of alternative and renewable energy sources. As the result of it, it is planned to create new structural areas in order to improve the management system in the field of alternative and renewable energy and its efficient use, to regulate activities, to establish interaction.

3.2.2. Transport

The Transport sector is an important source of GHG emissions. According to statistical data (State Statistics Committee of the Republic of Azerbaijan) during 2000-2016, the sharp increase in quantity of all types of transport systems was observed. Over this period the number of passenger cars increased about 3 times, the number of freight traffic increased 50 times.

In last decade, the Government of Azerbaijan has taken several actions towards developing and improving transportation system. In fact, some actions were carried out in the framework of "**State Program for development of transportation system in the Republic of Azerbaijan (2006-2015)**" and "**State program for renovation and development of highways in the Republic of Azerbaijan (2006-2015)**" towards developing transportation system in the country. In order to make Azerbaijan an attractive transit and trade hub, special attention was paid to the expansion of road and railway routes along the north-south and east-west transport corridors of the country. To this end, it is planned to invest about $ 7 billion (4.7% of GDP) in 2017-2020.[52]

Despite the fact that, implementation of such actions has not directly caused decrease of contaminations, they will contribute indirectly to reducing road congestion, Despite the fact that, implementation of such actions has not directly caused decrease of contaminations, they have indirectly contributed to decrease of emission releases, especially for diesel trucks, etc., by reducing the indirect emissions into the atmosphere using the transit network without entering the city, i.e., without creating traffic jams. Within the Programme, numbers of highways were constructed, existing roads were enlarged, overpasses and underpasses, new parking stands were installed, which in its turn, caused reduction of traffic jams and ensured a speed-up in the movement of traffic, and resulted in decrease of emissions released from transportation sector to the atmosphere. Data on the reduction of these wastes need to be systematically reviewed in the next national report.

Based on the relevant decisions of the Cabinet of Ministers of the Republic of Azerbaijan, in order to ensure harmonization of requirements on harmful wastes released to the atmosphere from the means of transportation wheeled out in the Republic of Azerbaijan to European standards, since July 1, 2010,

[51] http://area.gov.az/public/uploads/AgentliyinEmr/strateji%20plan_%C6%8Fmr-21.pdf

[52] Asian Development Bank. (April 2019). Asian Development Outlook, 2019

Euro-2 ecological norms, while since April 1, 2014, Euro-4 ecological norms have been applied in the territory of the Republic of Azerbaijan. The main purpose of this action is to form the vehicle fleet of the Republic with vehicles that meet higher environmental standards.

One of the normative acts in the above-mentioned area, i.e., measures to use fuel in accordance with EURO-4 and higher environmental standards, is approved by the Decree of the President of the Republic of Azerbaijan dated December 27, 2018, No. 852 "State Program on road safety in the Republic of Azerbaijan for 2019-2023" [53]. One of the main objectives of the document is to take the necessary measures to reduce the damage to the country's economy and environment. The Action Plan for the implementation of the state program outlines measures to establish appropriate grounds for the quality of fuels used in vehicles to meet the requirements of Euro-4, as well as higher Euro-5, Euro-6 and other standards and the gradual implementation of this process. Meanwhile, the programme includes preparation and application of technical safety and environmental regulations in accordance with international agreements on vehicles, their spare parts, accessories and operating materials to which the Republic of Azerbaijan is a party, as well as prevention of import, sale, use of vehicles, their spare parts, accessories and operating materials, which do not comply with the technical regulations, as well as their circulation in other forms, and removal of obsolete, technically unsafe and environmentally unfriendly vehicles from circulation.

It should be noted that, passenger vehicles imported to the Republic of Azerbaijan are subject to excise tax rates depending on their engine size. According to the applicable legislation, low excise duty is applied to the motorcars with low capacity. Meanwhile, the policy towards application of low-level insurance premiums for motor cars with low-capacity engines under compulsory insurance of civil liability of vehicle owners has served for decrease of greenhouse gas emissions by stimulating the motor-vehicles with low-power engines.

As is known, the concept of green transport includes hybrid-engine vehicles which combine electric vehicles and internal combustion engine with electric engine. In this context, the application of **environmentally friendly modes of transport**, expansion of the use of electric modes of transport, electrification of railways and transition to alternating current traction, improvement of the intelligent transport management system and expansion of its coverage, development of metro and increase of the total number of stations, as well as construction of underground and overground pedestrian crossings and elimination of traffic jams are discussed.

Sub-section 7.3.3. Promoting the use of ecologically clean vehicles in Section 7.3 of the Action Plan for the implementation of the above-mentioned "**State Program on Road Safety in the Republic of Azerbaijan for 2019-2023**" provides for establishment of appropriate legal and regulatory framework with determination of tax, customs and other privileges and preferences for the production, import, export, circulation and exploitation of such vehicles for the purpose of stimulating the use of ecologically clean vehicles with electric motors, and taking measures to create an appropriate infrastructure for environmentally sound, electric motor vehicles.

Meanwhile, Article Sub-section 7.3.1 of the Action Plan for the implementation of the **State Program** envisages preparation of technical, safety and environmental regulations in accordance with international agreements to which the Republic of Azerbaijan joined on vehicles, their spare parts, accessories, and utilization materials, as well as other forms of circulation. Meanwhile, the sub-section **7.3.7. Organization of vehicle utilization** provides for preparation and application of vehicle utilization program to ensure the removal of obsolete, technically safe, and environmentally unfavorable vehicles in order to improve road safety in the Republic of Azerbaijan, the **environmental situation**, and stimulate domestic automobile production.

[53] http://www.e-qanun.az/framework/41118

Considering the fact that the amount of carbon emissions released during fuel use depends on speed of the means of transportation, plan and longitudinal profile for the design and construction of highways are developed to ensure movement of vehicles with the constant speed. The development of highway network has a special role in increasing the speed of passenger and cargo transportation by road transport. In this context, the "**State Program on Road Safety in the Republic of Azerbaijan for 2019-2023**" discusses ensuring more efficient use of the transport intellectual management system in the administrative territory of Baku city, gradually expanding its coverage in the country's main highways.[54]

Regarding the development dynamics of metro, it is to note that given the annual increase in the number of people and vehicles in Baku, the *capital of the Republic of Azerbaijan*, measures to develop and expand the transport network should be implemented regularly. In this sense, it is to note that the **Ministry of Transport of the Republic of Azerbaijan** has developed the **Conceptual Development Scheme of the Transport Network (infrastructure) in Baku until 2030**.

"Azerbaijan Railways" Closed Joint-Stock Company was established by the Order of the President of the Republic of Azerbaijan dated July 20, 2009. Meanwhile, the "**State Program on the development of the railway transport system in the Republic of Azerbaijan for 2010-2014**" was approved by the Decree of the President of the Republic of Azerbaijan dated July 6, 2010. The Program reflects all the factors that ensure the rapid development of railway transport in Azerbaijan, where the Action Plan includes the renewal of the car and locomotive fleet, roads, power supply, overhaul of signaling and communications and other facilities, transition from direct current to alternating current, modernization of technical means and other important tasks.

In recent years, the development of this infrastructure, its role in the country's economy, as well as the level of electrification of railways has been determined by the overall dynamics of economic development of the country. In 2019, about 15-16 million tons of cargo was transported, most of which was transit cargo. This figure is 14-15 percent higher than the statistical figure in 2018.[55]

The total amount of investments to be made in the development of railway infrastructure in the Republic of Azerbaijan in 2010-2022 is $ 4.879 billion.[56] Most of these funds are spent on the **reconstruction and electrification of railways**, overhaul of the Baku-Boyuk-Kesik railway, renewal of the wagon fleet, purchase of passenger and freight locomotives.

At present, the total length of the main tracks in the country is 2,954.74 kilometers, and the operational length is 2,133.07 kilometers, of which 803.3 kilometers are double-track, and 1,329.72 kilometers - are single-track. Some 1,169.17 kilometers or 54.82 percent of the total operational length of tracks are electrified, 964.9 kilometers, that is, 45.18 percent, are operated on diesel traction. Herein, 1,527.7 kilometers of tracks are equipped with an automatic signaling system.[57]

Meanwhile, it is known that the aviation sector currently accounts for 2% of global GHG emissions, and in this sense, this sector is expected to be included in the **EU Emissions Trade System** from 2023. In fact, this means that companies that own aircraft flying from the EU to other countries and vice versa must purchase European Union Allowances (EUA) or Certified Emission Reductions (CER) to compensate for emissions. In 2012, the maximum level of these emissions was 3% compared to the base year in 2004-2006, while in 2013-2020 this figure was already 5%. In fact, it is possible that the aviation sector of the Republic of Azerbaijan will be forced to join the EU Emissions Trade System from 2023, and in this sense, the Republic of Azerbaijan is already urgently renewing its aviation fleet in order to reduce fuel efficiency and CO_2 emissions.

The above documents and the main mitigation policies and measures for the sector and the assessment of their impacts will be discussed in detail in relevant section.

[54] http://www.e-qanun.az/framework/41118
[55] http://wvvw.adyexpress.az/az/archives/9295
[56] https://fed.az/az/biznes/demiryoluna-sermaye-qoyulacaq-5-milyard-dollar-27500
[57] https://ady.az/az/content/index/51/42

3.2.3. Construction and utilities

The boom in the construction sector in the Republic of Azerbaijan since 2003, has turned to slowdown in global energy prices in 2015 due to two devaluations and decline in intra-sectoral investment, financial market volatility and other negative developments. In fact, if in 2017 the decline was 1.5%, in 2018 the decline in this sector increased to 9% due to further 4.4% decrease in capital investment.[58]

As for the utilities sector, the development of this sector is conditioned by the development of other related sectors of the economy. Meanwhile, the country is implementing a policy to increase energy efficiency in buildings and save energy. Adoption of standards in this area and harmonization of relevant legal acts with European legislation will reduce the amount of heat emitted from this area. As mentioned in the **Nationally Determined Contribution (NDC) of the Republic of Azerbaijan**[59], massive use of control instruments in electric and thermal energy and natural gas systems used by the population, application of energy-saving lamps, use of modern, energy-saving technologies in heating systems, as well as organization of energy awareness programs will increase energy efficiency in the residential and commercial sectors, promote energy savings and ultimately reduce GHG emissions.

It is to note that in recent years, "Azerenergy" OJSC, which distributes energy to end consumers, has done substantial work to increase energy efficiency in electricity supply through the restoration and expansion of obsolete electricity distribution network. At present, all power facilities, transmission lines, offices and ancillary technical buildings owned by "Azerishig" OJSC are being renovated in accordance with the latest standards. In recent years, the construction, installation and repair of dozens of new substations have been completed both in Baku and in the regions. As the result of the work done, the supply of electricity in Baku and the regions will be improved, the efficiency and quality of customer service will be increased and, consequently, losses in the distribution of electricity will be reduced.

As mentioned in the Energy section, by providing the functions of production, transmission, distribution, sale and service of thermal energy in the Republic of Azerbaijan, providing heat supply to residential houses and buildings, educational and health facilities and other social facilities in Baku and regions of the country, "Azeristiliktechizat" OJSC continues efforts related to the application of modern systems. In fact, in 2014-2016, the completion of the necessary work in heating sector in Baku and suburban settlements and the restoration and modernization of relevant heating facilities, sources, construction of new boilers, reconstruction of heating systems, in fact providing consumers with reliable and quality heating services were carried out continuously. This is described in detail in the Energy section.

In general, the "**Strategic Roadmap for the development of utilities (electricity and heat, water and gas) in the Republic of Azerbaijan**"[60] approved by the Decree of the President of the Republic of Azerbaijan dated 06.12.2016 provides for strategic vision for the period up to 2025, long-term vision for the period up to 2025 and target vision for the period after 2025 in order to determine the priorities and future development directions of utilities sector in the Republic of Azerbaijan. Ensuring the generation of fully diversified, uninterrupted and environmentally friendly electricity, creating efficiency and quality standards in line with best international indicators, triggering key drivers to realize the objectives of the electricity generation sector, creating efficient and effective gas distribution infrastructure, including the establishment of high-level water management structure, ensuring efficiency in water consumption, eliminating the existing problems in heat supply system and ensuring operational efficiency of the system were identified as strategic objectives. Priorities were outlined against each strategic target, relevant analyses were conducted, the measures to be implemented for these priorities were specified, and the results to be obtained due to their implementation were forecast. For example, Action 7.1.2. Use alternative and renewable energy sources in the Strategic Roadmap discusses the use of alternative and renewable energy for heating purposes. In fact, it is planned to assess the use of alternative and

[58] https://www.stat.gov.az/
[59] http://eco.gov.az/az/1142-iqlim-deyismeleri
[60] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf

renewable energy for heating purposes and, particularly, the energy potential of solar, wind, geothermal and biomass energy to ensure their massive use[61]. Scenarios for mitigating the GHG impacts in the sector will be analyzed in the relevant section.

3.2.4. Industrial Processes and Product Use (IPPU)

The Industrial Processes and Product Use Sector is different from other sectors by the complexity of its structure. According to different international classifications, the single industrial sector includes more than 300 areas and subsectors.

As it is known, during the Soviet period, most industrial enterprises in the Republic of Azerbaijan were not equipped with waste control equipment, and the equipped ones ensured reduction of only 50% of some wastes. In 1990, the volume of waste from stationary sources reached to 1,447,000 tons of CO_2. This stage can be characterized as a period of decline due to the collapse of the former Soviet economic system. In the next period, i.e., in 1990-2000, these emissions decreased by almost 3 times. At this stage, outdated technology and equipment in industrial enterprises, frequent errors in the production network, improper use of waste collection equipment in enterprises and failure of industrial enterprises to take into account environmental issues can be cited as the main causes of air pollution.

Since 2000, great success has been achieved in the development of industry as in all sectors of the economy of the Republic of Azerbaijan. And since 2004, a new period of industrial development started in the Republic of Azerbaijan. During this period, part of the revenues from the oil and gas sector was directed to the development of various industries, state programs were developed to optimize the industrial structure in the regions, important work was performed to resolve energy supply problems, numerous projects were implemented to improve the overall infrastructure and to open new production facilities. Important decisions made to regulate the favorable business environment and entrepreneurship in the country played important role in the development of industry. **In fact, in 2015, compared to 2000, the volume of industrial production increased more than 3.1 times.** During this period, numerous projects were implemented to create competitive modern industries, improve the industry infrastructure, new jobs were created, and the country’s industry has stepped into a new stage of development. Thanks to the measures of state support for the development of entrepreneurship, the share of the private sector in GDP reached 81.2% in 2015. The number of business entities was more than 661,000, as well as legal entities were more than 84,000.

As a logical continuation of the work done, by the Order of the President of the Republic of Azerbaijan No. 212 dated January 10, 2014, the year of 2014 was declared the “Year of Industry” in the Republic of Azerbaijan, and the action plan for industrial development was implemented. Meanwhile, the “State Program on Industrial Development in the Republic of Azerbaijan for 2015-2020” was approved by the Decree of the President of the Republic of Azerbaijan No. 964 dated December 26, 2014. In general, among the latest legal and normative documents on industrial development in the Republic of Azerbaijan, “Azerbaijan 2020: Outlook for the Future” Development Concept approved by the Decree of the President of the Republic of Azerbaijan No. 800 dated December 29, 2012, “State Program of Social and Economic Development of the Regions of the Republic of Azerbaijan in 2014-2018” approved by the Decree of the President of the Republic of Azerbaijan No. 118 dated February 27, 2014 and “State Program of Social and Economic Development of the Regions of the Republic of Azerbaijan in 2019-2023” and “Strategic Roadmap for the Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan” should be noted.

The promotion and stimulation of investments in the economy of Azerbaijan led to **244.9 billion US dollars** be invested in the country’s economy in 2004-2018. Meanwhile, in order to ensure sustainable social and economic development, state capital investment expenditures in the state budget have

[61] see, previous reference

increased dynamically, and investment expenditures have had significant weight in the state budget. The growth dynamics of investments in the economy and non-oil GDP (2004-2018) has made a positive contribution to the state policy of building socially oriented economy and providing people with decent jobs, and thanks to implemented measures, more than 2 million new jobs were created during 2004-2018, of which 1.5 million were permanent, and 75% of these jobs were created in the regions. In order to develop the chemical industry in the country, **Sumgait Chemical Industrial Park** was established by the Decree of the President of the Republic of Azerbaijan No. 548 dated December 21, 2011 and its area is 508.14 hectares. “Azertechnoline” LLC, a resident of the Industrial Park, which produces steel and polyethylene pipes, mechanical and hydraulic equipment, is operating since 2013, while “STP” LLC, which produces various industrial products, is a resident of the Industrial Park since 2014. In Sumgayit Chemical Industrial Park, 4 more enterprises - MST Engineering Services LLC, which produces low, medium and high pressure resistant hoses and fittings, Alco Lubricant Company LLC, which produces high quality synthetic and semi-synthetic lubricants, “Agrokimya Azerbaijan” LLC, the manufacturer of pesticides and agro-chemical products, “STDC” LLC who process (register) data in 2017 started to function in 2017, and “Labdisc Azerbaijan” LLC, manufacturer of electronic educational equipment, Construction Chemicals Plant, Non-Ferrous Metals and Ferro-Alloys Plant of “Baku Non Ferrous and Foundry Company” LLC, tobacco factory of “Tabaterra” Closed Joint-Stock Company and polypropylene plant of “SOCAR Polymer” LLC in 2018. **Mingachevir Industrial Park** was established by the Order of the President of the Republic of Azerbaijan dated February 26, 2015, No. 1077 as a continuation of the work implemented to reduce dependence on imports in the light industry and increase export potential, to create national textile brands. In the first quarter of 2018, 2 yarn factories of “Mingachevir Textile” LLC (registered by “Ring” and “Open End” method) registered as residents in Mingachevir Industrial Park were put into operation and 750 new jobs were created in them.

Meanwhile, in 2011, Balakhani Eco-Industrial Park, in 2012, High Technology Park, in 2015, Garadagh Industrial Park, in 2015, Neftchala Industrial District, in 2016, Pirallahi Industrial Park, in 2016, Masalli Industrial District were opened and put into operation by the residents.

Along with non-traditional industries, big attention is paid to the development of traditional industries in the regions. By the Order of the President of the Republic of Azerbaijan No. 2032 dated May 5, 2016, **“Azerkhalcha” OJSC** was established in order to ensure the production and export of carpets and carpet products in the Republic of Azerbaijan, the organization of their sale in the country and abroad, the application of new technologies in the production of carpets and carpet products, modernization of material and technical base and its efficient use, as well as development of this field.[62]

In all these industrial parks, industrial districts, new enterprises opened in special economic zones, economic tools have been developed to stimulate the use of low-carbon, energy-efficient and resource-efficient green technologies, their import to the country is exempt from VAT and customs duties, and additional measures have been undertaken by the state to ensure wider scope of jobs and create new jobs. All these measures have accelerated the process in which products produced with new technologies remove from market the products produced by Soviet-era enterprises which operate with technologies with old, extensive and large-scale GHG emissions. Meanwhile, in order to improve the environmental situation of large cities, the process of relocation of Soviet-era enterprises to the city outskirts continued, and in some cases, they were liquidated or merged.

Achievements made by Azerbaijan are also reflected in the reports of international organizations and financial institutions. It is no coincidence that according to “Doing Business 2019” report, Azerbaijan was ranked 25th among 190 countries by increasing 32 ranks compared to the previous year. According to the document, Azerbaijan, which has further improved its position on 8 out of 10 indicators, was

[62] https://youthfoundation.az/wp-content/uploads/2019/04/Regionlarin-inkisafi-Dovlet-Proqram%C4%B1_2019-2023.pdf

included in the list of 10 most reformist countries in the world and was declared the most reformist country in the world.[63]

It is noteworthy that in 2015, the year of the global economic crisis, the non-oil industry grew by 8.4 percent. Significant progress has also been made in the non-oil industries such as metal industry and mechanical engineering over the past decade. In fact, during this period, production in the engineering industry increased by about 15 times, the share of the sector in the non-oil processing industry reached 21.5 percent. In 2015 alone, the products and services produced by the engineering industry doubled. The installation and repair of machinery and equipment, as well as the production of electrical equipment, which is an important part of the mechanical engineering sector, play an important role in this growth. Over the past years, the industrial structure has been gradually optimized, the share of the mining sector has decreased, and the share of the processing sector has increased. In 2015, fixed capital investment reached 16 billion AZN, of which 53.3% was invested in industry.

Meanwhile, in 2015, the year of the global economic crisis, the country experienced two consecutive devaluations of AZN, and the country experienced an economic downturn (recession) for the first time in 20 years. In fact, in 2016, this decrease was 3.1%. Meanwhile, after several economically difficult years, the growth rate of the Azerbaijani economy in 2018 reached 1.4%. As the result of partial increase in oil production and oil exports, the oil sector increased by 0.6% after a four-year decline. Although the non-oil sector increased by 1.8%, its share in GDP continued to decline in 2018 compared to 65.8% in 2016, reaching 58.5%. After 4.2% decline in 2017, the industry again achieved a growth of around 1.5%.

In 2019, the country's gross domestic product increased by 2.2 percent compared to the previous year and reached 81681.0 million manat. 41.4 percent of GDP was produced in industry, 10.0 percent in trade; repair of vehicles, 7.3 percent in construction, 6.0 percent in transport and warehousing, 5.7 percent in agriculture, forestry and fishing, 2.4 percent in tourist accommodation and catering, 1.8 percent in information and communication, 16.7% in other spheres, and net taxes on products and imports made up 8.7% of GDP. GDP per capita was 8247.0 manat (approximately 4867 US dollars).[64]

The International Monetary Fund forecasts that GDP growth in Azerbaijan will remain at 3.1% in 2020. This forecast reflects increase in public investment and local consumption as long as the exchange rate remains stable, and the government continues fiscal measures. The medium-term growth outlook is based on relatively stable oil prices and increased gas production from the Shah Deniz-2 field. As the result of the increased government investments in agriculture, transport, tourism, as well as in modernization of other sectors infrastructure, the construction sector is also expected to grow by 3% after this year's decline.[65]

In general, the sources and categories of GHG emissions in the Republic of Azerbaijan in the **Industrial Processes and Product Use (IPPU)** sector are mining products, chemical industry, metal industry, other production areas, production of halogenated carbon and sulfur hexafluoride, production of halogenated carbon compounds and sulphur hexafluoride, solvents, and the use of other products.[66]

[63] https://youthfoundation.az/wp-content/uploads/2019/04/Regionlarin-inkisafi-Dovlet-Proqram%C4%B1_2019-2023.pdf
[64] https://www.stat.gov.az/news/index.php?id=4442
[65] Asiya İnkişaf Bankı. (Aprel 2019). *Asiyanın İnkişaf Perspektivləri 2019. Asian Development Bank. (April 2019). Development Prospects of Asia 2019.*
[66] http://files.preslib.az/projects/azereco/az/eco_m4_7.pdf

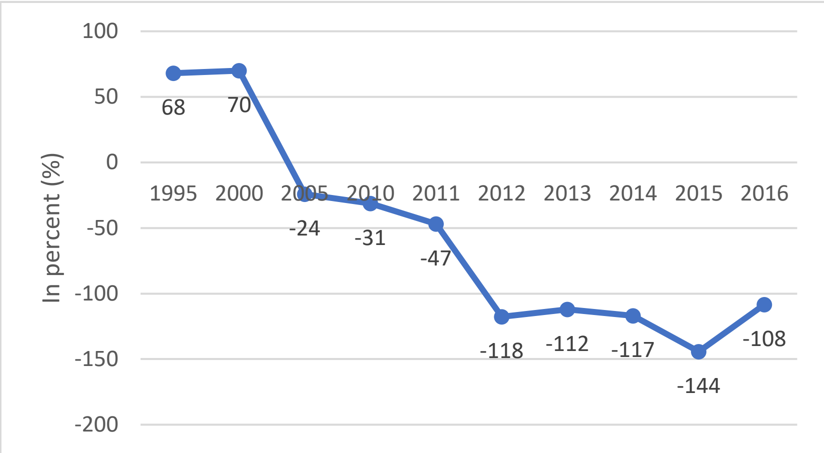


Chart 3-11. GHG emission reduction trend in IPPU sector compared to 1990 (without removals), %

As can be seen from chart 3-11, based on the relevant inventory data, between 1995 and 2000, there was a 68-70% decrease in GHG in the IPPU sector compared to the 1990 figure (without removals). However, from 2005 to 2016, GHG emissions in this sector increased compared to 1990 (without removals) due to the rapid development of various industries in the country, including cement and petrochemicals.

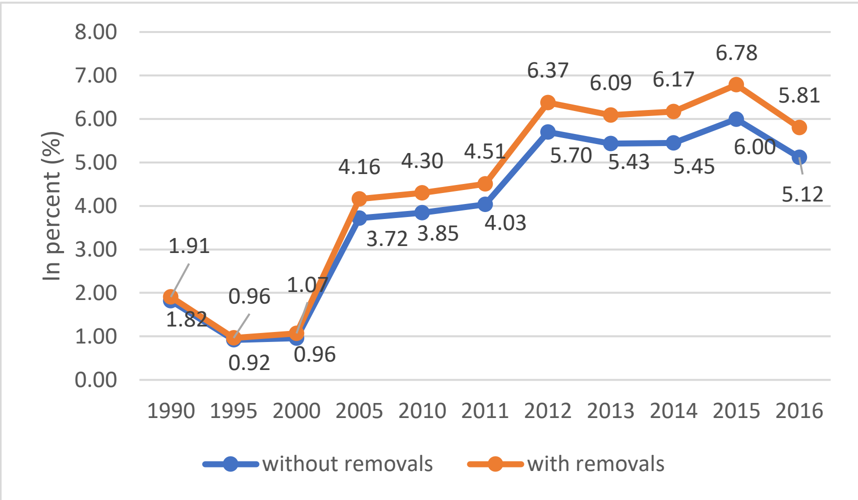


Chart 3-12. Annual trend of GHG emissions share in total GHG in the IPPU sector (in %)

As can be seen from chart 3-12, in 2016, the share of GHG emissions in the IPPU sector increased by about 2.5 times compared to 1990 and reached 5.12 percent. Interestingly, this figure was only 1.82 percent in 1990. This was due to the above-mentioned trend of industrial development in the country, in particular, the expansion of clinker production as intermediate raw material for cement production in the country since 2011, as well as the production of methanol since 2013. In general, in 2014, GHG emissions in this sector accounted for about 5.45% of total emissions (excluding removals), and 6% in 2015. In 2016, as the result of the known recession in the economy of the Republic of Azerbaijan against the background of sharp decline in energy prices in the world energy market, the share of GHG in total emissions in the IPPU sector fell to only 5.12%.

In general, when talking about policies to reduce GHG emissions in the IPPU sector in the Republic of Azerbaijan, first, it is necessary to list some sectoral international conventions to which the Republic of Azerbaijan is a party. These are:

- Convention on Environmental Impact Assessment in Transboundary Context (the Republic of Azerbaijan joined in 1999);
- Montreal Protocol on Substances that Deplete the Ozone Layer (the Republic of Azerbaijan joined in 2000);

- Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (the Republic of Azerbaijan joined in 2001);
- Stockholm Convention on Persistent Organic Pollutants (the Republic of Azerbaijan joined in 2001)

The sectoral development of the "Strategic Roadmap for the Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan"[67] (approved by the Decree of the President of the Republic of Azerbaijan dated 06.12.2016) prepared on the basis of these and other normative documents is especially noteworthy in terms of environmental content. In fact, this document is aimed at diversifying the country's economy through the dynamic development of the non-oil industry, taking into account the available resources and by application of modern regulatory and promotion policies in the heavy industry and engineering sector, and includes policies and concrete measures to **protect the environment** and, consequently, to achieve sustainable economic development and improve the living standards of the population along with increasing value added and employment in heavy industry and engineering. The goal of Priority 1.2. of the Strategic Roadmap is to achieve optimal energy efficiency. Meanwhile, "Strategic Roadmap for the production of consumer goods at the level of small and medium entrepreneurship in the Republic of Azerbaijan" (approved by the Decree of the President of the Republic of Azerbaijan dated 06.12.2016), along with the social and economic goals mentions the aims to increase the energy efficiency of small and medium enterprises (SMEs), stimulate the use of more alternative and renewable energy sources. The document notes that in the long run, the share of SMEs in GDP will exceed 60 percent. During this period, measures will be taken to stimulate access of SMEs to alternative and renewable energy sources and the legal framework and financing initiatives in connection with the transition to "green economy".

So far, the Republic of Azerbaijan has implemented various projects in cooperation with a number of international organizations, along with national initiatives on climate change and mitigation of its impacts. The main international donor organizations with which Azerbaijan cooperates on climate change are the Global Environment Facility, the Green Climate Fund, the European Union, the Asian Development Bank, the German KfW Bank, the German Agency for International Cooperation (GIZ) and others.

Against the background of social and economic and environmental measures, the increase in GHG emissions during the reporting period was insignificant, due to the closure of many polluting enterprises and their replacement with new, modern, environmentally friendly ones. However, it is to note that most of the large enterprises in Baku, especially oil and gas companies, have started to use modern low-waste technologies, which in turn prevents the growth of waste.

At this stage, taking into account modern challenges and new initiatives, it is necessary to take a number of measures to modernize industry and diversify the non-oil industry, as well as involve existing natural and economic resources in the economic circulation, establish new priority areas along with traditional industries, create industrial parks, strengthen industrial potential in the regions and create opportunities that will ensure the development of industry on the basis of innovations. In fact, in order to achieve the planned progress in the heavy industry and engineering in the medium term, the full use of assets and natural resources in industry will be provided by 2025, the application of effective work experience in enterprises will be fully implemented. The elimination of gaps in production at all stages of the value chain will be a key factor for the efficient use of the country' natural resources. The enterprises operating in the Republic of Azerbaijan will act as a model enterprise for neighboring countries in terms of energy and other types of efficiency. For sure, all this will contribute to achieving the country's reduction target under the Paris Agreement by 2030.

[67] http://iqtisadiislahat.org/store//media/documents/SYX/_A%C4%9F%C4%B1r_senaye_ve_ma%C5%9F%C4%B1nqay%C4%B1rman%C4%B1n_inki%C5%9Faf%C4%B1na_dair_strateji_yol_xeritesi.pdf

3.2.5. AFOLU sector

3.2.5.1 Agriculture

Agriculture is one of the most sensitive sectors to natural factors, including climate change, and requires serious adaptation measures. It is no coincidence that the world suffers from floods, hail, drought, frost, mass spread of dangerous pests and so on every year. Natural disasters cause significant damage to agriculture.

During the reporting period, the share of GHG emissions in total emissions (without removals) in the Agriculture, Forestry and Other Land Use sectors is shown in the table below:

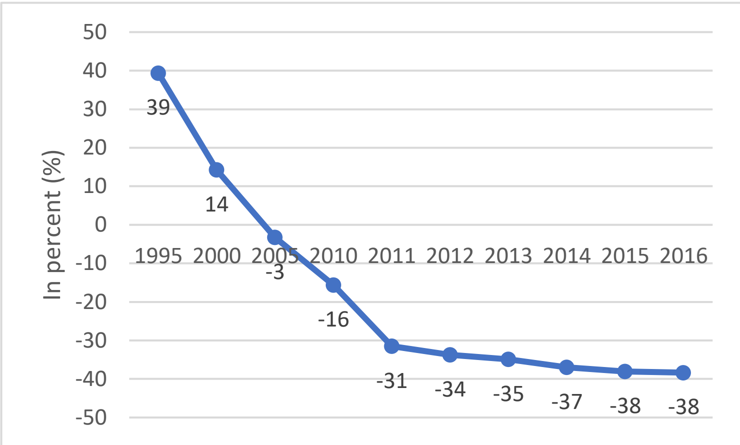


Chart 3-13. GHG emission reduction trend in the AFOLU sector compared to 1990 (without removals), (in%)

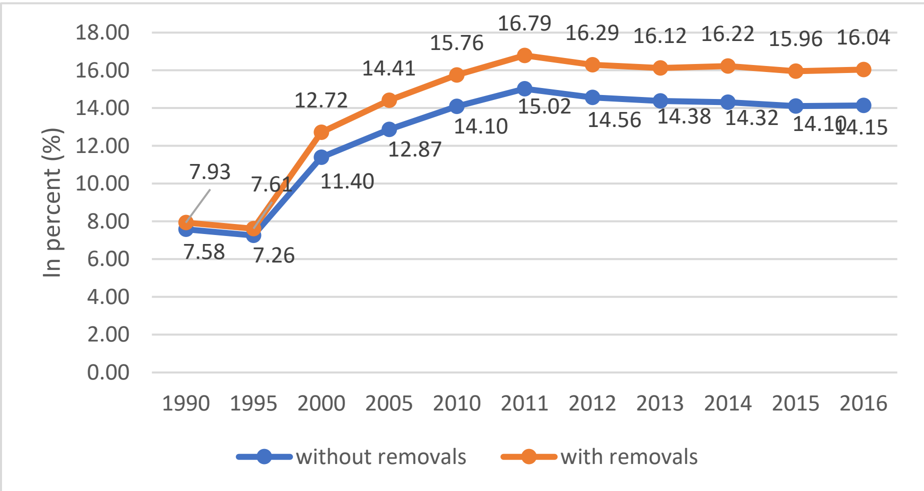


Chart 3-14. Annual trend of the share of GHG emissions in the AFOLU sector in the total GHG emissions, (in%)

As can be seen from chart 3-13, prepared based on the relevant inventory data, from 1990 to 2003, there was a significant downward trend in GHG levels in this sector compared to 1990 (without removals), and approximately in 2003 the decline is replaced by increase in emissions compared to 1990.

As seen from chart 3-14, GHG emissions in this sector in 2014 accounted for approximately 14.32 percent of total emissions (excluding removals), and 14.1 percent in 2015. In 2016, despite the known recession in the country's economy, the share of GHG emissions in total emissions in this sector increased slightly compared to the previous year and amounted to 14.17 percent. With these indicators, the agricultural sector ranks second in the country for the total share of GHG after the energy sector. Interestingly, this figure was only 7.58 percent in 1990.

In general, the development trends of this sector are reflected in a number of government programs and different regulatory documents. Among them are "State Program on Rational Use of Summer and

Winter Pastures, Hayfields and Prevention of Desertification in the Republic of Azerbaijan (2004-2010)", "State Program on Reliable Food Supply of the Population in the Republic of Azerbaijan in 2008-2015", "State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan in 2015-2008", "State Program on Social and economic Development of Regions of the Republic of Azerbaijan in 2014-2018", "Strategic Roadmap for Production and Processing of Agricultural Products in the Republic of Azerbaijan", and other documents. Meanwhile, special mention should be made of projects funded by FAO, GIZ (German Agency for International Cooperation), the European Union and other donor organizations for the development of this sector (information is available on the websites of relevant agencies).

The measures undertaken for the development of the agricultural sector within the relevant state programs are also one of the main priorities. Exemption of the agricultural sector from taxes, subsidies, granting preferential loans and other state support mechanisms, improvement of infrastructure in this sector, construction of Takhtakorpu, Shamkirchay, Tovuzchay and Goytepe reservoirs, Main Mil-Mugan collector and implementation of other major projects, reclamation measures, the establishment of "Agroleasing" OJSC to improve the quality of agrotechnical services, the announcement of the year of 2015 as the "Year of Agriculture" have given impetus to the development of this sector. Consequently, crop and livestock sectors have been developed to ensure food security in the country, and the food self-sufficiency level has been further improved. So far, large farms, agro-parks, intensive horticulture, modern greenhouses, logistics centers have been established, the material and technical base of the infrastructure serving to the development of agricultural production has been strengthened. One of the main goals is to transfer the agricultural sector to an innovative basis, including the creation of agro-parks. In accordance with the President's instructions, works are underway to establish 51 agro-parks, including 17 modern breeding livestock complexes and 34 large crop farms on 258,300 hectares in 33 districts. Meanwhile, decrees signed by the President of the Republic of Azerbaijan on the development of traditional agricultural sectors, including cotton-growing, sericulture, silkworm breeding, tobacco-growing, paddy growing, tea-growing, hazelnut growing, citrus growing, viticulture and winemaking, approved sectoral programs, as well as decisions on granting subsidies to producers have given important impetus to increase production and export potential in relevant areas and employment growth. As the result of systematic measures undertaken in the agricultural sector, the level of self-sufficiency in agriculture and food products of the country and food production has increased, and export opportunities have expanded.[68]

As mentioned above, the "**Strategic Roadmap for the Production and Processing of Agricultural Products in the Republic of Azerbaijan**"[69], approved by the Decree of the President of the Republic of Azerbaijan No. 1138 dated December 6, 2016, was adopted. The implementation of the Strategic Roadmap will create a favorable business environment by improving the relevant regulatory system, including improving the efficiency of state aid and further enhancement of competition in the market.

Meanwhile, the Target 7 in the mentioned the Strategic Roadmap is directly dedicated to the protection of the environment, sustainable use of natural resources and management of the natural factors impact on agriculture. In order to achieve the main goal, it was planned to implement activities in four priority areas **during 2016-2020**:

➢ Initially, develop mechanisms to reduce the negative impact of climate change and other natural factors on agriculture and develop an adequate adaptation plan;

➢ Develop indicators that meet modern requirements for compliance of agricultural production with environmental standards, conduct relevant assessments, reduce carbon emissions in the agricultural sector, create protective forest belts and implement other relevant measures within the priority of improving environmental protection mechanisms in the agricultural sector;

[68] https://youthfoundation.az/wp-content/uploads/2019/04/Regionlarin-inkisafi-Dovlet-Program%C4%B1_2019-2023.pdf
[69] http://iqtisadiislahat.org/store//media/documents/SYX/strateji_yol_xeritesi_kend_teserrufati_mehsullarinin_istehsalina_ve_emalina_dair.pdf

➢ Within the priority of improving the mechanisms of sustainable use of agricultural lands and water resources, establish a mechanism for assessing the environmental impact of the land category changing process, improve pasture management, improve reclamation of irrigated lands, prevent re-salinization and eliminate other problems;

➢ The last priority of this strategic goal is to contribute to the development of ecologically clean agricultural production in the country.

Meanwhile, Action 7.1.1 (Assessment of the Impact of Climate Change on Agriculture and Development of an Adequate Adaptation Plan) in Action Plan of the Strategic Roadmap states that the impact of climate change on agriculture in 2016-2020 will be assessed in regions of the country, the sensitivity degree will be determined, and adequate adaptation and impact mitigation plan will be developed to minimize expected losses.

Action 7.2.2 (Reduction of carbon emissions in the agricultural sector) in Action Plan of the Strategic Roadmap directly states that, in 2016-2020, the promotion of the methane gas collection from manure and its use as renewable energy will be considered through carbon emission reduction measures in crop farming and livestock husbandry.

As mentioned in the document, the actions to be taken for the development of livestock husbandry will be aligned with measures to mitigate greenhouse gas emissions. Meanwhile, the construction of forest shelterbelts around arable lands will be supported and an action plan for the development of protected forest areas until 2025 will be prepared. Relevant work will be implemented for field, soil and water forest shelterbelts with the involvement of international donors.

3.2.5.2 Forestry

As it is known, the FAO estimates that currently 1.2 billion hectares of the world’s land fund is already moderately and severely degraded. In particular, 20 percent of arable land, 30 percent of forests and 10 percent of pastures are degraded globally.[70]

Historically, the Republic of Azerbaijan has been considered as a country rich in forests and greenery, a country that resembles nature museum, and in the XVII-XIX centuries, 35% of the territory of Azerbaijan was covered with forests. Unfortunately, currently the total area of Azerbaijan forests is only 1.021 million hectares, which is 11.8% of its total area.[71] For comparison, this figure is 44% in the Russian Federation, 41% in Latvia and 39% in Georgia.

In general, the forests in the Republic of Azerbaijan are not of industrial importance, but sanitary forest cutting is carried out and mainly plays role for soil protection, water resources management, biodiversity refuge, microclimate, carbon removals, etc. The stock of wood is 148.8 million m^3, the forested area is 1.021 million ha, and per capita forest area is about 0.12 ha. This figure is less than twice the global average. According to international standards, each inhabitant should have an average of 0.25-0.26 ha of forest area, which means that about 20% of our territory should be covered with forest.[72] Although our country is less forested than most countries in the world, it is very rich in plant and animal species. About 450 wild trees and shrubs grow in Azerbaijan forests. 70 of them are endemic species and do not grow naturally anywhere in the world except Azerbaijan.

Meanwhile, the existing forests in the Republic of Azerbaijan are unevenly distributed throughout the territory. In fact, 48.7% of forests are located in the Greater Caucasus, 34.2% in the Lesser Caucasus, 14.6% in the Lankaran-Talysh region, 2.5% in the Kur-Araz lowland and Nakhchivan AR. Within these regions, the expansion of forests varies. Along with Balakan (49.8% of the territory) and Lankaran (44% of the territory) districts, which have extensive forest cover, there are also forestless (or less forested) districts such as Bilasuvar, Zardab, Sadarak and Sharur.

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[70] http://iqtisadiislahat.org/store//media/documents/SYX/strateji_yol_xeritesi_kend_teserrufati_mehsullarinin_istehsalina_ve_emalina_dair.pdf
[71] http://e-qanun.gov.az/framework/15399
[72] http://elibrary.bsu.az/110/N_7.pdf

Meanwhile, Azerbaijan's most productive forest fund, with an area of 260,311 hectares (of which 224,792 hectares were covered with dense forest), was under Armenian occupation and has been savagely destroyed for fuelwood and business purposes. [73] In fact, 54,328 hectares of forest areas, 215 natural monuments, 6 geological-paleontological sites, 145 certified East plane trees with height 45 meters, diameter 6-8 meters, age 120 to 2000 years, and other natural monuments were looted and most of them were destroyed. More than 460 species of wild trees and shrubs grow in the then occupied territories. Of them, 70 are endemic and do not grow naturally anywhere in the world. Yew, storax, Araz oak, wing nut, oriental plane, pomegranate, forest grape, ilex, buxus, Eldar pine, persimmon, willow-leaf pear, etc. species of trees were about to be destroyed in these territories and be erased from the treasury of the world's flora. Mass deforestation has led to desertification and soil erosion. Meanwhile, more than 50 species of fauna, including 4 species of mammals, 8 species of birds, 1 species of fish, 3 species of amphibians and reptiles, 8 species of insects and more than 70 species of plants included in the "Red Book of the Republic of Azerbaijan" were protected in these areas, many of which have already been destroyed. 43 thousand hectares of specially protected natural areas of great importance - Basitchay and Garagol state nature reserves, valuable trees and other rare specimens of biodiversity in the territories of Arazboyu, Lachin, Gubadli and Dashalti state nature reserves were being destroyed.

Indicators	1990	1995	2014	2015	2016
Total area of the country, thousand hectares	8660,0	8660,0	8660,0	8660,0	8660,0
Total area of forest fund lands, thousand ha	1039,0	1038,0	1040,3	1040,3	1040,3
their share in the territory of the country, in percent	12,0	12,0	12,0	12,0	12,0
Land area in the total area of the country, thousand hectares	x	X	8265,8	8265,5	8267,0
Total timber reserves, mln. cubic meters	x	X	151,0	151,8	153,4

Table 3-5. Main indicators of the forest fund

	1990	1995	2010	2014	2015	2016
Total land area of the country - total	x	x	8660,0	8660,0	8660,0	8660,0
including:						
Land suitable for agricultural use - total			4766,8	4769,7	4768,8	4772,9
of which:						
plowed lands			1884,1	1926,5	x	x
lands under permanent crops			227,4	233,5	237,0	241,1
lands under permanent pastures and hayfields			2655,3	2609,7	2595,2	2532,9
Non-agricultural lands - total			3893,2	3890,3	3891,2	3887,1
including:						
industrial, road and other non-agricultural lands			350,1	339,7	339,5	339,4
lands of specially protected areas			393,5	418,9	429,9	438,1
forest areas			1040,7	1040,3	1040,3	1040,3
water fund lands			147,1	147,3	148,5	146,3
other lands			1961,8	1944,1	1933,0	1923,0

Table 3-6. Distribution of the total land fund by land use categories (thousand hectares)

It is to note that although the level of removals decreased in 1990-1995 due to the decrease of forest areas in the country, in the following years, reforestation and afforestation measures in the forestry sector in Azerbaijan led to increase in carbon removals in the country. **While the forested area was 1.039 million hectares in 1990 and 1.038 million hectares in 1995, in 2001 these areas decreased to 989,000 hectares.**

The Forestry Development Department of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan has carried out reforestation measures in 159.7 thousand hectares in recent years within

[73] G.Sh. Mammadov, M.Y. Khalilov. Ecology, Environment and Human. Baku, "Elm" publishing house, 2006.- 608 p.

the framework of the "**National Program on Restoration and Expansion of Forests in the Republic of Azerbaijan (2003-2010)**"[74], new forests were planted on 53.9 thousand hectares, 102.7 million trees were planted. In general, large-scale tree-planting projects based on modern methods have been implemented in recent years after cleaning and rehabilitating arid areas and low-quality lands, 5,386,196 trees have been planted on 4,438 hectares, and about 11,000 kilometers of modern drip irrigation systems have been provided.

Meanwhile, for the implementation of the Order of the President of the Republic of Azerbaijan "On Greening of protective lanes on motorways", more than 3,000,000 evergreens and other trees and shrubs have been planted in recent years along the Alat-Hajigabul highway, the area between Bayil slope and the 20th Section, Gunashli Pass, around the International Airport, along the Alat-Astara highway.

Meanwhile, the issues of expanding the share of forest areas in the total land area to 12.5% by the end of 2015 and expanding the share of protected areas in the total area to 12% have been directly mentioned as targets within the strategic goals of "Improving the environmental situation, sustainable environmental management" in the "**State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015**" [75].

Thanks to actions undertaken in this sector, the GHG removals trend was as follows:

	GHG wastes and removals (Gg CO_2 eq.)										
	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Removals	-3690	-2456	-4870	-5349	-5410	-5773	-6082	-6335	-7044	-7119	-7224

Table 3-7. GHG removal trend

3.2.6 Waste sector

What distinguishes the waste sector from other sectors is that this sector has experienced annual increase in GHG levels for a long time since 1990. As shown in chart 3-15 below, prepared according to relevant inventory data, this sector had 72% increase in GHG emissions in 2016 compared to 1990.

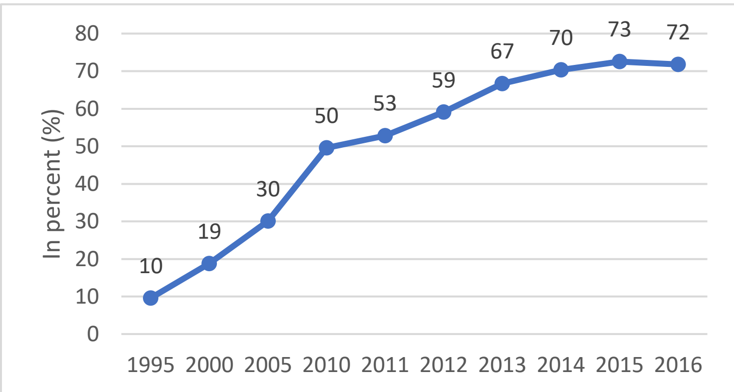


Chart 3-15. GHG emissions increase trend in the waste sector compared to 1990 (without removals), (in%)

This increase can be explained partly by population growth and partly by improvement in overall living standards.

The following chart shows the share of GHG emissions in total emissions in the waste sector during the reporting period:

[74] http://files.preslib.az/projects/azereco/az/eco_m4_1.pdf
[75] http://e-qanun.gov.az/framework/15399

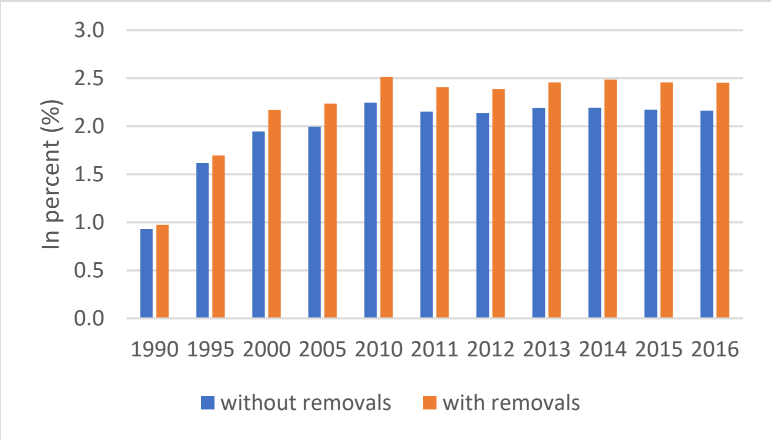


Chart 3-16. The share of waste sector in total GHG emissions

In fact, in 2016, GHG emissions in this sector accounted for about 2.2% of total emissions (excluding removals). Interestingly, this figure was only 0.9 percent in 1990.

At present, it is problematic issue to obtain accurate information on the amount and composition of waste in the country, as well as its changing trends. Especially in the countries of the former Soviet Union, it is not possible to conduct long-term analysis and accurately identify trends, as reports are conducted only by waste management organizations and these figures are expressed only in units of volume. Because in terms of GHG emissions, not only transportable but also generated wastes need to be considered. Prior to transportation, waste can be sorted several times, and vary in both quantity and composition. It is possible to separate paper, glass, metal and plastic materials from waste at the source, collection points and during transportation. In the last 10 years, about 100 wastes have been sorted blindly and unsystematically in order to provide raw materials for secondary processing plants created in Baku and Sumgait. Second, the density of solid household waste varies between 60-700 kg/cubic meter, mainly depending on the location[76]. Therefore, analyzes based on information about the amount and composition of solid household waste in the reports are usually inaccurate.

Analysis of policy and legislative documents of the Republic of Azerbaijan in household waste management

Such wastes in the Republic of Azerbaijan are governed by the Law "On industrial and household wastes" adopted by the "Milli Majlis" in 1998 and amendments made to the Law in 2007, as well as by normative-legal acts of the Cabinet of Ministers, separate Ministries, Baku City Executive Power and other relevant bodies. The list of these legislative documents is given in Table 4-8:

No.	Documents	Date of adoption	Note
1	"Guidelines for payment for natural resources and payments and penalties for harmful substances released into the environment and the use of these payments"	03 March 1992	Resolution of the Cabinet of Ministers No. 122 with Annex No. 216
2	"On conditions of supply and delivery of ferrous and non-ferrous scrap metal in the Republic of Azerbaijan"	23 March 1993	Resolution of the Cabinet of Ministers No. 158
3	"On approval of the list of activities requiring special permit (license)"	4 October 1997	As amended on July 1, 2000 and October 23, 2003
4	Law of the Republic of Azerbaijan "On industrial and household waste"	30 June 1998	Law on Amendments and Addenda to the Law No. 341-IIIQD, dated 22.05.2007
5	Law of the Republic of Azerbaijan "On Environmental Protection"	8 June 1999	No. 678-IQ
6	Law of the Republic of Azerbaijan "On Environmental Security"	8 June 1999	No. 677-İQ
7	Order on permission to build plants for processing of hazardous waste	29 June 1999	Cabinet of Ministers

[76] Понятие плотности ТКО (твердые коммунальные отходы) и формулы расчета (Concept of solid household waste (SHW) and calculation formulas. https://promusor.info/othody/plotnost-tko/

8	"Guidelines for transportation of dangerous goods by road"	27 January 2000	Resolution of the Cabinet of Ministers No.10
9	"Guidelines for transportation of dangerous goods by sea"	20 April 2000	Resolution of the Cabinet of Ministers No.75
10	Resolution "On types of production and enterprises where discharge (discharge) of industrial waste is prohibited"	13 July 2000	Resolution of the Cabinet of Ministers No. 122
11	"Guidelines for transportation of dangerous goods by rail"	20 November 2000	Resolution of the Cabinet of Ministers No. 207
12	Law of the Republic of Azerbaijan "On protection of atmospheric air"	27 March 2001	No. 109-İIQ
13	"Guidelines for certification of hazardous waste"	31 March 2003	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 41
14	Instruction "Inventory and classification of waste generated in production process and service areas"	31 March 2003	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 41, Certificate No. 419 dated July 1, 2003
15	Law of the Republic of Azerbaijan "On the basics of urban planning"	23 October 2003	Decree of the President of the Republic of Azerbaijan No. 953
16	On regulation of tariffs for solid waste collection, transportation and disposal services	24 November 2011	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 247 dated November 24, 2011
17	Law of the Republic of Azerbaijan "On Municipalities"	30 November 2004	Decree of the President of the Republic of Azerbaijan No. 637
18	"Guidelines for cleaning the territory of cities and other settlements in accordance with sanitary rules, hygiene and environmental standards, temporary storage, regular transportation and disposal of household waste"	21 April 2005	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 74
19	"Requirements for medical waste management"	28 December 2007	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 213
20	"Guidelines for inventory of wastes generated in production process"	25 January 2008	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 13
21	"Guidelines for cross-border transportation of hazardous waste"	25 July 2008	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 167
22	On improving the management of household waste in Baku city	06 August 2008	Decree of the President of the Republic of Azerbaijan
23	"Guidelines for determination of the charges for collection, placement, use and disposal of wastes"	12 August 2008	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 185
24	On water supply and wastewater	28 October 1999	Decree of the President of the Republic of Azerbaijan No. 723-IQ
Policy documents			
1	National Program on ecologically sustainable social and economic development in the Republic of Azerbaijan	18 February 2003	Decree of the President of the Republic of Azerbaijan No. 1152
2	"State Strategy for Hazardous Waste Management in the Republic of Azerbaijan"	25 August 2004	Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 117
3	"Comprehensive Action Plan on improving the ecological situation in the Republic of Azerbaijan for 2006-2010"	28 September 2006	Decree of the President of the Republic of Azerbaijan No. 1697
4	National Strategy on Improving Solid Waste Management in the Republic of Azerbaijan for 2018-2022.	01 November 2018	Decree of the President of the Republic of Azerbaijan
5	Action Plan on reduction of negative impact of plastic wastes on the environment in the Republic of Azerbaijan for 2019-2020.	7 February 2019	Decree of the President of the Republic of Azerbaijan

Table 3-8. List of legislative documents in waste management

The state ecological policy in the field of industrial (production) and household waste management in the Republic of Azerbaijan is implemented primarily through the relevant laws in force. The main legislative act in this area is the Law of the Republic of Azerbaijan "On Industrial and Domestic Waste" adopted in 1998. Along with this law, the framework principles of industrial and household waste management are reflected in the Law on Environmental Protection (1999), the country's main legal act in the field of environment. This Law covers all environmental components, the general legal regulation of the protection of ecosystems. Consisting of 5 chapters and 24 articles, the Law on Industrial and Domestic Waste mainly regulates the area under consideration. However, many provisions of the Law did not meet the legal requirements of modern waste management, in particular the European Union's Waste Directives. For this reason, the law was amended in May 2007. In fact, the preamble and 3 articles of the Law were compiled in a completely new wording, about 65 additions were made to 12 articles, and 6 new articles were added to the document.

The law introduces a new approach to the principles of state policy in waste management and the responsibilities of government agencies in this area. The articles added to the Law set requirements for solid waste landfills, medical waste, and waste management in the metal, oil, gas, and electricity power industries.

Meanwhile, the Basic Law on Wastes defines in detail the responsibilities of state bodies in the field of waste management relations regulation.

These are:

- determine and implement the state policy in waste management;
- state control over preparation, approval and performance of legislative acts and target programs;
- maintenance in waste control of compensation of damage to the environment by the party that caused harm;
- develop and approve waste management guidelines (collection, transportation, storage, use, neutralization, disposal, burial, state cadastre and registration, etc.), ensure their implementation;
- develop and apply state standards, norms and standards on waste management;
- conduct state ecological expertise, state cadastre and registration related to the field;
- design of waste management facilities, land allocation and construction of such facilities.

According to the provisions of the Law, the site for the placement and construction of solid waste landfills must be allocated in accordance with the approved master plans or projects for the planning and construction of urban and other settlements and suburban areas. The area selected for the location and construction of landfills must meet environmental standards and human health related legislation. According to the Law, economic regulation in the waste management field should be applied taking into account their volume, hazard level and disposal standards. Provisions for domestic, cross-border and transit transportation of waste have been drafted in accordance with the requirements of modern international environmental law. Relevant normative legal acts have been adopted by the Cabinet of Ministers and individual Ministries to ensure the implementation of the laws in the field of waste management. Meanwhile, the country's civil, administrative, disciplinary and criminal legislation provides for relevant provisions to ensure compliance with the requirements of waste management legislation and to determine liability. The Government of Azerbaijan has developed and approved National Plans, Strategies, Comprehensive Action Plans in the field of production (industrial) and household waste management, and a separate section has been devoted to waste management issues in the current State Programs on social and economic development. In 2004, the Cabinet of Ministers adopted the "State Strategy for Hazardous Waste Management in the Republic of Azerbaijan". The strategy fully covers hazardous waste management. Implementation of the strategy is entrusted to the Ministry of Ecology and Natural Resources and other relevant bodies.

In order to prevent the factors which, impact the environment negatively and improve the environmental situation in the country, the President of the Republic of Azerbaijan approved the "Comprehensive Action Plan on improving the environmental situation in the Republic of Azerbaijan for 2006-2013" by the Order dated September 28, 2006.

"6.3. the "Environment" section of the State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015 approved by the Decree of the President of the Republic of Azerbaijan No. 3043 dated September 15, 2008, covers the whole area of environmental protection, including waste management. The State Program envisages the development of a new strategy for the utilization of solid industrial, agricultural, and household waste generated from various activities in the country as raw material, energy carrier, fertilizer, construction and composite materials, and improvement of the quantitative and qualitative waste assessment.

It is planned to create new landfills that meet environmental and hygiene requirements for large settlements, to assess the location and area of existing legal and illegal landfills, their degree of damage to environment, to modernize them, and if not possible, to eliminate them.

The State Program of Social and economic Development of the Regions of the Republic of Azerbaijan for 2009-2013 (dated April 14, 2009) has defined the establishment of new enterprises for the collection, transportation, neutralization and processing of household waste, the involvement of the private sector in this area as a priority area of development.

Meanwhile, as noted in Table 4-8, the "National Strategy for Improving Solid Waste Management in the Republic of Azerbaijan for 2018-2022" which deals with waste management was approved by the order of the President of the Republic of Azerbaijan dated 01.11.2018. In the first stage, relevant measures aimed at making specific steps and achieving positive results for the successful implementation of this National Strategy, which will cover 5 (five) years, have been identified.

By implementation of the National Strategy, disposal and utilization of food waste, paper, plastic, metal, glass, demolition and construction waste, as well as electric lamps, old and useless electrical / electronic devices, batteries, discarded drugs and chemicals in places where solid household waste is generated (households, social and trade facilities, offices and organizations, recreation and tourism facilities, etc.) will enable to eliminate existing problems, to improve the system of collection, transportation and disposal of solid waste in the country, to increase efficiency, to form additional raw material market, to build recycling facilities, to create favorable conditions for potential entrepreneurs and investors interested in recycling, to gradually reduce subsidies from the state budget, to intensify the collection of payments for provided services, as well as to create new enterprises based on modern technologies using international experience, to enhance the processing market and to increase employment.

The concept document envisages expanding the scope of solid waste collection and sets specific goals. In fact, the document aims to fully collect 100% of waste in urban areas and 90% in rural areas by 2036. In general, according to the concept document, the forecast of waste generation and collection targets until 2036 is given in the following chart:

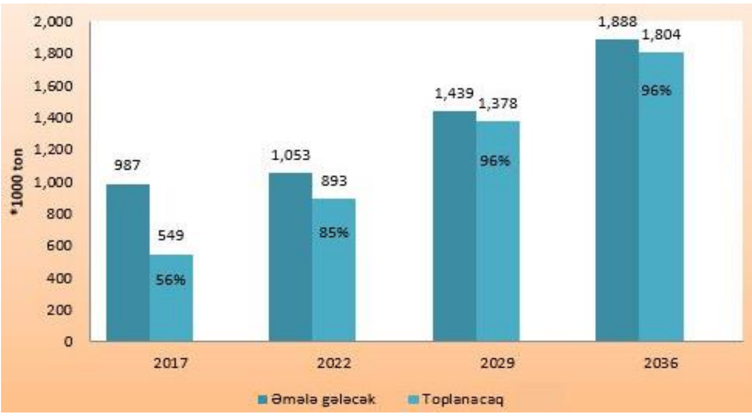


Chart 3-17. Waste Generation Forecast and Collection Targets

Meanwhile, landfills for waste (including radioactive) collection, disposal and disposal have been created by attracting international investments in the national economy and key sectors of the economy within the "National Program for Environmentally Sustainable Social and economic Development in the

Republic of Azerbaijan" [77] (Decree dated 18.02.2003), approved by the relevant decrees and orders of the President of the Republic of Azerbaijan, "Comprehensive Action Plan on improving the environmental situation in the Republic of Azerbaijan for 2006-2010", "State Program on social and economic development of Baku and its settlements in 2011-2013" [78] (Decree dated 04.05.2011), as well as within the framework of strategic roadmaps. As mentioned above, for this purpose, Solid Waste Incineration Plant with production capacity of 500,000 tons was constructed in Balakhani Settlement in order for disposal of waste generated in Baku.

3.3. Climate change mitigation and projection measures by sectors

As mentioned, in connection with the **Paris Agreement**, the Republic of Azerbaijan, in its Nationally Determined Contributions (NDCs) document, as a contribution to global climate change prevention initiatives, targeted a 35% reduction in GHG emissions compared the base year of 1990.

In this sense, the current information has been developed in accordance with the Guidelines for the preparation of national communications by Parties not included in Annex 1 to the Convention, as contained in paragraph 3 of decision 17/CP.8, adopted at the Conference of the Parties to the UN Framework Convention on Climate Change. During the reporting period, the Republic of Azerbaijan implemented a number of sectoral mitigation policies and measures to meet the commitments set out in the Nationally Determined Contributions (NDCs), i.e., to achieve the GHG emission reduction target.

This Chapter has described the most important specific mitigation actions in different sectors in both text and table format, calculated their effects in terms of reducing GHG emissions, analyzed the projections of separate measures until 2030, as well as the methodology used, including models and approximations, hypotheses, and sensitivity analysis. Then, the overall effect of the main mitigation actions in terms of reducing GHG emissions in each sector and projections until 2030 has been provided. Based on these analyzes, an assessment of the potential to reduce GHG emissions (mitigation potential) in the country has been made. It is precisely the calculation of this potential that allows the relevant decision-making bodies to make adequate decisions to achieve the goals set out in the Nationally Determined Contributions (NDCs).

Methods and tools for assessing GHG emission reduction potential

Based on the inventory data obtained in this Chapter, as well as the analysis and forecasting of GHG emissions on the basis of forecasting and development scenarios for different sectors of the economy, GHG emission mitigation actions related calculation and modelling have been made in special software, i.e., LEAP (**Low emissions analysis platform**). It is to note that the LEAP was developed by the **Stockholm Environment Institute (SEI)** specifically for different countries to implement the obligations of the Paris Agreement and is currently implemented in more than 40 countries, including Azerbaijan.

In fact, in the relevant sections of this Chapter, the reduction of GHG emissions has been calculated by modeling the effects of different policies and individual specific measures and their projections until 2030 in the LEAP software. Then, the total effect of all available measures for each sector and the projection until 2030 have been determined by modeling in the LEAP software.

It is to note that prior to the overall sectoral assessment, the effects and projections of separate actions were classified as **Existing Action Scenarios** or **Additional Action Scenarios** and compared with the **Baseline Scenario**, depending on their implementation in the reporting year.

For this, let's first familiarize ourselves with the concepts of **Baseline Scenario**, **Existing Action Scenario** (hereinafter, to be called '**WM (with measures)** scenario'), **Additional Action Scenario** (hereinafter, to be called '**WAM (with additional measures)** scenario').

[77] http://eco.gov.az/az/370-azerbaycan-respublikasinda-ekoloji-cehetden-dayaniqli-sosial-iqtisadi-inkisafa-dair-milli-program
[78] http://www.e-qanun.az/framework/21652

As it is known, the Baseline Scenario is a development scenario of the economy in which no policy and measures (i.e., mitigation actions) are implemented in terms of reducing GHG emissions, i.e., economic development takes place in its own way. In ex-post analysis, i.e., the analysis of the period before certain year, the Baseline Scenario is also called the **Business as Usual Scenario (BAU)** in a number of different sources.

In **Existing Action Scenario**, mitigation action that is being implemented or mitigation action, the financing of which has already been determined and the implementation of which has been approved. In the case of the **Additional Measures Scenario**, the mitigation action in question has not yet been implemented, no financial allocations and other organizational issues have been resolved, but decision on its implementation is very likely.

As noted, this Chapter has used software to calculate the mitigation potential, i.e., the potential to reduce GHG emissions, in accordance with the appropriate mitigation actions for different sectors. Examples of such tools are the **LEAP (Low Emissions Analysis Platform)** and other software tools (Table 4-9). Based on these analyzes, the total effect of measures to reduce GHG emissions in different sectors has been calculated, then this total effect when all sectors are taken into account together is calculated and this potential is projected for 2030 years. The main goal is to provide decision-makers with accurate information on the potential of being implemented and planned mitigation actions to reduce GHG emissions, thereby enabling them to make adequate decisions to achieve the objectives set out in the Nationally Determined Contributions (NDCs).

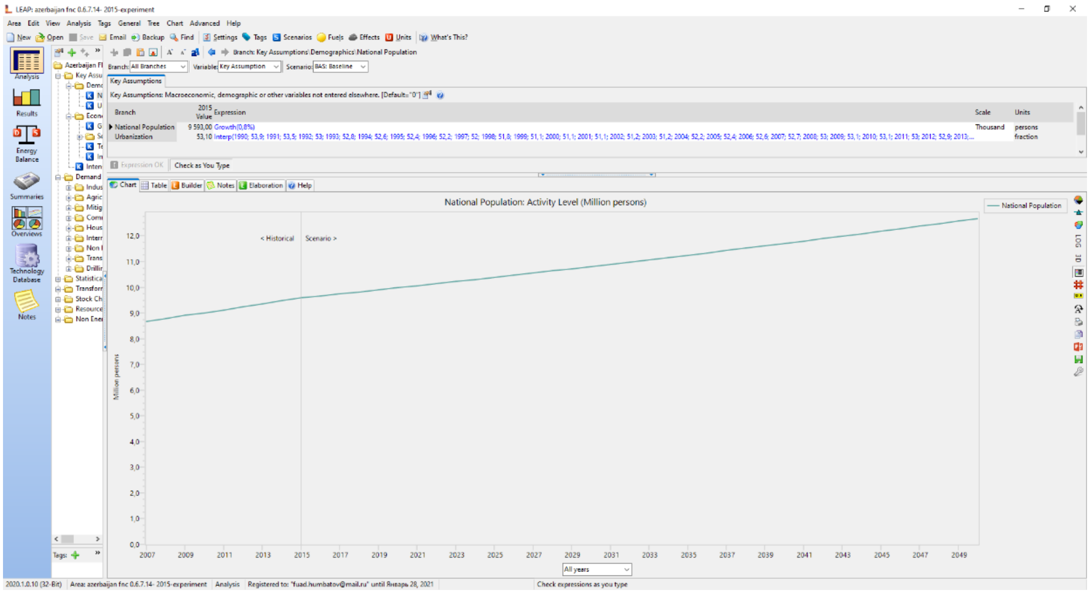
Sector	Recommended tools	Used tools	Notes
Energy	MESSAGE, MARKAL, ENPEP-BALANCE, LEAP, RETScreen	LEAP, LEAP2020 Standard calculation tool (IPCC 2006)	GHG mitigation potential for Heat Supply and Energy (including ARES) as well as transport sub-sectors was calculated using the LEAP software
Industry	LEAP	LEAP Standard calculation tool (IPCC 2006)	Along with LEAP software, the Standard Calculation Tool (IPCC 2006) was used to assess the mitigation potential of GHG in agricultural sector.
Agriculture	STAİR	Standard calculation tool (IPCC 2006)	The Standard Calculation Tool (IPCC 2006) was used to assess the mitigation potential of GHG in agricultural sector
Land Use and Forestry	COPATH	Standard calculation tool (IPCC 2006)	Standard Calculation Tool (IPCC 2006) was used to assess mitigation potential in land use and forestry sector
Waste	LEAP	Standard calculation tool (IPCC 2006)	Standard Calculation Tool (IPCC 2006) was used to assess mitigation potential in waste sector

Table 3-9. Tools for calculating the mitigation potential of GHG in different sectors in the Republic of Azerbaijan

Basic development assumptions on macroeconomic parameters

Population growth dynamics

Population of the Republic of Azerbaijan, according to the official data as of February 1, 2020, was 10.073 million people and the population growth compared to the corresponding period of 2019 was 0.8%. In fact, in the LEAP (**Low Emissions Analysis Platform**) software for 2019-2030, population growth in the baseline and other scenarios has been accepted as 0.8%. Meanwhile, based on the analysis of relevant data, the urbanization growth in the software has been accepted as 0.1 percent. With these parameters, the dynamics of population growth until 2030 will be as follows:



Graph 3-1. Forecast on population growth dynamics in the Republic of Azerbaijan

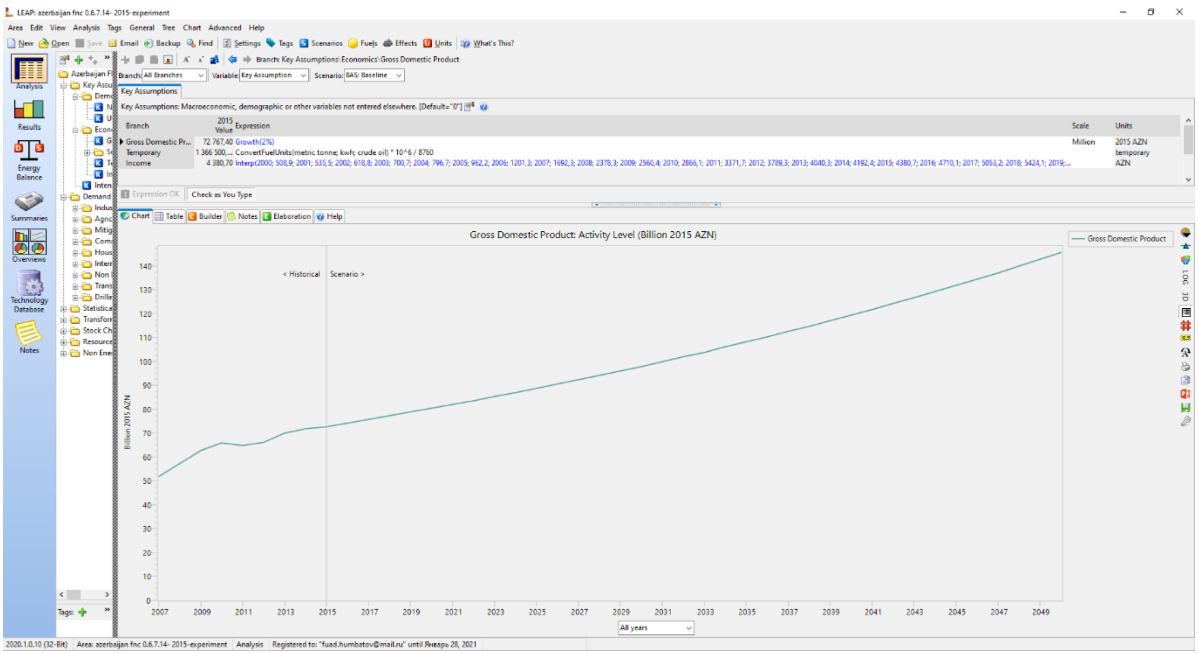
The table shows the population growth trend over the years more clearly:

Population	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Million people	9,5	9,6	9,7	9,7	9,8	9,9	10,0	10,1	10,1	10,2	10,3	10,4	10,5	10,6	10,6	10,7	10,8

Table 3-10.

Changing dynamics in GDP Growth

The Strategic Roadmaps, which define the development areas of the national economy in the Republic of Azerbaijan, forecast an average real annual growth of more than 3% in GDP by 2025. Meanwhile, the International Monetary Fund forecasts that the Azerbaijani economy will grow by 2-3% annually until 2025. In a statement in September 2016, the International Monetary Fund forecast that the average annual GDP growth rate in Azerbaijan in 2017-2020 will be 2.275%. In the current calculations, the annual GDP growth rate of 2% is assumed in the Baseline Scenario. In 2016-2050, the exchange rate between the US dollar and Azeri manat was taken as $ 1 = 1.7 manat.



Graph 3-2. Forecast on the GDP growth dynamics in the Republic of Azerbaijan until 2030

GDP	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Billion manat	72,0	72,8	74,2	75,7	77,2	78,8	80,3	81,9	83,6	85,3	87,0	88,7	90,5	92,3	94,1	96,0	97,9

Table 3-11. (1 $=1,7 manat)

In general, the GDP development of the Republic of Azerbaijan for the last 25 years can be divided into 4 periods:

- Recession period (1991–1994);
- Deep economic reforms, transition and recovery period (1995–2003);
- Economic development and progress period (2004–2014);
- Economic diversification period.

Other macroeconomic parameters, including per capita income, annual share estimates and forecast estimates of individual sectors, are included in the LEAP software, in the Baseline Scenario, as well as in the Existing Action Scenario (WM scenario in future) and Additional Action Scenario (WAM scenario in future) were taken into account.

3.3.1. GHG emissions reduction measures by sectors and their projections

Energy sector

As mentioned in different strategic documents mentioned in the previous chapter ("Azerbaijan 2020: Outlook for Future Development Concept"[79], Strategic Roadmap for the Prospects of National Economic of the Republic of Azerbaijan[80], etc.), the important share of the energy sector in the overall economy and the role in country's overall sustainable inclusive development have been historically high and in this sense, climate change mitigation policies and measures in the sector, sectoral assessment of their impact, projection of measures to reduce GHG emissions in the coming years are of particular importance. In this regard, the following will provide information on mitigation actions in place to reduce GHG emissions in the energy sector, which have been identified or financing of which has been defined and approved. During the reporting period, detailed information on individual mitigation actions was collected and systematized by inquiry we sent to relevant government agencies and enterprises in tabular form and their total effect on GHG emission reduction and projection until 2030 were calculated in the LEAP software. In fact, as at the end of each section, at the end of the Energy section, the overall sectoral total effect of mitigation actions was calculated in the LEAP and compared with the **Baseline Scenario**, and mitigation projections for these measures by 2030 were provided.

Oil and gas

1) **Oil and natural gas production**

Plan to reduce associated gas emissions (PRAGE),

Implemented by – SOCAR

This action is one of the most effective mitigation actions for the energy sector as a whole. It is a mitigation action implemented by SOCAR (State Oil Company of Azerbaijan) since 2010 in two stages, i.e., (2010-2015) and (2017-2022), and is aimed at reducing associated gas emissions in the production process.

The main goal of this action is to reduce associated gas emissions from normal production process to 95 million m^3 per year by 2022.

Initially, SOCAR became a member to the World Bank's Global Gas Flaring Reduction Partnership in 2008 and developed the "**Plan to Reduce Emissions by SOCAR and Emissions from Projects in which SOCAR**

[79] https://president.az/files/future_az.pdf
[80] https://static.president.az/pdf/38542.pdf

Participated in 2010-2015" and successfully implemented the activities envisaged in the Plan. As the result of its implementation, 656.9 million m^3 of gas was collected and provided to end users during the 5 years.

The chart below shows the **action projection scenario**, **baseline scenario**, and **actual scenario** for the specific mitigation action until 2022 and describes the ex-post analysis of the mitigation action for 2019. Here, the **action projection scenario** (project line in the chart) aims to reach the target of the action by 2022, i.e., 95 mln. m^3 represents the level of emissions planned to achieve reduction in volume each year. **Baseline scenario** (the "Baseline" in chart 3-18) - describes a scenario in which no mitigation actions are envisaged in SOCAR. **Actual Scenario** (the "actual" in chart 3-18) reflects the annual actual wastes until 2019:

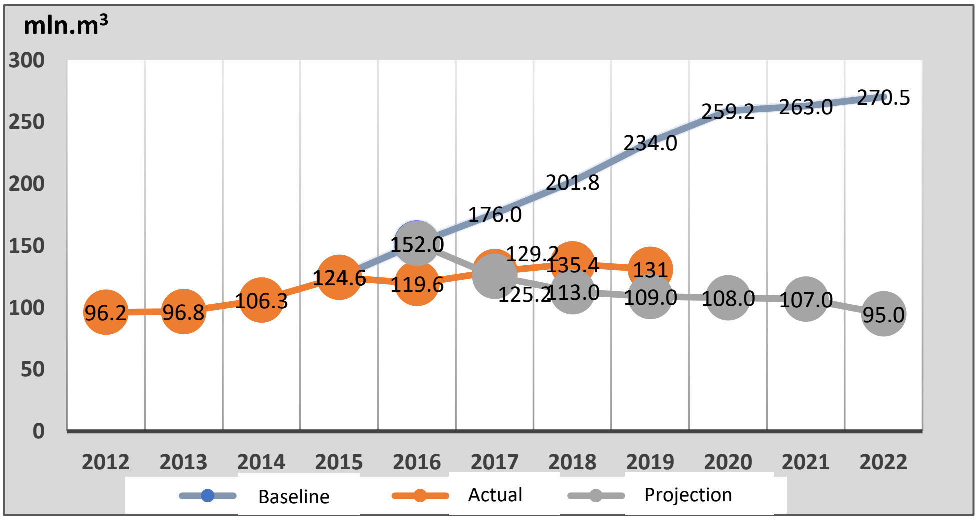


Chart 3-18. Ex-post analysis of associated gas emission reduction action for 2019

Based on the analysis of the scenarios given in chart 4-18, the following can be noted:

- According to the comparative analysis of the baseline scenario with the actual scenario, decrease of 32.4 million m^3 (i.e., 21.3%) was achieved in the emissions in 2016.
- In 2017, 46.8 million m^3 (i.e., 26.5%) less emissions were achieved than the baseline, and the projected action was 97% successful in the projection scenario that year.
- In 2018, 66.4 million m^3 (i.e., 32.9%) less emissions were achieved than the baseline, and the projected action was 83.5% successful in the projection scenario that year.
- In 2019, 103 million m^3 (i.e., 44%) less emissions were achieved than the baseline, the projected action was is 83.2% successful in the projection scenario that year.

In fact, in 2016-2019, SOCAR achieved a total reduction of 248.6 million m^3 and prevented the emission of about 158,000 tons of CH4 - methane gas (i.e., 3316.12 thousand tons of CO^2 eq.) corresponding to that volume of gas.

It is to note that the above-mentioned action is **WM scenario** action according to the relevant classification, as its funding has been determined. In fact, in order to fulfill SOCAR's commitments to the World Bank to reduce associated gas emissions, as well as to respond to annual inquiries sent by the Global Gas Flaring Reduction (GGFR) in accordance with international standards, SOCAR will provide instrumental measurements to determine associated gas volumes on annual basis, and the status of the implementation of the measures provided for in the "Plan to Reduce Emissions by SOCAR and Emissions from Projects in which SOCAR Participated" is being studied through environmental monitoring.

Meanwhile, SOCAR cooperates with a number of international organizations and oil companies to collect and use associated gas from some oil fields, as well as to prevent emissions from low-potential wells. One of such projects has already been successfully completed by SOCAR and the UNDP Azerbaijan

Office. The project was successfully completed within the framework of the "Nationally Appropriate Mitigation Actions (NAMA) to Reduce Carbon Emissions in the Fuel Consumption Sector of Azerbaijan" in the Zagli-Zeyva field of "Siyazanneft" OGPD. Within the framework of the project, new compressor and separator equipment, refrigeration systems and online control system were installed at 3 gas collection points in the field area, and a main gas pipeline with a total length of 32 km was laid. As the result of the project, which lasted for 2 years, it is planned to collect 6.8 million m^3 of associated gas per year. The main feature of the project is that the associated gas to be collected will be directed to the consumption of the population after processing. In fact, natural gas supply will be provided to 1250 subscribers in 15 surrounding villages.

Meanwhile, as the result of these mitigation actions, the emissions of other pollutants into the atmosphere was prevented. It is to note that in order to reduce the impact of climate change, SOCAR has been reporting on GHG inventory affecting climate change in all its areas and facilities since 2008 in its Sustainable Development reports.

2) Oil and natural gas production

Flaring gas volume reduction within Azeri-Chirag-Guneshli (ACG) project, Implemented by - BP (Azerbaijan)

This mitigation action is to reduce gas flaring in the production process at the Azeri-Chirag-Guneshli (ACG) oil fields. In order to reduce gas flaring, a joint "Working Group" was established between SOCAR and BP in 2011 and this Group has executed a number of actions to reduce flaring at the ACG field.

The following work has been done within the project so far:

Work done by BP-Azerbaijan:

To ensure the supply of associated gas from the Chirag-1 platform to the Neft Dashlari (Oil Rocks) compressor station:

- operational efficiency increased;
- Gas compressors and gas collection system were reconstructed on the Chirag-1 platform;
- A soft barrier was installed on the Chirag-1 platform to comply with safety regulations.

Work done by SOCAR:

- Neft Dashlari booster compressor station (BCS-2) has been modernized to increase gas volume.
- Additional compressor station consisting of 4 turbine booster compressors with capacity of 3.6 million m^3 each was installed at Neft Dashlari.
- The gas separation station and BCS-2 were connected by two new gas pipelines with an outer diameter of 300 mm.
- Necessary measures were taken to reduce the gas pressure level in Chirag-1 from 7.5-7.6 to 5.0-5.1.
- The station is equipped with gas drying unit to ensure dry gas supply; gas receiver equipment was modernized.

As the result of the works, the total volume of gas transported from the Chirag-1 platform to Neft Dashlari increased from 1.5-1.6 million m^3 per day to 1.9-2.0 million m^3. According to the above technical regulations, safe delivery of associated gas to the coast and delivery to end users was arranged. Both companies have invested heavily in the project.

Results of flaring gas reduction

As the initial Baseline of the project, the volume of associated gas flaring in 2010-2011 was accepted as 4%. Within the framework of the project, an improvement plan was developed in order to reduce the amount of gas flaring in 2012. As the result of the plan, the volume of gas flaring was reduced from 4% (initial scenario) to 2%. In 2019, this figure will be reduced to 0.9%.

This has been the best flaring gas reduction indicator in the last 20 years.

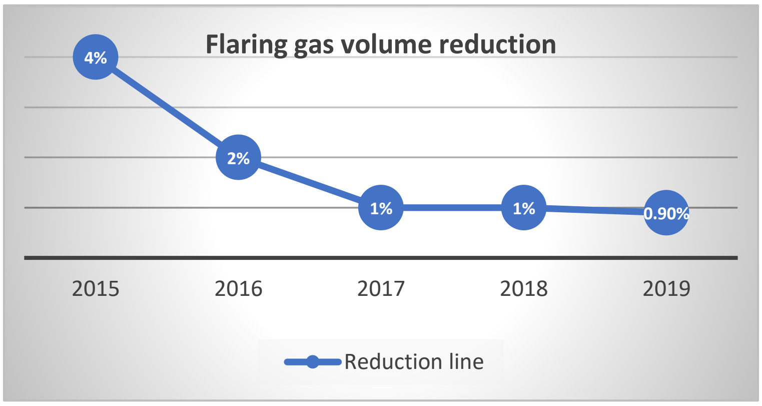


Chart 3-19. Ex-post analysis of the downward trend in gas flaring in 2019

As the result of this project, an additional 400,000 m^3 of gas will be collected per day, or 146 million m^3/year, on the other hand, about 265,000 tons of CO_2 eq./year of emission, which affect climate change will be prevented. The project has resulted in the reduction of flaring, the collection and transportation of low-pressure gas through existing infrastructure, the delivery of gas to consumers, the efficient use of energy sources and the improvement of consumers' access to energy. It is a significant mitigation action in terms of both economic benefits and mitigation of the climate change impacts.

3) Oil and natural gas production

Energy efficiency actions at Absheronneft OGPD (SOCAR), Implemented by - (Azneft PU, SOCAR)

Another important mitigation action in the oil and gas production process was implemented at the "Absheronneft" OGPD of to the "Azneft" PU under SOCAR. According to the action, in 2016, two modern Russian-made **ПТБ РТВ–5-40-Э** process furnaces used for deemulsification of crude oil were installed in the newly installed tank farm at "Absheronneft" OGPD of "Azneft" PU under SOCAR. As the result, these furnaces allow the economical use of natural gas used to heat crude oil, while minimizing toxic gases emitted into the atmosphere.

In fact, as the result of the action, in 2017 alone, 473 thousand m^3 of gas was saved compared to the previous year. According to the classification, this is a **WM scenario** action, as the mitigation action was implemented entirely with internal capabilities of SOCAR ("Azneft" PU).

4) Oil and natural gas production

Mitigation action for electricity efficiency, Implemented by – "Karasu" Operating Company and "Neftchala" Operating Company

The current mitigation action consists of two main parts.

In the first part, "**Karasu**" Operating Company saved electricity by applying new electrical equipment. In fact, if the volume of annual electricity consumption in 2015 was 72048621 kW/h, this figure was 55523556 kW/h in 2018 thanks to the use of new electrical equipment. This means 16525065 kW/h of electricity savings in 2018 and each subsequent year.

In the second part of the mitigation action, "**Neftchala**" Operating Company also saved electricity by applying new electrical equipment. In fact, if the volume of annual electricity consumption in 2015 was 7634603 kW/h, as the result of the use of new electrical equipment this figure was 7134534 kW/h in

2018. This means 500069 kW/h or 500,069 MW/h of electricity savings in 2018 and each subsequent year.

In fact, let us assume that in 2016, about 1/3 of this new volume of electricity (i.e., 166,689,667 MW/h) and in 2017, 2/3 (i.e., 333,379333 MW/h) decreased. Meanwhile, if we take into account that the volume of gas burned to produce 1 MW/h of electricity is equal to 0.53 tons of GHG emissions into the atmosphere, then the volume of GHG emissions will be 265.03657 tons of CO^2 in 2018. In fact, as the result of the mitigation action launched in 2015, the volume of GHG emissions will decrease 88.3455233 tons of CO_2 equivalent in 2016, 176.691047 tons of CO_2 equivalent in 2017, 265.03657 tons of CO_2 equivalent in 2018 and each subsequent year.

The action is a **WM scenario** action funded entirely by the operating companies themselves.

Meanwhile, mitigation actions prevented the emissions of other pollutants into the atmosphere.

5) Oil and natural gas production

Drilling process - Application of new technologies

Implemented by - SOCAR

The next significant mitigation action was implemented by the “Complex Drilling Works Trust” of SOCAR. In fact, starting from 2015, the Trust replaced its worn-out and obsolete equipment, i.e., BU-3000BD, BU-75, etc., which had been used for a long time in drilling, with new generation ZJ-30D, ZJ-50D, ZJ-30DVS, ZJ-70DVS drilling equipment sets. The action was implemented held at the expense of SOCAR’s internal financial resources. The mitigation action covers 2015-2030. In fact, it is planned to procure and install new generation drilling equipment on the foundations and sites where future drilling works are planned.

Assessment of the mitigation action’s effect on reducing GHG emissions showed that as the result of this action, 4,669.38 tons of diesel fuel were saved in 2015-2018, reducing 14,759,000 tons of CO_2, 0,6 tons of CH_4, and 0.1 tons of N_2O during that period.

The application of modern drilling equipment in the drilling areas during the mitigation actions, along with the reduction of GHG emissions, increased drilling speed, reduced drilling costs and in fact improved the social welfare of workers.

6) Oil and natural gas production

Gas transportation process - Reduction of process losses

Implemented by - SOCAR

As part of this mitigation action launched by SOCAR in 2013, it is planned to reduce losses in the gas transportation system to 1% by 2030 thanks to modernization of gas transmission technology, elimination of leaks and anti-corrosion measures.

In fact, making the gas and dust removal facilities operational in the gas-supplied regions of the country, detection of leaks and on-site repair in the gas transportation system through the infrared camera as per the contract with the “Clean Gas” company, renewal of pipes, replacement of corroded sections, installation of underground plastic pipes are being carried out. As the result, according to the dynamics observed in 2015-2018, the volume of annual gas transmission losses was 1.15-1.2%.

The mitigation action is a **WM scenario** action, according to the classification, as being implemented entirely by internal capabilities of SOCAR (“Azneft” PU).

7) Oil refining

Production process optimization action at Heydar Aliyev Oil Refinery

Implemented by – Heydar Aliyev Oil Refinery (SOCAR)

Before moving on to specific mitigation actions, it is necessary to provide information on the modernization project in the oil and gas refining site of Heydar Aliyev Refinery, in 2015-2020.

In fact, the Oil Refinery Modernization and Reconstruction Project is aimed at reconstruction of existing facilities and equipment, installation of new facilities in accordance with modern standards, increasing the overall productivity of the plant, bringing the quality of fuel produced in line with Euro-5 standards.

Specifically, the mitigation action aims to optimize the existing production process at the Heydar Aliyev Oil Refinery and covers 2015-2030. In fact, the mitigation action consists of stopping some air coolers during the technological process at the plant due to the cold weather in winter months, without disturbances of process conditions, and by this way saving electricity. As the result of the implementation of this action, the negative impact on the environment has been reduced, and the efficient use of material resources and natural resources has been achieved.

This mitigation action is a **WM scenario** action, according to the relevant classification, as being implemented entirely by internal capabilities of SOCAR.

8) Oil refining

Actions to replace incandescent lamps with energy-efficient lamps in the administrative buildings in the production sites and areas of the Heydar Aliyev Oil Refinery

Implemented by - Heydar Aliyev Oil Refinery (SOCAR)

This mitigation action consists of replacing incandescent lamps with energy-efficient lamps in the administrative buildings of the production sites and areas of Heydar Aliyev Oil Refinery. The action covers the years of 2015-2030. As the result of the implementation of this action, the negative impact on the environment has been reduced, and the efficient use of material resources and natural resources has been achieved.

The following table and chart show the effect of the action, i.e., the savings in electricity and the corresponding GHG (CO_2) reductions from the mitigation action over the years:

Years	2015	2016	2017	2018	Total
Reduction of electricity consumption (MW/h)	145	292,434	275,057	339,633	1052,124
Decrease in GHG emissions (tons of CO_2 eq.)	76,85	154,99	145,7802	180,0055	557,6257

Table 3-12. Estimation of total reductions in electricity consumption and GHG emissions from mitigation actions by years

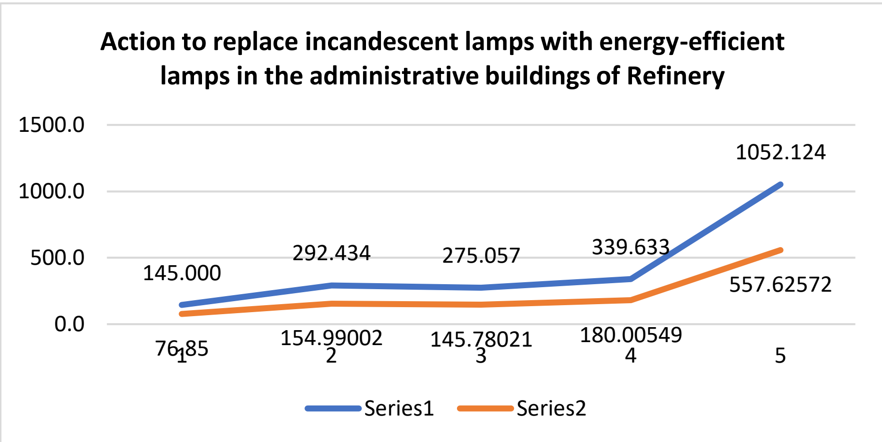


Chart 3-20. Estimation of total reductions in electricity consumption and GHG emissions as the result of mitigation actions by years

In the chart, the blue line shows the decrease in electricity consumption in the respective years (2015-2018) and in general, while the yellow line shows the total decrease in GHG, specifically CO_2 emissions over the years (2015-2018).

This mitigation action is a **WM scenario** action, according to the relevant classification, as it is implemented entirely by the internal capabilities of SOCAR. Its projection to 2030 has been modeled in terms of the emissions dynamics of the relevant GHG emissions, and based on its comparative analysis with the Baseline Scenario, the following reductions have been identified by 2030:

Years	2015	2016	2017	2018.	2030	Total
Reduction of electricity consumption (MW/h)	145	292,434	275,057	339,633	339,633	5127,72
Decrease in GHG emissions (tons of CO_2 eq.)	76,85	154,99	145,7802	180,0055	180,0055	2717,6916

Table 3-13. Estimation of total reductions in electricity consumption and GHG emissions as the result of mitigation actions by years

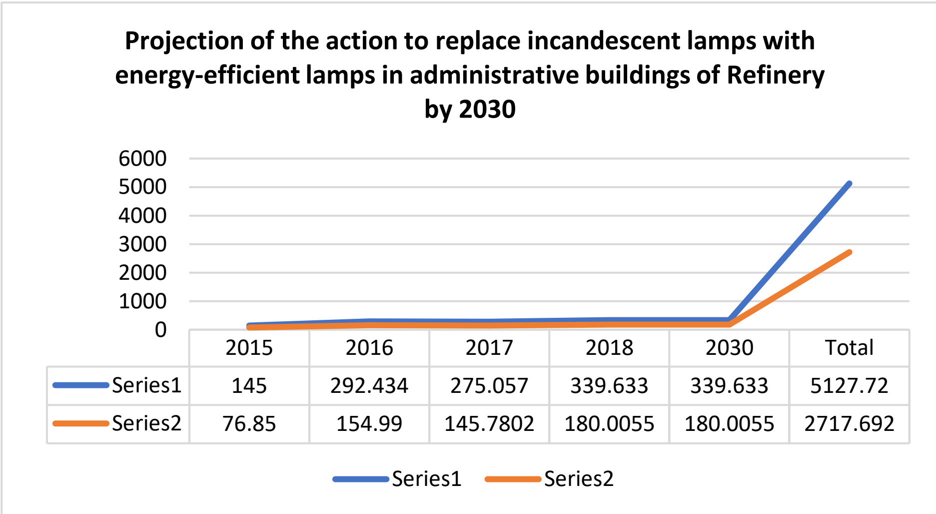


Chart 3-21. Estimation of total reductions in electricity consumption and GHG emissions as the result of mitigation actions by years

In the chart, the blue line represents the total reduction in electricity consumption over the corresponding years (2015-2030), and the yellow line represents the total decrease in GHG, specifically CO_2 emissions over the years (2015-2030). Modelling on relevant scenario was made in the LEAP software.

The funds saved as the result of the mitigation actions were spent for social security of the employees in the Heydar Aliyev Oil Refinery and for environmental projects.

9) Oil refining

Modernization and reconstruction at Heydar Aliyev Oil Refinery

Implemented by - Heydar Aliyev Oil Refinery (SOCAR)

The mitigation action consists of modernization and reconstruction works at Heydar Aliyev Oil Refinery. The action covers the years of 2016-2021. Reconstruction and modernization of the Refinery is implemented in 3 stages within the mitigation action:

- Phase 1 - install new bitumen plant and produce bitumen (2018)
- Phase 2 – provide Euro-5 diesel production (2020)
- Phase 3 – provide Euro-5 gasoline production (2021).

Reconstruction works at the Heydar Aliyev Oil Refinery will result in:

- increase the Plant's initial processing capacity from 6 million tons up to 7.5 million tons;
- increase the catalytic cracking unit's capacity from 2 million tons up to 2.5 million tons;
- construction of new bitumen plant;
- production of diesel and gasoline to meet Euro 5 standards;
- overall reconstruction of the Plant;
- optimization of the Plant's operating costs;
- provision of "Azerkimya" PU with gas raw material (LPG);
- It is planned to decommission the infrastructure of "Azerneftyag" oil refinery and vacate the territory.

The first phase of the modernization project, which began in 2016, consists of three main parts:

Construction and commissioning of new bitumen plant liquefied natural gas (LNG) refueling station and demolition and cleaning works in the areas where the facilities to be constructed in the next stages will be located and prepared for construction.

- The bitumen production facility covers an area of 7.7 hectares. About 150 thousand m² of soil, more than 650 tons of metal structures and more than 500,000 tons of pipes were used for the construction of the facility.

- The liquefied natural gas refueling station consists of loading arms for 6 tank trucks and 5 filling pipes. It is planned to transport 180,000 tons of propane-propylene, 100,000 tons of liquefied petroleum gas (LPG) by tanker and rail, and 178,000 tons of butane-butylene fraction by pipeline, and if necessary, by tanker or by rail.

- Propane-propylene and butane-butylene fractions will be used as raw materials in the enterprises of "Azerkimya" PU, as well as will be sold as a commodity for use in household and vehicles.

The issues of clearing the site of 13 main facilities to be built in the next stages from old facilities, conducting soil research works, which are very important for the overall progress of modernization, and preparing the area for construction and installation have already been resolved.

As the result of the modernization and reconstruction project of the Heydar Aliyev Oil Refinery, carbon monoxide emissions from the transport sector of Azerbaijan will be reduced by 20.57 thousand tons and NOx emissions by 3.6 thousand tons during the production of fuel to meet Euro-5 standards.

Indicators	Diesel vehicles	Gasoline vehicles
Annual mileage, km	7021590909,10	14958787878,70
Emissions from fuel meeting Euro-3 standard, thousand t		
CO	4,63	34,41
NO_x	3,51	2,24
Emissions from fuel meeting Euro-5 standard, thousand t		
CO	3,51	14,96
NO_x	1,26	0,90
Reductions, thousand t		
CO	**1,12**	**19,45**
NO_x	**2,25**	**1,34**

Table 3-14. Estimation of reductions in CO (carbon monoxide) and NOx emissions as the result of mitigation actions

Reduction of ozone precursors in the transition to the EURO-5 standard (for vehicles)

This mitigation action is a **WM scenario** action, according to the relevant classification, as it is carried out entirely by the internal capabilities of SOCAR.

10) Gas distribution system

Modernization of gas distribution system by "Azerigas" Production Association of SOCAR

Implemented by – SOCAR's "Azerigas" PU

The volume of annual natural gas losses is vast as the large part of the existing gas supply system in the Republic of Azerbaijan consists of the network constructed in 1960-1980s according to the standards existing in the former Soviet Union. The dynamic growth of natural gas demand by the population and industry, the recent acceleration of gasification, and the incompatibility of the existing network capacity with growing demand have led to big challenges to regulate natural gas supply regimes, communication failures and, as the result, significant natural gas losses. In 2015, the total loss from natural gas distribution was 1.07 billion cubic meters.[81] Despite the decrease in the level of losses compared to five years before, in 2015 it amounted to 18.6% of the volume of natural gas purchased by "Azerigas" PU. Also, the level of losses was 12.7 percent in January-September 2016.

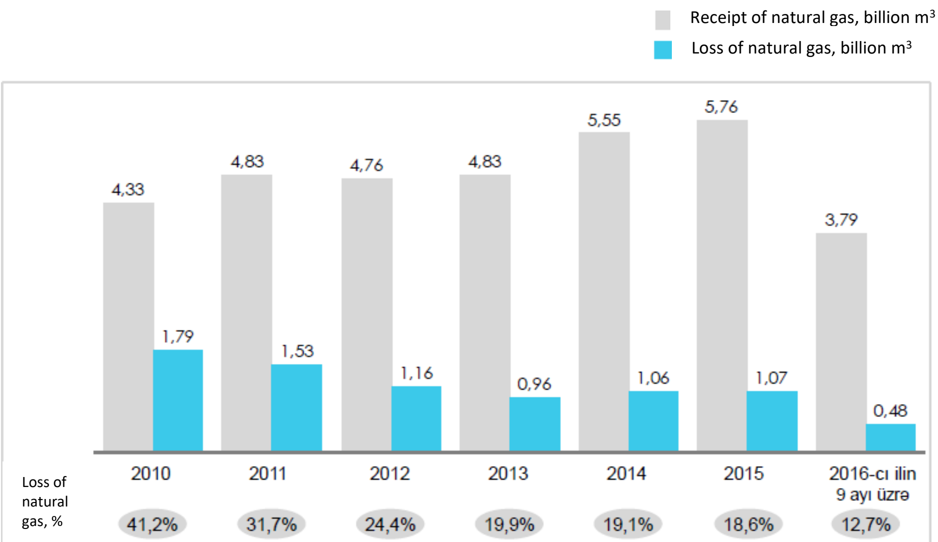


Chart 3-22. Receipt and loss of gas in the domestic gas distribution network (Source: "Azerigas" PU)[82]

In general, the vast majority of natural gas losses in the country occur in Baku. In fact, in January-August 2016, Baku accounted for 49.7% of the country's total natural gas consumption, as well as 68.4% of gas supply losses.

As the result of the mitigation actions implemented, gas losses in 2014 amounted to 19.09% of the total volume of transportation, while in 2018 this figure was 8.85%. As the result of the actions taken, the loss of 419 million m^3 of natural gas was reduced in 2015-2018. **Meanwhile, as the result of the current mitigation action, methane gas (CH_4) emissions decreased by 6693.52 thousand tons of CO_2 equivalent in GHG emissions in 2015-2018.**

This mitigation action is a **WM scenario** action, according to the relevant classification, as it is implemented by internal capabilities of Azerigas PU, i.e., SOCAR.

It is to note that as the result of mitigation actions, the gas supply to consumers has been stabilized and the sale of gas from the reduction of losses has generated additional financial resources.

Electric power industry

As noted, at present the country has 14 thermal power plants with a total installed capacity of 6270.9 MW (about 85% of the total electric power system capacity), 20 hydroelectric power stations (10 of

[81] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf
[82] See, the same link

which are small hydropower plants) with a total capacity of 1133.63 MW (about 15% of the total power system capacity). The installed capacity of renewable energy sources in the electricity system of the Republic is 1270,505 MW, of which 1133.63 MW are hydropower plants (including 1109.50 MW large HPP, 24.13 MW small HPP), 32.83 MW of solar, 66.04 MW of wind and 38 MW of bioenergy. Mitigation actions for renewable energy sources will be discussed in a separate section.

Actions taken in the electricity sector during the reporting period in the following areas have given impetus to the expansion of low-waste production:

- Rehabilitation of obsolete power plants;
- Construction of new stations with high energy efficiency;
- Reconstruction of transmission and distribution networks;
- Improve energy efficiency in the demand sector;
- Construction of power plants based on renewable energy sources;
- Improve tariff policy.

Mitigation actions to improve energy efficiency in electricity generation

The main purpose of the most activities in the areas mentioned in the Introduction is to increase energy efficiency in the electricity sector (including in thermal power plants), i.e., to reduce the specific consumption of fuel used to produce 1 kW/h of electricity and, consequently, to reduce GHG emissions. Therefore, as these measures reduce GHG emissions, they can be considered GHG mitigation actions. For example, the analysis of reports submitted by “AzerEnergy” OJSC in previous years showed that the fuel consumption (i.e., specific fuel consumption) consumed to produce 1 kW/h of electricity had the following dynamics:

- In 2011, compared to 2010, the specific fuel consumption for the generation of 1 kWh electricity per year dropped from 318.7 g/kWh to 315.0 g/kWh (i.e., 3.7 g/kWh) and as the result 62 thousand tons of conventional fuel were saved.

- In 2012, the specific fuel consumption for the generation of 1 kWh electricity was 314.9 g/kWh, the forecast of the Fuel Energy Balance increased by 1.03% compared to 311.7 g/kWh, which is 60.7 thousand tons excessive consumption of conventional fuel per year.

- specific fuel consumption for the generation of 1 kWh electricity decreased from 314.9 g/kWh in 2012 to 303.7 g/kWh in 2013 (i.e., 11.2 g/kWh) and as the result 201.0 thousand tons of conventional fuel were saved.

- specific fuel consumption for generation of 1 kWh electricity decreased from 303.7 g/kWh in 2013 to 293.5 g/kWh in 2014 (i.e., 7.2 g/kWh) and as the result 154.5 thousand tons of conventional fuel were saved.

- specific fuel consumption for generation of 1 kWh electricity decreased from 293.5 g/kWh in 2014 to 292.2 g/kWh in 2015 (i.e., 1.3 g/kWh) and as the result 16.1 thousand tons of conventional fuel were saved.

- specific consumption of conventional fuel for generation of 1 kWh electricity decreased from 292.2 g/kWh in 2015 to 285.9 g/kWh in 2016 (i.e., 6.3 g/kWh) and as the result 124,7 thousand tons of conventional fuel were saved.

- Fuel consumption for generation of 1 kWh electricity increased from 285.9 g/kWh in 2017 to 296.3 g/kWh in 2016 (i.e., 10.4 g/kWh) and as the result 203.0 thousand tons of extra conventional fuel was consumed. The main reason for this is the electricity generation at stations with high specific consumption of conventional fuel (“Azerbaijan” TPP and “Shirvan” TPP) due to the current repair works at efficient thermal power plants which are based on modern technologies (“South” TPP and “Sumgayit” TPP), as well as the share of fuel oil use with greater heat capacity (9520 kcal/kg) than natural gas (8000 kcal/kg) in total production in the country during the year.

- Fuel consumption for generation of 1 kWh electricity decreased from 296.3 g/kWh in 2017 to 280.8 g/kWh in in 2018 (i.e., 15.5 g/kWh) and as the result 316.9 thousand tons of conventional fuel were saved.

According to the relevant classification, this is a **WM scenario** action, as the mentioned measure led to GHG reduction and was implemented as a mitigation action entirely by internal financial capacity of "AzerEnergy" OJSC.

Mitigation actions for rehabilitation of obsolete power plants and construction of new power plants with high energy efficiency

"**Rehabilitation Program**", a new document prepared by AzerEnergy OJSC in 2018 envisages the implementation of comprehensive and in-depth measures in the energy sector. In fact, according to the program, one of the main goals is to transfer the load from one substation to another in emergency conditions, to eliminate losses, and most importantly, to reconstruct and increase the capacity of substations to provide consumers with better quality electricity. Works have been undertaken to restore lost power at **"Baku", "Astara", "Sheki", "Khachmaz", "Shahdag"** and **"Sangachal"** modular power plants, which play important role in the supply of electricity to infrastructure and business facilities in Baku, as well as in the regions, within the program launched in late 2018. Reconstruction of 500 kV, 330 kV, 320 kV, 110 kV overhead lines of many power plants and substations, as well as reconstruction of substations was continued. In 2019, power restoration works were conducted at "South", "North", "Baku" and "Sheki" power plants and 270 MW of power was restored. Meanwhile, the Rehabilitation Program envisages the complete reconstruction of the "Azerbaijan" Thermal Power Plant, the largest thermal power plant in the South Caucasus. During the past period, complex reconstruction work was implemented at the power unit No. 6 of "Azerbaijan" Thermal Power Plant, and consequently, after the reconstruction, 60 MW load limit was eliminated at the power unit No. 6. Turbines, generators, protective relay system, workshops, substations, 500 kV and 330 kV overhead lines, emergency control automatics are being reconstructed and restored at this station. The target is to increase the station's capacity by 320 MW and achieve 2,000 MW capacity. The Rehabilitation Program will improve the social status of about 5,600 employees working in the energy system, raise their salaries, as well as upgrade the level of vocational training.

In general, in 2018-2020, "AzerEnergy" OJSC implemented restoration works at the following power plants and restored 892 MW of electricity generation capacity (Table 3-15):

Name of Power Plant	Restored power (MW)	Actions
"South" PP	180 MW	Reconstruction of gas compressors, new gas line with a diameter of 530 km at a distance of 25 km to increase the efficiency of the combustion process, overhaul of units
"North" PP	20 MW	Replacement of damaged rotor with new one, overhaul of the unit
"Baku" PP	20 MW	Rehabilitation of 4 overhead lines (110 KV), replacement of 1 out of 12 units with brand new ones and overhaul of others
"Sheki" PP	40 MW	2 units were restored from scratch, the other 8 units were overhauled
"Sangachal" PP	62 MW	4 out of 18 units were completely out of order, 1 unit was completely replaced with new one, spare parts of 3 units were replaced, and the other 14 units were overhauled.
"Khachmaz" PP	40 MW	2 units were restored from scratch, the other 8 units were overhauled
"Baku" TPP	10 MW	many spare parts of Unit 2 were replaced with new ones, and some pipes for heating were renewed
"Shamkir" HPP	80 MW	replacement and complete overhaul of many spare parts in Unit 2
"Azerbaijan" TPP	440 MW	Bearings, couplings, pumps, steam lines were replaced with new ones in the turbine sets of units 1,2,3,4,5,7 and 8 and steam distribution system, lubrication system, feed water pipes, etc. were overhauled Separators, collectors, water economizer, suspension pipes and other parts were replaced with new ones in the boiler unit of units 1,2,3,4,5,7

		and 8 and lubrication pumps, silencers, pipelines, gas-air passages, and other parts were overhauled Fittings, regulators, rotating nets, etc. in the generator and electrical sections of units 1,2,3,4,5,7 and 8 were overhauled, some transformers were completely replaced with new ones Major repairs and restoration works in Unit 6 are underway
"Mingachevir" HPP	Not completed	Major repairs and restoration works are underway

Table 3-15. Restoration works by "AzerEnergy" OJSC in power plants in 2018-2020

Mitigation actions for construction of independent modular power plants

Meanwhile, along with to the main traditional power plants in the country, there are independent modular power plants which are designed for local economic needs, connected to the general network, have small installed capacity (usually up to 10 MW, but can be slightly higher) and which do not transmit generated power to long distances with main transmission lines (distributed electricity generation). Examples of such stations in the Republic of Azerbaijan are Samukh Agroenergy and Residential Complex, Hokmali wind power plant (WPP), Shurabad WPP, Surakhani solar power plant (SPP) and others.

It is to note that 3.7 MW "Yashma Gardens" WPP was added to the 50 MW "New Yashma" WPP and both plants are fully integrated into the central SCADA system. In 2019, 84.9 million kWh of electricity was generated. These plants are discussed in the ARES section.

The study of the impact of mitigation actions on the reduction of GHG in accordance with the construction of the independent modular power plants from 2011 to the present and in future years was modeled in the LEAP software. In fact, this action is also a **WM scenario** action according to the relevant classification, as it is implemented entirely by the internal financial capabilities of "AzerEnergy" OJSC.

Mitigation actions to reduce losses in transmission and distribution networks in power generating industry

The ultimate goal of the actions discussed in the Introduction - **Reconstruction of transmission and distribution networks** - is to reduce GHG emissions by reducing technological losses. In fact, technological losses in distribution was 3232.5 mln. kWh (16.4%) in 2015, 1934.0 mln. kWh (10.0%) in 2016. In 2017, the total loss of the electricity system was 2349.5 million kWh (10.8%). Of this, transmission losses were 518.1 mln. kWh (2.4%), and distribution losses were 1831.4 mln. kWh (9.9%). In 2018, technological losses were about 2341 million kWh (10.76%). Transmission losses were 509 mln. kWh (2.4%), and distribution losses were 1832 mln. kWh (9.6%). The reduction of technological losses in transmission was achieved as the result of reconstruction works in transmission networks (construction, renewal of transmission lines, etc., in line with the power increase).

Mitigation actions toward the construction of power plants based on renewable energy sources

Balakan Small Hydroelectric Power Plant (HPP), initiated by AzerEnergy OJSC and commissioned in 2017 in Balakan district of the Republic of Azerbaijan, is one of the actions to reduce GHG emissions. The main target in the construction of the 1.44 MW HHP is to increase the use of alternative and renewable energy sources and save traditional hydrocarbon fuels. In fact, the preliminary result is the savings in fuel consumption for the production of 2.9 million kWh of electricity in 2018. As hydropower plants have no emissions, the estimated emission reductions in the total electricity network in CO_2 equivalent for 2018 were 1,175,000 tons of GHG. According to the relevant classification, this mitigation action is a **WM scenario** action, as it is implemented entirely by internal capabilities of "AzerEnergy" OJSC.

Energy efficiency and use of renewable energy sources

In recent years, a number of important actions in the field of ARES have been implemented within the framework of the "Strategic Roadmaps for the National Economy and Key Sectors of the Economy" [83], "Azerbaijan 2020: Outlook for the Future" Development Concept[84] and "State Program for Industrial Development in the Republic of Azerbaijan for 2015-2020". [85]

Works implemented on ARES

In 2016-2018, the State Agency for Alternative and Renewable Energy Sources (**SAARES**) continued to implement Surakhani, Sumgayit, Pirallahi, Garadagh-Sahil and Samukh SPP projects (9.1 MW) and Nakhchivan Solar Power Station with a total capacity of 20 MW was constructed and put into operation. Meanwhile Chichekli, Ismayilli 2, Balakan hydropower plants were constructed (total 6.1 MW).

The Asian Development Bank (ADB) has launched a pilot project on "Knowledge Exchange and Technical Assistance for the Development of Floating Solar Panels Systems". The pilot project envisages the installation of a photovoltaic system with a capacity of up to 100 kW on Boyukshor Lake, as well as the building of business models to promote private sector participation in the installation of solar panels and strengthening national capacity through trainings. The project is planned to be completed by March 2021.

The implementation of the second phase of the project "Development of the necessary legal framework to promote favorable conditions for private sector's participation in the energy sector" implemented through technical assistance provided by the Asian Development Bank was completed, the final report was submitted. Cooperation was established with BP and ATKINS in the field of operation, construction and design of small hydropower plant, and discussions were held with ATKINS on the implementation of projects in this field with the support of BP. On October 19, 2018, the Ministry of Energy and BP signed a Letter of Intent to support the Ministry's efforts to improve the operation of the HPP in Azerbaijan and the efficient use of the hydropower potential of the rivers. Based on the results of the analysis and evaluation to be conducted by SNC-Lavalin's Atkins, selected as a consultant under the Letter of Intent, recommendations and a roadmap for improving the operation of stations and efficient use of river hydropower potential will be developed, taking into account best international practices.

The Ministry of Energy of the Republic of Azerbaijan cooperates with BP, Norway's Equinor, France's Total, Korea's Hyundai Engineering, United Arab Emirates' Masdar, Germany's Siemens Gamesa, Russia's Avelar Solar, Turkey's TEKFEN Construction and Installation Co., Inc., Turgas and Genay Construction Industry & Trade LLC, China's National Technical Imp. and exp. Corporation and China Power Engineering and Consulting Group LLC, Netherlands' Ballast Nedam and Qatar's Nebras. BP, TEKFEN Construction and Installation Co., Inc., Avelar Solar and the Ministry signed a Memorandum of Understanding on cooperation in the field of alternative and renewable energy, and Masdar signed a Framework Document for the Action Plan. With the support of the European Bank for Reconstruction and Development (EBRD), the projects "Strengthening the Network to Support Renewable Energy Projects in Azerbaijan" and "Regulatory support for the use of renewable energy sources in Azerbaijan" are under implementation.

In 2010-2017, water, solar, wind and waste incineration plants generated 17 billion kWh of electricity, which in turn saved 4.3 billion cubic meters of natural gas and prevented 7.7 million tons of carbon dioxide (CO_2) emissions into the atmosphere.

The installed capacity of renewable energy sources in the electricity system of the Republic is 1270,505 MW, of which 1133.63 MW are hydropower plants (including 1109.50 MW for big HPPs, 24.13 MW for

[83] http://iqtisadiislahat.org/documents/strateji_yol_xeritesi-11
[84] https://president.az/files/future_az.pdf
[85] http://senaye.gov.az/content/html/2281/attachments/Az%C9%99rbaycan%20Respublikas%C4%B1nda%20s%C9%99nayenin%20inki%C5%9Faf%C4%B1na%20dair%202015-2020-ci%20ill%C9%99r%20%C3%BC%C3%A7%C3%BCn%20D%C3%B6vl%C9%99t%20Proqram%C4%B1.pdf

small HPPs), 32.83 MW of solar, 66.04 MW of wind and 38 MW of bioenergy. It can be concluded that the share of renewable energy sources (RES) in total electricity is 17.79%.

As mentioned above, the potential of renewable energy sources in the Republic of Azerbaijan is 26,940 MW, including 3,000 MW for wind energy, 23,040 MW for solar energy, 380 MW for bioenergy, and 520 MW for mountain rivers. In order to use this potential, in 2014, on the basis of ARES potential, the ARES Energy Supply Atlas for all regions of the country was developed in the short, medium and long term and a three-stage "**Energy Development Model**" was developed for its implementation:

1. Small-capacity power plants - power supply of residential and non-residential buildings with the application of ARES and ESI technologies within the principle of "1 house-1 power plant";
2. Medium- capacity power plants - shaping of energy supply at the expense of local energy sources in cities and regions within the principle of "hybrid power stations";
3. Large- capacity power plants - enhance energy security by diversification of energy sources in the country.

Within the first component of the energy development model, numerous pilot projects were implemented, including solar panels and heat pumps, were installed in 24 social facilities of various types in Baku and the regions (Beylagan, Masalli, Bilasuvar and other districts) and as the result, the full or partial supply of electricity and heat was provided to some facilities from renewable energy sources.

Under the second component of the Model, hybrid power plants were constructed in Gobustan and Samukh districts. Two **hybrid-type** power plants that connect wind, solar and gas power plants is operating at the Gobustan Experimental Polygon and Training Center, which was established in 2011. Three wind turbines with capacity of 0.9 MW each, one solar power plant with capacity of 1.8 MW and one biogas plant with capacity of 1 MW have been installed in the Center.

Meanwhile, Samukh Agroenergy Residential Complex, opened in 2017, plans to construct hybrid power plant with capacity of 31 MW (20 MW solar, 3 MW geothermal, 8 MW biomass) and thermal power plant with capacity of 48 MW. At present, a 1.5 MW solar power plant is operating in Samukh.

Within the third component of the Model, 50 MW 'New Yashma', 8 MW 'Hokmeli', 3.6 MW 'Yashma Gardens' wind power parks and 1.7 MW 'Shurabad' wind power park, 22 MW 'Nakhchivan' solar power plant, 'Surakhani', 'Pirallahi', 'Garadagh', 'Sumgayit' solar power plants with design capacity of 2.8 MW each, 37 MW 'Baku Solid Waste Incineration Plant', 25 MW 'Fuzuli' HPP, 1.6 MW 'Ismayilli-1' HPP, 25 MW 'Takhtakorpu', 'Arpachay-1' and 'Arpachay-2' HPPs with total capacity of 21.9 MW, 25 MW 'Shamkirchay' HPP and the 2nd unit of 'Sheki HPP' with total capacity of 0.6 MW were constructed.

Meanwhile, the 'Azguntex' solar panels plant with annual production capacity of 60 MW and solar collectors producing enterprise was established in in Sumgayit Technologies Park, Sumgait.

Design and survey work and relevant calculations were carried out for the placement of 870 MW wind farms and other ARES facilities in 2021-2025. Designed ARES capacities are expected to exceed 910 MW in the next 5 years (Chart 3-23).

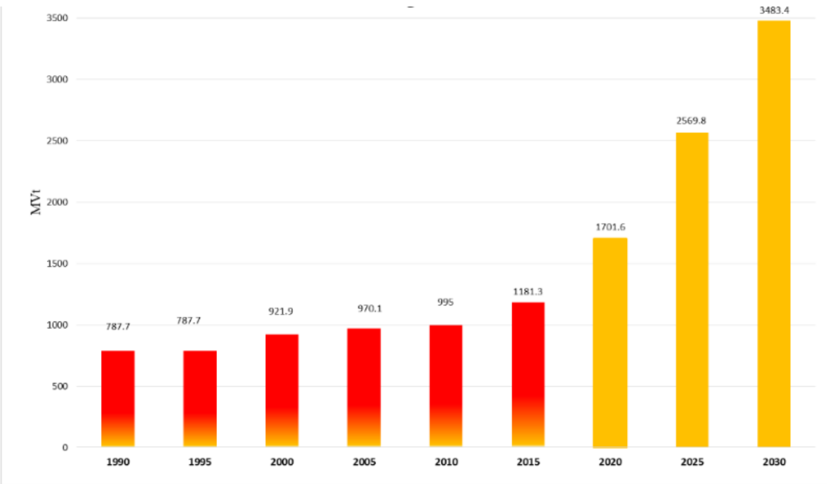


Chart 3-23. Installed capacities existing and predicted until 2030 for ARES in the Republic of Azerbaijan

The following chart (Chart 3-24) shows the current and projected situation, which provides for the production of electricity through ARES and, accordingly, the saving of natural gas and the prevention of CO_2 emissions.

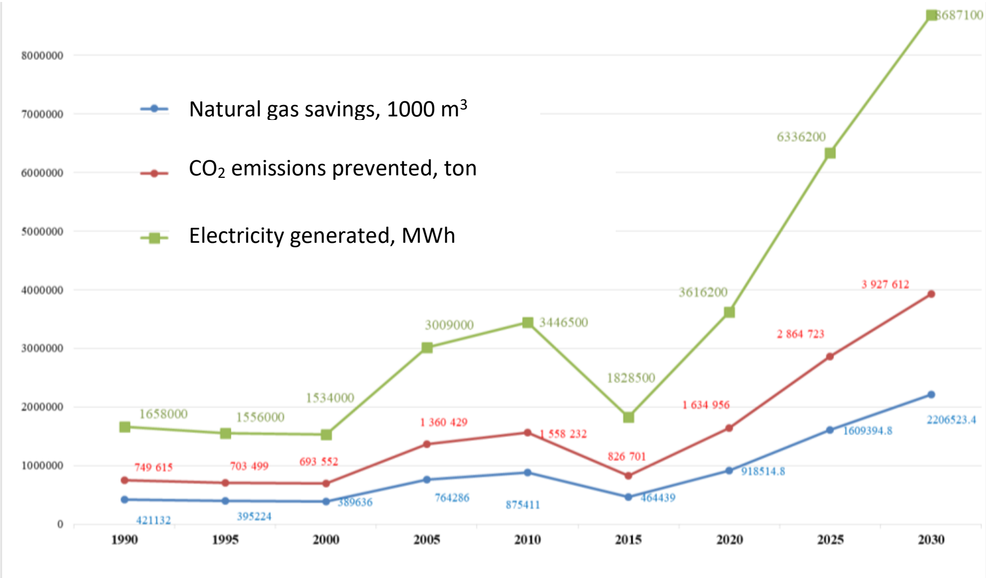


Chart 3-24. ARES electricity generation, natural gas savings and CO_2 emissions to be prevented by 2030

As shown in chart 4-24, it is planned to prevent about 3,000 tons of carbon dioxide emissions by 2030 from more than 2,200 MW of power generation by using varied ARES sources, which will facilitate the implementation of voluntary commitments under the Paris Climate Agreement.

Along with planned investments to provide sufficient electricity supply over the next 5-10 years, investments will be made to increase production to 1,000 MW. With these investments, the existing production capacity is expected to increase by 19 percent between 2015 and 2020, which is a level that will ensure safe reserve capacity (if there is steady growth in consumption).

In order to assess the efficiency of small hydropower plants (HPPs), the necessary analyzes were conducted to conduct research and analysis at the unfinished HPPs operated by AzerEnergy OJSC, as well as to assess the effectiveness of the construction of the stations to be designed and operated by AzerEnergy OJSC. “Ismayilli 1” and “Ismayilli-2” power plants, “Oguz-1”, “Oguz-2”, “Oguz 3” power plants under construction, as well as the area where the designed “Ismayilli-3” power plants will be built were inspected. Based on the results of the analysis and review, “Reference on the analysis of the current situation in state-owned small HPPs” and the draft Order of the President of the Republic of Azerbaijan “On additional measures to ensure the use of hydropower potential of small rivers (canals) and the efficiency of small HPPs” were developed.

SAARES together with the International Renewable Energy Agency is implementing the "Assessment of Renewable Energy Readiness in Azerbaijan" project. The Ministry of Energy has joined the program to benefit from the European Commission's TAIEX Information Exchange and Technical Assistance instrument.

In pilot areas selected for provision of alternative sources to remote localities where gasification is technically and economically inefficient, analyzes were conducted on the amount of energy required for heating per square meter of houses and on electricity consumption depending on climatic conditions. As the result, maps were developed, and a pilot project proposal was developed to meet energy needs using varied energy sources.

In 2018, takeover at Surakhani, Pirallahi solar power plants (SPPs) where construction and installation works were implemented at the request of the SAARES, and Gobustan Experimental Polygon and Training Center (EPTC) was continued. In accordance with the Work Schedule, Azalternativenerji LLC under the SAARES implemented extensive preventive measures at Surakhani and Pirallahi solar power plants and at Gobustan EPTC.

To assess the use of alternative and renewable energy in heat supply, especially solar, wind, geothermal and biomass energy, and ensure its widespread use, monitoring was conducted, and the benefits of its use were investigated. "Methodology for estimating heat demand in the Republic of Azerbaijan, taking into account the administrative-territorial division, climate and relief" was developed.

Meanwhile, in order to develop proposals to expand the use of ARES in the heating system and stimulate its use, "Regulations on the estimates of the heating requirements in old residential buildings", "Integrated intelligent system of low-rise buildings and cottages (suburban small houses)", "Recommendations for residential heating stations in high-rise residential buildings", "Methodology for calculating energy demand in buildings", " Regulations on energy demand in buildings ", " Design standards for replacement of central heating points in buildings with automated individual heating points ", "Standards on gas fuel consumed per unit of electric and thermal energy" and "Recommendations for assessing the economic efficiency of heating investment project".

Along with studying the combined use of pellet furnaces, biogas and cogeneration installations, heat pumps and solar power plants in order to ensure the efficiency of the heating supply system, experience of developed countries to eliminate problems in centralized systems (losses, downtime, accidents, etc.) has been investigated.

During 2018, the SAARES studied international experience in "Possibilities of using alternative energy sources in areas irrigated by subartesian wells and phased transition of subartesian wells to electronic management system", determined the suitability of subartesian wells for alternative and renewable energy sources, technical analyzes were conducted, initial negotiations were started on the selection of equipment and procurement of consulting services.

Specialists of the SAARES submitted a design on programming of water pumping systems working with solar panels, and automatically controlled irrigation systems to the competition held by the State Fund for Development of Information Technologies under the Ministry of Communications and High Technologies.

In order to maintain the balance of active and reactive power and power distribution in connection with the total measuring power in the power system, measurements were made for each hour at the appropriate hours and submitted to "AzerEnerji" OJSC, the Central Dispatching Service.

Based on the requests of the Baku International Sea Trade Port and Sadarak Shopping Center, the specialists of the SAARES got acquainted with the areas and conducted research in order to clarify the renewable energy potential in those areas. As the result, the installed capacity and other technical parameters of solar and wind power plants that can be installed in these areas were investigated.

The 2017 report of the UN Mainstreaming, Acceleration and Policy Support Mission (MAPS MISSION) on Sustainable Development Goals (SDGs) places great emphasis on the ARES area and the "Renewable energy and energy efficiency promotion" was identified as a possible area where progress can be accelerated by "greener" development from SDG Platform 3 to Platform 2 "renewable energy and energy efficiency promotion" was identified. The development of the relevant sector plays a multiplier effect and increase oil and gas export revenues and extend its life, diversify the economy, protect the environment, optimize consumption and production, and increase employment, and will have a positive impact on the achievement of other goals along with SGP Goal 7 (Access to affordable, reliable, sustainable, and modern energy for all).

Energy generation indicators on ARES

According to the latest statistics, the production capacity of electricity in the country is 7546,565 MW. There are 14 thermal power plants with total installed capacity of 6,270.9 MW and 20 hydroelectric power plants with total capacity of 1,134.46 MW (10 of which are small hydropower plants).

The total installed capacity of Renewable Energy Sources (RES) power plants, including all major hydropower plants, was 1,270 MW, which is about 18% of the total capacity.

According to preliminary statistics for 2018, 8.64% or 2054.2 million kWh[86] of 23774.3 million kWh of electricity generated from all sources[87] came from alternative and renewable energy sources (ARES) and large hydroelectric power plants (HPPs), which is 4.23% more than the electricity produced in the corresponding period of 2017. In terms of total energy production, ARES production increased from 8.61% to 8.64% during this period (Table 3-16).

No.	Indicators	Power production, mln. KW		Difference from previous year, mln. KW	Difference from previous year, %
		2017	2018		
	Total production	22900,0	23774,30	874,30	3,82
	Including, by ARES	1970,90	2054,20	83,30	4,23
	ARES share in total production, %	8,61	8,64		0,03
	Production distribution by ARES:				
1	In wind plants	25,74	85,66	59,92	232,78
2	In solar plants	37,83	39,84	2,01	5,31
3	In biogas plants	170,33	162,23	-8,10	-4,76
4	In small and big hydroelectric power stations	1737,00	1766,47	29,48	1,70

Table 3-16. Comparative analysis of electricity indicators produced from alternative and renewable energy sources in the Republic of Azerbaijan in 2018

In 2018, 507.91 million m^3 of natural gas was saved due to the energy produced by ARES and 1109.16 thousand tons of carbon dioxide (CO_2) was prevented from being released into the atmosphere.

In general, from the dates of commissioning of power plants on ARES in the country (excluding large hydropower plants) to the end of 2018, electricity of 862.95 million kWh by bio power plants, 227.73 mln. kWh by Small Hydroelectric Power Stations (SHPS), 139.21 mln. kWh by Wind Power Plants (WPP), and 120.93 mln. kWh by Solar Power Plants (HPP) was produced (Table 3-17).

[86] State Statistics Committee.
[87] State Statistics Committee.

No.	Plant name	Capacity (kW)	Total energy production by end of 2018, mln. KW
1	Wind Power Plants (WPPs)	60720	139,21
2	Solar Power Plants (SPPs)	36830	120,93
3	Small Hydroelectric Power Stations (HPSs)	25877	227,73
4	Bio power plants	44700	862,95
	Total	**168127**	**1350,82**

Table 3-17. Capacities and production indicators of alternative and renewable energy sources in the Republic of Azerbaijan by end of 2018

Accordingly, 333.998 million m^3 of natural gas was saved thanks to the energy produced by ARES (excluding big hydropower plants) and 729.44 thousand tons of carbon dioxide (CO_2) was prevented from being released into the atmosphere.

The energy produced by "Azalternativenerji" LLC under the SAARES from alternative and renewable energy sources was 8.3504 mln. kWh in 2017, 8.9707 mln. kWh in 2018 and the share of energy produced increased compared to the same period of previous year (Table 3-18).

No.	Indicators	Power production, mln. KW		Difference from previous year, mln. KW	Difference from previous year, %
		2017	2018		
1	Wind Power Plants (WPPs)	2,61	3,04	0,43	16,35
2	Solar Power Plants (SPPs)	5,62	5,06	-0,56	-9,96
3	Small Hydroelectric Power Stations (HPSs)	0,0004	0,0007	0,0003	88,35
4	Bio power plants	0,12	0,87	0,75	644,19
	Total	**8,3504**	**8,9707**	**0,6203**	**7,48**

Table 3-18. Comparative analysis of electricity generated from alternative and renewable energy sources by "AzalternativEnerji" LLC in 2018

The energy produced from ARES saved 2.28 billion m^3 of natural gas and prevented the release of 4,844,000 tons of carbon dioxide (CO_2) into the atmosphere. Thanks to equipment installed in social and service facilities, 14.6 thousand m^2 area was provided with heat along with hot water.

The increase shown in Table 3-18 was mainly in Small Hydroelectric Power Stations (750,000 kWh) and Wind Power Stations (430,000 kWh), which resulted from the repair and commissioning of the 3rd turbine at Gobustan HPP by internal funds of "AzalternativEnerji" LLC. Also, there were reductions (560,000 kWh) in solar power plants.

During 2018, a number of works were implemented at the expense of the budget in order to carry out repair and testing of electrical equipment at power plants and installation of new equipment. As the result of repairs and installation of new equipment, the amount of electricity produced at power plants in 2018 increased by 18.1% compared to 2017.

Perspective development and future investment projects

The Action Plan of the "Strategic Roadmap for the Development of Utilities (Electricity and Heat, Water and Gas) in the Republic of Azerbaijan" approved by the Decree of the President of the Republic of Azerbaijan No. 1138 dated December 6, 2016, envisages to create installed capacity of 420 MW from alternative and renewable energy until 2020, including 350 MW from wind energy, 50 MW from solar energy and 20 MW from bioenergy. In order to make additional investments to increase production capacity and diversify investments to new production capacities for forecasting domestic demand for electricity by the SAARES, new generation capacities and electricity and heat to be generated from ARES by 2020 and 2030 were forecasted in accordance with the potential and relevant proposals were developed.

According to the forecasts, in 2030, the amount of emissions released into the atmosphere will be reduced by 35% of the 1990 level or from 73.6 million tons of carbon equivalent to 47.6 million tons in accordance with the commitment of the Republic of Azerbaijan to implement the Nationally Defined Contributions under the Paris Agreement. To achieve this goal, ARES installed capacity should be 420 MW by 2020; 840 MW by 2025; and 925 MW by 2030:

ARES	2020	2025	2030
Wind	350 MW	440 MW	465 MW
Solar-electricity	50 MW	150 MW	190 MW
Water-rivers	10 MW	220 MW	220 MW
Bioenergy	20 MW	30 MW	50 MW
Total (MW)	430 MW	840 MW	925 MW
Total (ARES %)	20 %	25-28 %	30-35 %

Table 3-19. Forecast installed capacity from alternative and renewable energy sources until 2030

Generation of installed capacities of 420 MW (350 MW wind, 50 MW solar, 20 MW bioenergy) from the ARES by 2020 to diversify the energy portfolio in the "Strategic Roadmap for the Development of Utilities (Electricity, Heat, Water and Gas) in the Republic of Azerbaijan", the installed capacity will increase the share of renewable energy sources in total capacity from 18% to 24.4%, which will save more than 800 million m^3 of natural gas per year and reduce 1.4 million tons of carbon emissions.

Proposals on the implementation form and financing of 420 MW installed capacity from renewable energy sources, which is planned to be implemented by 2020, were developed by considering specific importance of public-private partnership in terms of efficient use of public funds, attraction of private sector resources, as well as risk sharing. By public investments, institutional measures, and the involvement of the private sector, it is possible to increase the share of alternative energy in the country's energy balance to 50% by 2050.

The mitigation action, which is consistent with the implementation of these installed capacities, is implemented entirely by internal capabilities of the State Agency for Alternative and Renewable Energy Sources (SAARES), and therefore, this is a **WM scenario** action, according to the classification.

Perspective investment projects

"WIND ISLAND–1"

As the result of the analysis conducted for the implementation of the project, the coastal zone of the Absheron Peninsula (the area between Pirallahi and Chilov Islands) was selected as a more potential and priority area.

The project has already been submitted to the Government in early 2020. At the initial stage, it is planned to implement a 198 MW WPP project in the selected area. The area of the studied priority zone is 227 km^2. In fact, the project includes the construction of a 22.5 km long road to connect the small islands from Pirallahi to Chilov Island via elevated roads and bridges, and creating a direct transport infrastructure to Chilov Island, which has a population of 2,000 people. Meanwhile, special platforms will be created for the installation of turbines every 350 meters, on the right and left sides of the road. If the project is approved, the works will be entrusted to a Chinese company specialized in this field.

"Buzovna Eco-Village" project

The project is planned to be implemented on an area of 40 hectares in Buzovna settlement, Khazar district, Baku.

The "Buzovna Eco-Village project" on the shores of the Caspian Sea consists of a fully sustainable "Smart" residential complex that will use solar and wind energy. It is planned to build 2 types of apartments (cottages and buildings) within the project. The “Smart” residential complex, consisting of cottages and apartments, is designed mainly for young families.

Under the project, it is planned to provide buildings with clean energy (solar, geothermal, biomass and small wind turbines).

“Samukh Agroenergy Residential Complex”

The Agroenergy Complex (AEC), located in the Samukh district, is a project that combines an ARES power plant, agriculture, and its processing industries.

The project envisages the construction of one 20 MW Solar Power Plant (HPP), one 8 MW Biogas plant, one 3 MW Geothermal, and one 48 MW Thermal Power Plant.

“Aqua Energy Park”

The project envisages the construction of a floating solar power plant with a capacity of 300 MW in the Samukh district and the establishment of a complex to produce about 1,000 tons of fishery products. Analysis of the results of perennial observations shows that, the optimal amount of solar radiation falling on the surface of the area per year allows considering the area preferable for the 300 MW installation capacity of solar power.

“Biomass and Pellet Production Plant”

The Pellet Production Plant is designed to provide thermal energy to different regions of the country by cotton waste. Taking into account the sound development of the cotton industry, the first project is planned to be implemented in Sabirabad district. The project envisages the construction of a pellet plant with a capacity of 1.5-2 tons/hour.

Pilot projects with ACWA Power (Kingdom of Saudi Arabia) for wind power plants and with Masdar (UAE) for solar power plants

On January 9, 2020, the Ministry of Energy of the Republic of Azerbaijan and ACWA Power of the Kingdom of Saudi Arabia and Masdar of the United Arab Emirates signed Implementation Agreements of pilot projects on renewable energy. According to the agreements, pilot projects will be implemented with “ACWA Power” for the construction of 240 MW wind power plant and with “Masdar” for the construction of 200 MW solar power plant. Totally, production of about $ 1.4 billion KWh of electricity per year is forecasted from the wind and solar energy projects.

It is to note that, in accordance with the Presidential Decree No. 1209 of 2019 “On accelerating reforms in the energy sector of the Republic of Azerbaijan”, in order to expand the use of renewable energy sources intensive discussions were held with 9 international energy companies by establishing cooperation with 9 international energy companies. ACWA Power and Masdar were selected as the result of a three-stage selection process among the seven bidders.[88].

Meanwhile, special mention should be made of the “Support for Renewable Energy Auctions in Azerbaijan” project with the technical assistance of the European Bank for Reconstruction and Development and the “Floating Solar Systems” project with the technical assistance of the Asian Development Bank (ADB) which envisages construction of a 100 kW power plant on Boyukshor Lake, as well as enhancing knowledge and skills in this area.

Roadmap for Wind Energy in the Caspian Sea in Azerbaijan

In 2020, the Ministry of Energy of the Republic of Azerbaijan and the World Bank Group (known as the WBG jointly with the World Bank and the International Finance Corporation) made agreement on cooperation for the use of wind energy in the Caspian Sea based on BOEM technology and for development of roadmap. The ground for this cooperation served the scientific results obtained during

[88] http://www.minenergy.gov.az/index.php/az/news-archive/618-01-09-2020

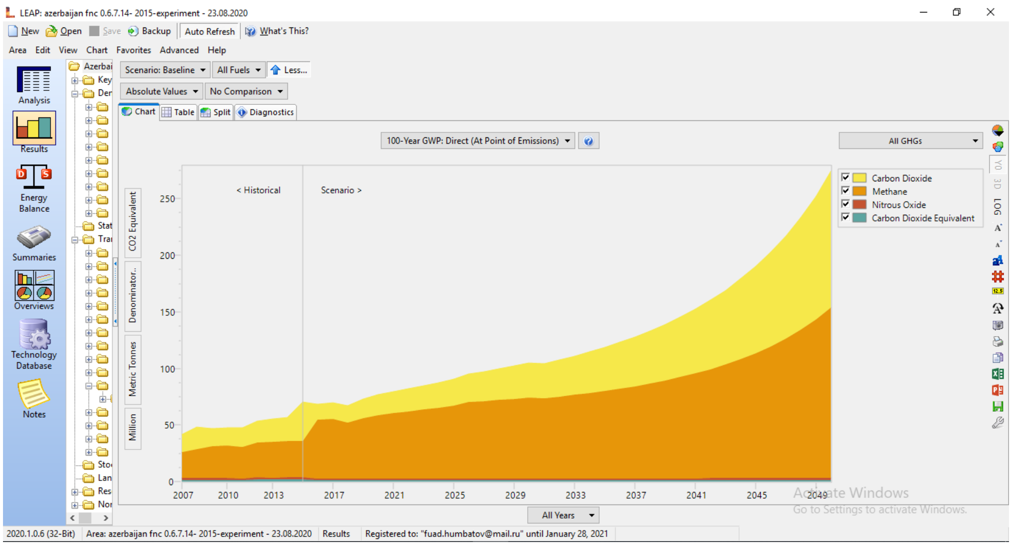
the research conducted by the International Renewable Energy Agency (IRENA) for 2010-2019[89]. In fact, although offshore wind energy is more expensive than both onshore wind and solar energy, its efficiency is higher. For example, on onshore wind systems this figure is 35.6%, while offshore this figure is 43.4%. At the same time, modern technologies can reduce the average cost of offshore wind systems by 29%, i.e., from $ 4,650 to $ 3,800 per kWh (the cost of 1 kW was about $ 11.5) [90]. Meanwhile, calculations show that by the end of 2019, the total installed capacity of actual offshore wind power plants around the world is already 28.3 GW, of which 21.8 GW accounts for European countries.

Globally, the potential of offshore wind energy is estimated at 80 GW. In fact, for the future application of the BOEM technology in our country, i.e., in the Caspian Sea, it is important to assess the potential in this area and develop an appropriate Road Map.

Once fully agreed at the government level and the sources of funding for their implementation are identified, these mitigation actions can be considered as additional measures, **i.e., WAM-measures**, and can be compared with the baseline scenario.

Total effect and projection of GHG emission reduction measures in the energy sector (excluding transport)

First, in order to get an idea of the overall total effect of mitigation actions in the energy sector and all other sectors and their projection until 2030, let's get acquainted with the forecast-analysis of GHG emissions during the development of the economy according to the **Baseline Scenario** under the existing conditions, that is, during development without implementing any mitigation measures by years in LEAP until 2030:



Graph 3-3. GHG emissions volume by years according to the Baseline Scenario, GHG Analysis (LEAP)

The table corresponding the mentioned graph is described below:

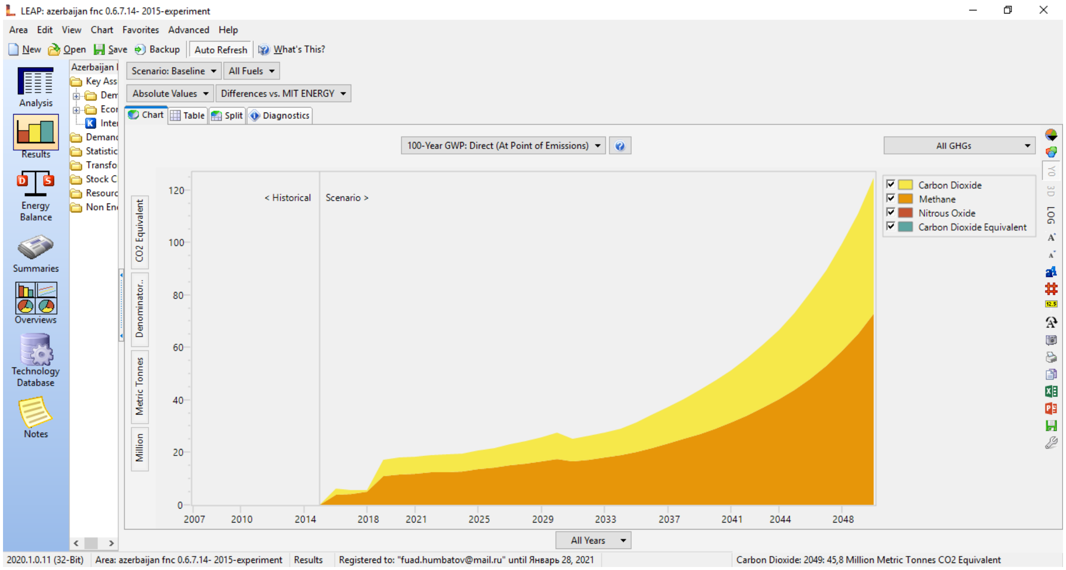
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO2	19.8	20.4	35.0	13.8	14.6	15.2	16.8	17.9	19.2	20.0	21.1	22.1	23.3	24.8	26.2	27.5	29.0	30.5
CH4	32.1	31.9	31.6	52.1	52.4	49.5	53.3	56.0	57.6	59.1	60.8	62.6	64.5	67.3	68.3	69.3	70.4	71.5
N2O	1.3	2.2	2.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3
Other GHG gasses	2.1	1.8	1.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
TOTAL	55.3	56.4	70.6	68.7	69.8	67.4	72.8	76.7	79.6	81.9	84.7	87.4	90.7	94.9	97.4	99.7	102.2	104.9

Table 3-20. (million tons of CO_2 equivalent)

As can be seen from Graph 3-3 and the corresponding table, in such development scenario, the volume of GHG emissions in 2030 is projected at **104.9 million tons of CO_2 equivalent** (including removals).

[89] http://www.irena.org
[90] http://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019

Then, in order to assess the overall effect of the above-mentioned mitigation actions in the energy sector and their projection until 2030, we will make a comparative analysis of the GHG emissions generated during the development of the economy according to the **Baseline Scenario**, i.e., without any mitigation actions. To this end, upon modeling all the mitigation measures in the energy sector mentioned above and obtained in tabular format in the LEAP software, a unified MIT-Energy scenario was developed to integrate all of them to determine their overall effect and projection for future years. Further, the dynamics of the decrease in GHG emissions under this scenario compared to the Baseline Scenario over the years was calculated as follows:



Graph 3-4. Dynamics (LEAP) of decrease in GHG Emissions in the MIT-Energy Scenario by years, which includes existing mitigation actions in the energy sector, compared to the Baseline Scenario

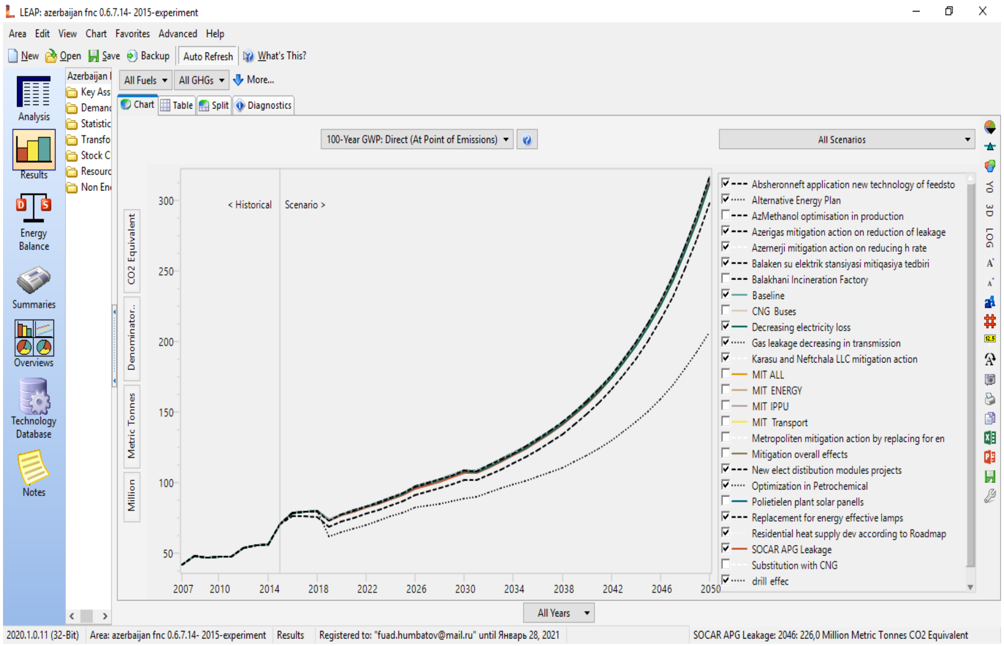
The table corresponding the mentioned graph is described below:

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO_2	4,1	4,2	6,1	5,8	6,1	6,3	6,3	6,5	6,4	6,8	6,8	7,2	7,7	8,2	8,7
CH_4	5,6	7,0	9,6	10,7	11,2	11,6	11,8	12,2	12,4	13,1	13,5	14,2	14,8	15,5	16,3
N_2O	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Other GHG gasses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**9,7**	**11,3**	**15,6**	**16,5**	**17,3**	**17,9**	**18,1**	**18,7**	**18,8**	**19,9**	**20,3**	**21,4**	**22,5**	**23,7**	**25,0**

Table 3-20. (million tons of CO2 equivalent)

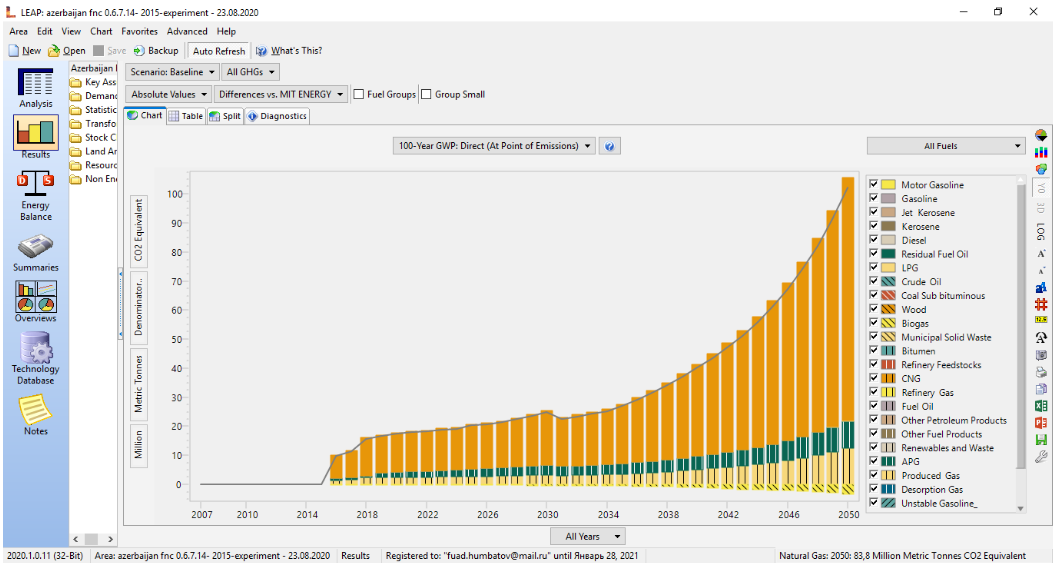
The analysis of the last table shows that the downward trend in GHG emissions in the energy sector which resulted from the above-mentioned mitigation actions (according to the Baseline Scenario) will continue until 2030, and if this decrease is 9.7 million tons of CO_2 equivalent in 2016, the figure will reach the level of 25 million tons of CO2 equivalent (including removals) by 2030. Together with the mitigation actions in the following paragraphs, the analysis will show that mitigation actions in this sector are the most effective in terms of reducing emissions compared to other sectors, just as they are in the first place in terms of GHG emissions in the energy sector.

The following graph compares the GHG emissions by 2030 according to the various mitigation actions in the energy sector and the Baseline Scenario:



Graph 3-5. Graphs on GHG emission volumes according to individual mitigation actions and the Baseline Scenario in the energy sector (LEAP)

The following graph shows a comparison in which types of fuels reductions occurred and which reductions occurred from the overall application of mitigation actions in the energy sector in terms of the Baseline Scenario:



Graph 3-6. Volume of reductions for different types of fuels resulted from general application of all mitigation actions in the energy sector in terms of the Baseline Scenario (LEAP)

As can be seen from the last graph, during the overall application of mitigation actions in the energy sector, there are significant reductions mainly in natural gas emissions, in terms of the Baseline Scenario.

Transport sector

The transport sector is one of the most crucial sectors, which generate GHG emissions. As noted, according to statistics, the number of vehicles increased by almost 3 times from 2000 to 2016, while the volume of freight traffic increased by 50 times.

As noted, in order to make the Republic of Azerbaijan an attractive transit and trade hub, special attention was paid to the expansion of highway and railway routes along the north-south and east-west transport corridors of the country. It is planned to invest about $ 7 billion (4.7% of GDP) for this purpose in 2017-2020.[91]

While these measures will not directly reduce pollutants, they will indirectly cut emissions. Under the program, numbers of highways were constructed, existing roads were enlarged, overpasses and underpasses, new parking stands were installed, which in its turn, caused reduction of traffic jams and ensured a speed-up in the movement of traffic, and resulted in decrease of emissions released from transportation sector to the atmosphere.

Highways and transportation

Considering the fact that, the amount of carbon emissions released during fuel use depends on speed of the means of transportation, plan and longitudinal profile for the design and construction of highways are developed to ensure movement of vehicles with the constant speed. Technical and economic indicators, as well as environmental impacts during highway construction are calculated, compliance of road with landscape is considered and design solution with minimum environmental impacts is preferred during the selection of direction and structure of highways.

Use of industrial wastes which are located in the construction zone and useful for construction, as well as of asphalt-concrete wastes which are re-treated in the course of construction for the construction of highways allows saving raw materials and energy consumed for the production of new materials.

Development of highways plays special role in increasing the speed of passenger carriage and shipments by means of transportation. Several significant actions were taken towards improving transportation-operation indicators which directly meet the interests of consumers using highways and developing road infrastructure in 2011-2016. As a result of purposeful and systematic actions, the scope of construction, reconstruction and repair have increased year by year. In fact, the number of passage bridges under general use constructed, reconstructed, and repaired within this period was 194, which in its turn served for decrease in the amount of release of harmful wastes into the atmosphere as well as the speed-up in the movement of traffic.

In recent years, rapid economic development, annual population growth and welfare improvement of Republic of Azerbaijan has resulted in rapid increase of parking vehicle lots. Based on the relevant decisions of the Cabinet of Ministers of the Republic of Azerbaijan, in order to ensure harmonization of requirements on harmful wastes released to the atmosphere from the means of transportation wheeled out in the Republic of Azerbaijan to European standards, since July 1, 2010 Euro-2 ecological norms, while since April 1, 2014 Euro-4 ecological norms have been applied in the territory of the Republic of Azerbaijan. This measure has mainly been introduced to complement the country’s vehicle fleet with vehicles that meet higher environmental standards.

It should be noted that, passenger vehicles imported to the Republic of Azerbaijan are subject to excise tax rates depending on their engine size. According to the applicable legislation, low excise duty is applied to the motorcars with low capacity. Meanwhile, the policy towards application of low-level insurance premiums for motor cars with low-capacity engines under compulsory insurance of civil liability of vehicle owners has served for decrease of greenhouse gas emissions by stimulating the motor-vehicles with low-power engines.

[91] Asian Development Bank (April 2019). Asian Development Outlook 2019

Taxation item	Excise duty limit
When engine yield is up to 2000 cubic centimeter	0.20 AZN per each cubic centimeter of engine yield
When engine yield is up to 3000 cubic centimeter	400 manats+ 3 AZN per each cubic centimeter when engine yield is at 2011-3000 cubic centimeter
When engine yield is up to 4000 cubic centimeter	3400 manats+ 8 AZN per each cubic centimeter when engine yield is at 3001-4000 cubic centimeter
When engine yield is up to 5000 cubic centimeter	11400 manats+ 20 AZN per each cubic centimeter when engine yield is at 4001-5000 cubic centimeter
When engine yield is more than 5000 cubic centimeter	31400 manats+40 AZN per each cubic centimeter when engine yield is more than 5000 cubic centimeter

Table 3-21. Information on excise tax applied on imported vehicles

Some significant actions were taken in street-road network in Baku (the city where vehicles are most concentrated) in order to reduce traffic jams and speed-up the movement in the traffic. Under these actions, highways at 539.9 km length, 32 numbers of different overpasses and 48 numbers of overground and underground passages were constructed.

Since December 29, 2011, based on the Intelligent Transportation System technology, Intelligent Transportation Management Center was established, which ensures security, comfort, effectiveness, promptness and environmental protection. This technology, which was further improved in 2014-2016, includes an integrated network of transportation information, advanced transportation monitoring and management, analysis and optimization of the current situation, crash & incident detection, notification and response and advanced crash avoidance.

Application of Intelligent Transportation System in Baku not only increased the average speed of traffic movement for 8-10 km/hour, but also eliminated several problems related to passenger carriage by town-service buses. As a result of high quality and comfortable service, the preference of public transportation to private vehicles by the citizens to meet their needs have stimulated the decrease of greenhouse gas emissions.

Substantial works have been and are being taken carried out towards modernization of vehicle parking lots, which are used for shipment and passenger carriage purposes, and improvement of production and technological processes. Minibuses used for passenger-carrying were replaced with large buses and passenger-carrying route plans were optimized.

Meanwhile, BakuBus Limited Liability Company was established in 03.04.2014 as a state enterprise under the Baku City Executive Power by Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 92 dated 03.04.2014, to serve the passengers in Baku in the field of bus transportation in compliance to international standards, provide this field with modern means of transportation, ensure technological and ecological safety during passenger carriage. According to the Decree No. 181 of the President of the Republic of Azerbaijan dated July 6, 2018, “BakuBus” Limited Liability Company was transferred to the subordination of Baku Transport Agency. 300 new buses manufactured in France and operated with Compressed Natural Gas (CNG) were purchased and put into operation by “BakuBus” LLC. Considering that, carbon emission released during the use of compressed natural gas is less than compared to other fuel types, the use of such means of transportation in passenger carriage is one of the measures serving for decrease of greenhouse gas emissions In Section 1.2.2 below, the effect of this mitigation action was calculated in the LEAP software and its projection to 2030 is given.

Furthermore, several other engineering and administrative measures have been taken in the field of transportation in recent period which served for decrease of greenhouse gas emissions. According to Minutes no. 1 dated June 30, 2015 by Traffic Security Commission of Cabinet of Ministers of the Republic of Azerbaijan, motion of lorries, having more than maximum allowed 5 tones weight was restricted to enter Baku city in the daytime (except for certain group of vehicles) and free parking lots with necessary convenience for means of transportation from towns and districts of the republic were set in operation at south and north entries to the city. Such progress might be assessed as positive actions towards reducing traffic density and traffic jams in Baku.

It is to note that, Draft "State Program for Traffic Security in the Republic of Azerbaijan for 2017-2021 years" have been developed jointly with relevant state agencies, based on the instruction by the Cabinet of Ministers of the Republic of Azerbaijan. This Draft includes the following actions towards decrease of greenhouse gas emissions:

- Improving and expanding the performance of Intelligent Transportation management System (ensuring more efficient use of opportunities under Intelligent Transportation Management System in administrative area of Baku city and expanding its coverage for Absheron as well as other main highways of the Republic);
- Optimizing speed limit allowed in highways;
- Improving road dividers in highways (taking relevant measures for unrestricted access);
- Increasing traffic potential of highways and reducing the traffic density;
- Constructing bicycle strips and parkings;
- Stimulating the use of ecologically clean means of transportation;
- Arranging the utilization of means of transportation.

The mitigation actions that are important in this sector are outlined in the following sections, and their effects and projections in terms of reducing GHG emissions have been calculated in the LEAP software.

Action to use alternative transport fuels (CNG project)

Implemented by - SOCAR PETROLEUM Closed Joint-Stock Company

According to current world experience, the most effective way to reduce GHG emissions in the transport sector is to reduce the carbon content of the fuel used, i.e., to switch to compressed natural gas (hereinafter, the 'CNG') or liquefied gas (LPG), biofuel instead of gasoline and diesel. In this sense, the reduction of carbon content in the fuel used in vehicles is maintained in two main ways:

- Gradual replacement of conventional fuels - gasoline and diesel with compressed natural gas and liquefied natural gas (LPG), as well as the use of fuel which meet EURO-4 and higher environmental standards in order to reduce emissions;

- Mix conventional fuels with biofuels[92]

The current mitigation action was initiated by **SOCAR PETROLEUM Closed Joint-Stock Company (CJSC)** in 2015.

The action consists of two stages. In fact, the initial stage consists of the production of CNG and construction of fueling stations by **SOCAR PETROLEUM CJSC**. At this stage, natural gas is used as raw material for CNG production. In fact, in the production process of CNG, the gas is compressed by special compressor and filled into fuel tanks of vehicles by CNG pump. For this purpose, SOCAR PETROLEUM CJSC for the first time in the retail fuel market of Azerbaijan sells compressed natural gas as more affordable alternative fuel to customers and installs special equipment to vehicles to run on CNG at all fueling stations operating under the SOCAR brand. For example, on July 4, 2018, SOCAR PETROLEUM CJSC opened a CNG station for consumers at the entrance to Baku-Hovsan highway, near Baku-Bus LLC. In 2019, the Company commissioned 11 more CNG stations. It is to note that the amount of methane gas released into the atmosphere during the production and filling with CNG may be 0.1%, and there is no emission of other substances.

In fact, given the fact that the use of compressed natural gas produces less carbon emissions than other fuels, the use of this type of vehicle in passenger transport is considered one of the effective measures to reduce GHG emissions.

[92] Greenhouse Gas Reduction Strategies in the Transport Sector: Preliminary Report, OECD/ITF, 2008

The first phase of the mitigation action has already been implemented. In fact, 30 169,857 thousand tons of Compressed Natural Gas (CNG) were produced and sold completely in 2015-2018.

The second stage is the installation of special equipment for vehicles to run on CNG. The action covers the years 2015-2030 and SOCAR Methanol LLC uses its own internal financial source for its implementation.

The action of launching CNG-powered buses by Baku Bus

Implemented by: "Baku Bus" LLC

As noted, the action is important in terms of reducing GHG emissions, as it envisages the replacement of diesel buses on intra-city and suburban routes action in Baku with more modern and CNG-powered buses. The action was launched in 2015 by **BakuBus Limited Liability Company (LLC)**.

In fact, in 2015, **BakuBus LLC** procured 151 new French production Iveco Crealis and 151 Iveco Urbanway buses running on compressed natural gas (CNG). In 2015, 171 out of 2,046 buses operating on intra-city and suburban routes in Baku were replaced by these buses, which run on CNG. It accounts for 0.5 percent of the total number of buses operating in the country. In 2016, a total of 342 intercity and suburban buses were replaced by CNG-operated buses. In 2017, totally 313 intercity and suburban buses were replaced by CNG buses (1.6% of the total number of buses operating in the country). In 2018, totally 684 intercity and suburban buses were replaced by such buses, which run on operates with CNG (2.2% of the total number of buses operating in the country). In 2019, totally 855 intercity and suburban buses were replaced with CNG-operated buses.

This mitigation action is a **WM scenario** action, according to the relevant classification, as it is implemented entirely by internal capacity of Baku Bus LLC.

Other social and economic effects of the current mitigation action include the creation of new jobs in the country, the prevention of informal employment in transport, as well as the improvement of service quality.

Action to establish low-carbon transport fleet in SOCAR

Implemented by: - SOCAR

The current mitigation action concerns the arrangement of eco-efficient management of relevant vehicles through the improvement of the relevant structure in the Transport Department of SOCAR, as well as the reduction of GHG emissions through the renewal of the relevant fleet, technological equipment.

In fact, structural changes have been made in accordance with the Decree of the President of the Republic of Azerbaijan "On improvement of the structure of the State Oil Company of the Republic of Azerbaijan" dated February 24, 2014 and the relevant orders of SOCAR "On reorganization of the transport management structure". The action consists of three stages, which cover 2014-2030, and uses SOCAR's own internal financial source:

Stage 1: Application of unified vehicle management system;

Stage 2: Application of eco-efficient driving practices, more efficient work methods and selection of economical road routes within the NAMA project;

Stage 3: Renovation of vehicles and process equipment

At present, the first and second stages of the mitigation action have been implemented. In fact, in 2015 and 2016, Monitoring and Tracking Systems - GPSs were installed in the service vehicles. Later, in 2017 and 2018, within the framework of the NAMA project, relevant trainings on "Innovative technologies and eco-driving practices for the use of low-carbon fuels" were facilitated to about 1,000 drivers.

According to international experience, drivers trained in energy efficiency and safety have the opportunity to reduce vehicle emissions by at least 10-15%.

As the result of this mitigation action, **10.7 thousand tons of CO_2 was reduced in 2015-2018**. By 2030, by eco-driving it will be possible to prevent the emission of 1,500 tons of carbon emissions per year. In fact, the relevant calculations show that if the action saves 5% on fuel used in SOCAR's vehicles, it means about 1 million liters of fuel saved each year.

Other social and economic effects of this mitigation action include reduction in the amount of fuel consumed by the Transport Department and the use of the savings in social protection of employees, as well as in the Corporate Social Responsibility projects funded by SOCAR.

Metro

As is well known, green transport is a concept that combines electric vehicles and hybrid vehicles that combine internal combustion engine with electric engine. In this regard, the Nationally Determined Contributions (NDCs) of the Republic of Azerbaijan to the UN Framework Convention on Climate Change provide for the introduction of environmentally friendly types of transport, extension of electric vehicles use in passenger transport, increasing the electrification of railways and switching to alternating current traction system, improvement of the intelligent transport management system and expansion of its coverage, as well as the development of **Metro** and increasing the number of metro stations - the construction of underground and overground pedestrian crossings and the elimination of traffic jams.

In this regard, it is to note that the development dynamics of metro, given the annual increase in the number of people and vehicles in Baku, the capital of the Republic of Azerbaijan, measures to develop the transport network should be taken into account on regular basis. It should also be noted that the Ministry of Transport of the Republic of Azerbaijan has developed a Development Scheme for the Transport Network (infrastructure) of Baku until 2030. Currently, construction work is underway in the Baku Metro in accordance with the conceptual development program. According to the State Program, in 2030, the total length of underground railways in Baku will reach 119.1 km, and the number of stations will be 76.

Meanwhile, in recent years, significant work has been done towards improvement of quality of services in suburban electric trains, their speed, the restoration of electric vehicles, the improvement of railway signaling and communication infrastructure, the creation of bicycle lanes and parking lots.

Concerning this, it is to note that, on April 19, 2016, "Avtovagzal" and "Memar Ajami" stations, which are included in the first priority area of the long-term development plan of Baku Metro, were put into operation, and in fact the length of metro lines has reached 36.6 kilometers, the number of lines - 3, the number of stations - 25. At present, construction work is underway in the Baku metro in accordance with the conceptual development program. According to the State Program, in 2030, the total length of underground railways in Baku will reach 119.1 km, and the number of stations will be 76.

Mitigation action on efficient use of electricity by Baku Metro

Implemented by – "Baku Metro" CJSC

The current mitigation action was implemented by **Baku Metro Closed Joint-Stock Company** in 2018 and aims to ensure efficient use of electricity in the company's rooms, replacement of incandescent and fluorescent lamps with LED lamps at stations. The action was implemented at the expense of **"Baku Metro" CJSC**'s own internal resources. As the result of the mitigation action, 126637.9 thousand kWh of electricity was used instead of 135594.0 thousand kWh envisaged for 2018.

This mitigation action is a **WM scenario** action, according to the relevant classification, as it was implemented entirely by the internal capacity of "**Baku Metro" CJSC**. Its projection to 2030 was modeled in the LEAP software in terms of the dynamics of the relevant GHG emissions and, based on its comparative analysis with the **Baseline Scenario**, allowed to identify the following cuts in relevant gases by 2030:

Simultaneously with the current mitigation action, a tree planting campaign was carried out. In fact, pine, and fruit trees, which are good for the environment, have been planted in the “Narimanov” Electric Depot.

Railway transport

Azerbaijan Railways Closed Joint-Stock Company (“ADY” CJSC) was established by the Order of the President of the Republic of Azerbaijan dated July 20, 2009. Meanwhile, the **“State Program on the development of the railway transport system in the Republic of Azerbaijan for 2010-2014”** was approved by the Decree of the President of the Republic of Azerbaijan dated July 6, 2010. The program reflects all the factors that ensure the rapid development of railway transport in Azerbaijan, where the Action Plan includes the renewal of the car and locomotive fleet, roads, overhaul of power supply, signaling and communications, etc., transition from direct current to alternating current, modernization of equipment and other important objectives.

As an example of energy efficient projects implemented by Azerbaijan Railways, the Baku-Sumgait Road superstructure materials were renewed in accordance with the overhaul plan and wooden sleepers were replaced with reinforced concrete sleepers, which resulting in speed increase and 5 KISS ES-2 electric double-deckers with four wagons each, which meet modern standards, were procured and put into operation. Meanwhile, the overhaul of the 29.2 km Baku-Pirshagi-Sumgait circular railway started in November 2016 and has already been completed. The overhaul of 317 km of Baku-Boyuk Kesik main railway was started in 2010 and was completed in 2015. In 2015, the second phase of the “Azerbaijan Railways Reconstruction” project continued with the overhaul of 600 km of railways. 850 km of railways have been overhauled and replaced with 800-meter-long seamless rails (strings) and necessary actions are underway. During the overhaul of the railways, wooden sleepers are being replaced with reinforced concrete sleepers, and the transition of the Baku-Boyuk-Kesik power supply system to 25 kV AC traction system is being completed. Works are underway to replace the automated railway signaling system with microprocessor-based control.

Modernization of diesel locomotives in order to modernize the locomotive and wagon fleet and ensure increased cargo capacity - replacement of old engines with modern energy-efficient, environmentally friendly engines was started and 10 new TE33A “Evolution” diesel locomotives were procured and put into operation. The TE33A “Evolution” locomotives are equipped with modern, asynchronous driving motor with 6-axis, 2-cab, alternating current, which is economical in terms of diesel fuel consumption. Necessary actions are underway in this area to procure 40 new AC electric freight locomotives, 10 two-system passenger electric locomotives, modernize electric and diesel locomotives to increase their service life and ensure safe operation and improve the material and technical base of the locomotive fleet. Within the renewal of the wagon fleet, 3101 wagons, including 401 house cars, 1000 open railroad freight cars, 200 container cars, 600 tank cars, 300 grain cars, 100 hopper cars, 400 universal platforms and 100 cement cars were procured and put into operation in 2015-2016.

For the purpose of applying the ecological management and industrial safety system in the field of environment, in order to organize the work of environmental protection in the enterprises and organizations of “Azerbaijan Railways” Closed Joint-Stock Company, to comply with the legislation in the field of nature protection, to strengthen the control over the level of harmful substances emitted into the atmosphere and related fuel and energy resources, the Environmental Strategy of the Company until 2030 has been developed and approved. It identifies technical reforms to reduce negative impacts on the environment and save funds, as well as the following strategic goals and objectives in the field of environmental protection:

- reduction of harmful substances released into the atmosphere from stationary sources, including greenhouse gases;

- reduction of harmful substances emitted into the atmosphere from mobile sources, including greenhouse gases;
- prevention or reduction of wastewater discharged into sewage systems;
- implementation of measures to prevent the negative impact of production activities on the soil and eliminate the consequences of pollution;
- use of waste as additional source of raw materials in economic turnover;
- introduction of the most modern technologies of waste management and disposal;
- increase energy efficiency, reducing material consumption in technological processes;
- application of unified corporate principles and norms in environmental management;
- application of environmental control in production sector, improvement of the environmental auditing practices;
- increase the economic efficiency of nature protection.

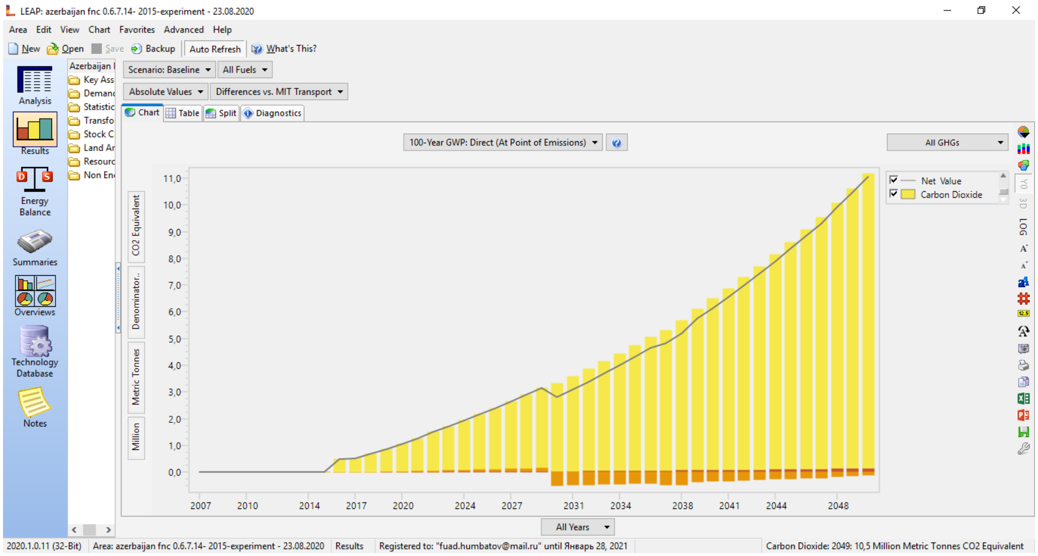
In recent years, the development of this infrastructure, its role in the country's economy, as well as the level of electrification of railways has been determined by the overall dynamics of economic development in the country. In fact, as it is known, due to the development of the oil industry in the country in 2005-2009, the annual GDP growth in the Republic of Azerbaijan was about 21 percent. Although this growth slowed down in the following years, it played an important role in the development of energy and transport infrastructure in the country as a whole. Meanwhile, the total amount of investments to be made in the development of railway infrastructure in the Republic of Azerbaijan in 2010-2022 is $ 4.879 billion.[93] Most of these funds are spent on the **reconstruction and electrification of railways**, overhaul of the Baku-Boyuk-Kesik railway, renewal of the car fleet, and purchase of passenger and freight locomotives.

Meanwhile, the development of the sector has led to overall social and economic development and increase in the share of the non-energy sector in GDP and increase in the social welfare of the population. It is no coincidence that the average salary of 20,000 employees of Azerbaijan Railways in 2019 was raised by about 95 percent compared to 2015 and amounted to 583 AZN.

Total effect and projection of actions to reduce GHG emissions in the transport sector

As in the energy sector (excluding transport), in order to assess the overall total effect and projection of mitigation actions presented in tabular format in transport until 2030, comparisons have been made with the amount of GHG emissions generated during the development of the **Baseline Scenario**, i.e., without any mitigation actions by years. To this end, MIT-Transport scenario that includes all of them to determine their cumulative effect and projection for future years after modeling all mitigation actions in the sector was entered into the LEAP software. According to this scenario, the dynamics of the decrease in GHG emissions over the years compared to the Baseline Scenario is shown in the following graph:

[93] https://fed.az/az/biznes/demiryoluna-sermaye-qoyulacaq-5-milyard-dollar-27500



Graph 3-7. Dynamics of reduction in GHG emissions over the years compared to the Baseline Scenario (LEAP), which resulted from all mitigation actions in the transport sector (MIT-Transport)

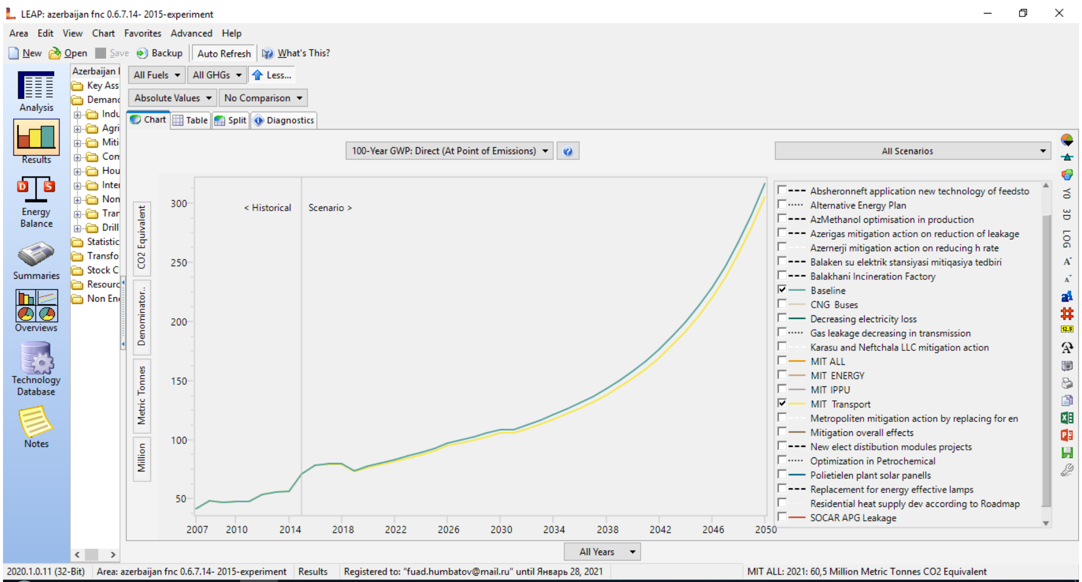
The table corresponding the graph is described below:

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO_2	0,5	0,5	0,7	0,8	1,0	1,2	1,4	1,6	1,8	2,0	2,3	2,5	2,7	3,0	3,3
CH_4	0,0	- 0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	- 0,5
N_2O	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Other GHG gasses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**0,5**	**0,5**	**0,7**	**0,9**	**1,1**	**1,3**	**1,5**	**1,7**	**1,9**	**2,2**	**2,4**	**2,6**	**2,9**	**3,2**	**2,8**

Table 3-22. (million tons of CO_2 equivalent)

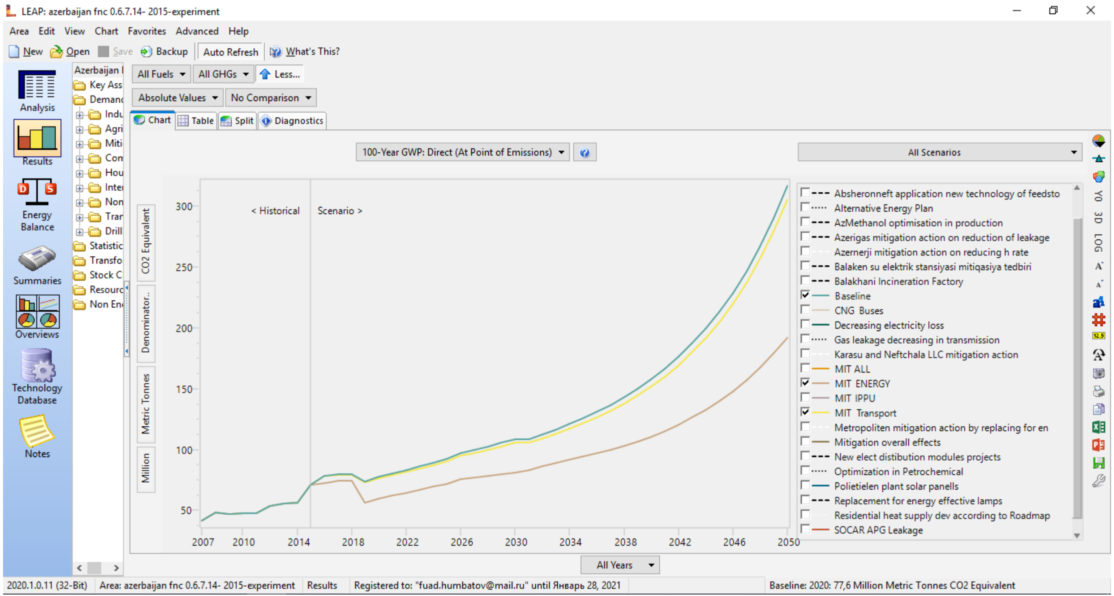
As can be seen from the table and the corresponding graph, based on the data received, the reductions in GHG levels compared to the Baseline Scenario have been steadily increasing over the years as the result of current mitigation actions in the sector, and these reductions will reach 2.8 million tons (in CO_2 equivalent), including removals) in 2030.

The following graph shows the volume of GHG emissions with the graph for all mitigation actions in the transport sector (MIT-Transport) (in yellow) and the graph for the Baseline Scenario (in green):



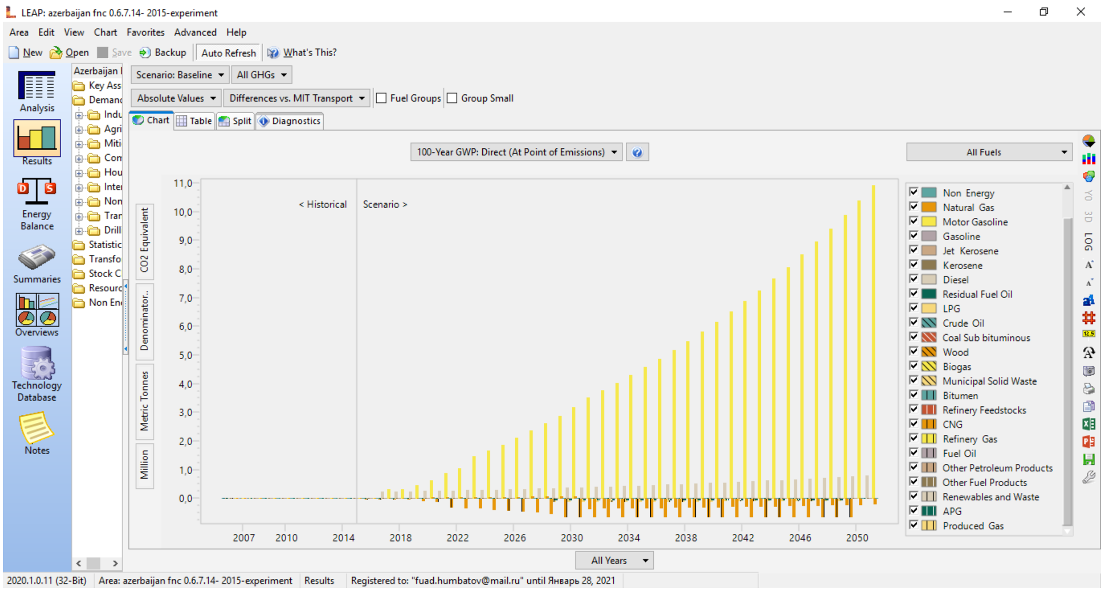
Graph 3-8. Scenario for all mitigation actions in the transport sector (MIT-Transport) and graphs according to Baseline Scenario (LEAP)

The next graph shows the volume of GHG emissions, the graph for all mitigation actions in the energy sector (in MIT-Energy) (in brown), as well as the graph for all mitigation actions in the transport sector (in MIT-Transport) and the graph for Baseline Scenario (in green):



Graph 3-9. Graph on Scenario for all mitigation actions in the energy sector (MIT-Energy, brown), Graph for all mitigation actions in the transport sector (MIT-Transport, yellow) and Graph for Baseline Scenario (green) (LEAP)

The following graph shows which fuels resulted in GHG emissions reduction as the result of all mitigation actions in the transport sector, according to the Baseline Scenario:



Graph 3-10. Impact of different fuels on GHG reductions according to the Baseline Scenario as the result of the general application of all mitigation actions in the transport sector (LEAP)

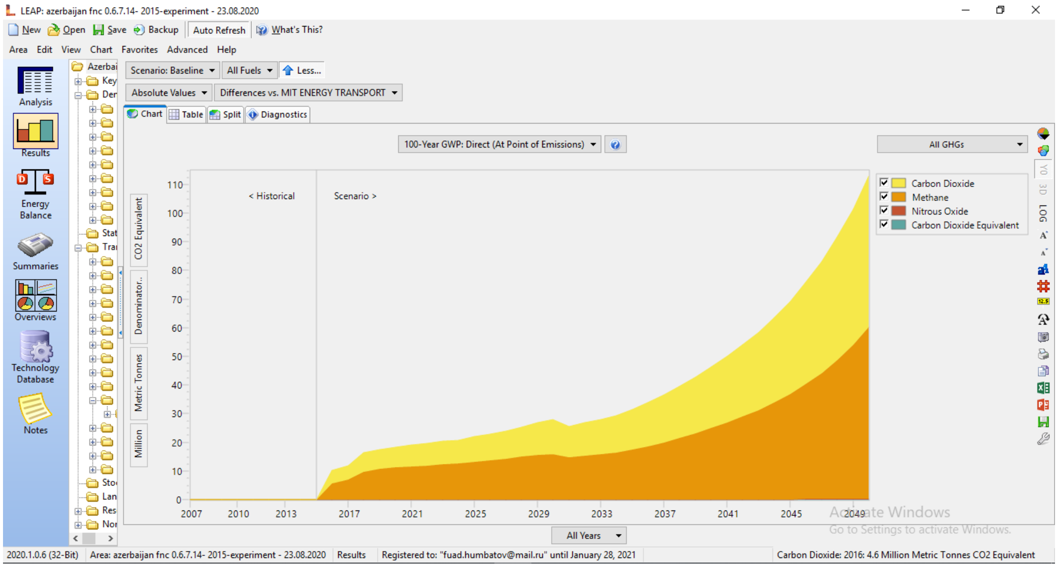
As can be seen from table 3-23, as the result of all mitigation actions implemented in this sector, GHG emissions decreased as the result of the gasoline consumption reduction:

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gasoline	0,3	0,3	0,5	0,6	0,9	1,1	1,5	1,7	1,9	2,1	2,4	2,6	2,9	3,2	3,5
Diesel	0,2	0,2	0,2	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,4	0,4	0,4

Table 3-23. (million tons of CO_2 equivalent)

Total effect and projection of GHG emission reduction actions in the energy sector (including transport)

Finally, in accordance with the IPCC 2006 methodology, let us add the assessments in Section 2.4 on mitigation actions in the transport sector to the calculation of the total effect of mitigation actions in the energy sector (excluding transport) and the assessment of the relevant projection until 2030. To this end, let's create a MIT Energy Transport scenario in the LEAP software that combines MIT-Energy (i.e., scenario that includes all of the above energy mitigation actions, excluding transport) with MIT-Transport scenario (scenario that includes all mitigation actions in transport) and let's compare this scenario with the **Baseline Scenario** in the LEAP software in order to evaluate its overall total effect on GHG reduction and its projection to 2030:



Graph 3-11. Dynamics of reduction in GHG emissions over the years compared to the Baseline Scenario (LEAP) as the result of all mitigation actions (MIT-Energy Transport)

The table corresponding the mentioned graph is described below:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO2	0.0	4.6	4.8	6.7	6.7	7.1	7.5	7.7	8.1	8.3	8.9	9.1	9.7	10.4	11.2	11.9
CH4	0.0	5.6	7.1	9.6	10.7	11.3	11.7	11.9	12.3	12.5	13.2	13.6	14.2	14.9	15.6	15.8
N2O	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Other gasses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**0.0**	**10.2**	**11.9**	**16.3**	**17.4**	**18.4**	**19.2**	**19.6**	**20.4**	**20.8**	**22.1**	**22.7**	**24.0**	**25.4**	**26.8**	**27.8**

Table 3-24. (million tons of CO_2 equivalent)

Analysis of the Graph and declines in the corresponding table shows that, in the projection for 2030, the effect of mitigation actions in the energy sector of the country is 27.8 million tons of CO_2 equivalent. This shows that in the Republic of Azerbaijan, the energy sector remains the main sector for GHG inventory, as well as for policies and actions to mitigate the climate change impacts and reduce GHG emissions. Estimates and recent calculations for the following sectors also show that the effect of mitigation actions implemented in this sector is about 95-98% of the total effect of mitigation actions in all sectors.

Industrial processes and product use (IPPU) sector

In recent years, the role of industry in the world economy is growing again. This growth is the observed in both developed and developing countries. In general, it is to note that among the issues considered in the report, the IPPU sector is characterized by the complexity of its structure. According to varied international classifications, the industrial complex includes more than 300 sectors and subsectors.

In general, among the recent legal and normative documents on industrial development in the Republic of Azerbaijan, the Development Concept “Azerbaijan 2020: Outlook for the Future” approved by the Decree of the President of the Republic of Azerbaijan No. 800 dated December 29, 2012, the “Social and Economic Development of the Regions of the Republic of Azerbaijan in 2014-2018” approved by the Decree No. 118 of the President of the Republic of Azerbaijan dated February 27, 2014 and the “State Program of Social and Economic Development of the Regions of the Republic of Azerbaijan in 2019-2023” and the “Strategic Roadmap for Development of Heavy Industry and Mechanical Engineering in the Republic of Azerbaijan” should be mentioned.

As noted, the policy pursued in recent years in the Republic of Azerbaijan to stimulate investment, including the import of new green technologies, in order to mitigate the climate change impacts is commendable. In fact, the above-mentioned Sumgait Chemical Industrial Park, Balakhani Eco-Industrial Park, High Technologies Park, Mingachevir High Technology Park, Garadagh Industrial Park, Mingachevir Industrial Park, Pirallahi Industrial District, Neftchala Industrial District, Masalli Industrial Sector are economic zones where the customs incentives are applied for the private sector. In them, business entities are exempt from property, land, corporate income taxes, as well as VAT and customs duties on imported equipment for a period of seven years.[94] These fiscal stimulus measures allow entrepreneurs to expand imports of new, green technology-based equipment and facilities, reduce GHG emissions and their impact on the private sector, and increase their involvement in the Sustainable Development Goals.

If we look at the sectors and categories of GHG emissions sources, they include fuel combustion in energy sector, energy industry, processing industry and construction, transport, leaks in fuel production and transportation, oil and natural gas, etc. In terms of industrial processes, these sources and categories are mining products, chemical industry, metal industry, other production areas, halocarbons and sulfur hexafluoride production, use of solvents and other products.[95]

Speaking about the policies to reduce GHG emissions in the industrial sector in the Republic of Azerbaijan, first, it is necessary to mention some sectoral international conventions to which the Republic of Azerbaijan is a party. These are:

- Convention on Environmental Impact Assessment in a Transboundary Context (the Republic of Azerbaijan joined the Convention in 1999);
- Montreal Protocol on Substances that Deplete the Ozone Layer (the Republic of Azerbaijan joined in 2000);
- UN Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (the Republic of Azerbaijan joined the Convention in 2001);
- Stockholm Convention on Persistent Organic Pollutants (the Republic of Azerbaijan joined the Convention in 2001)

So far, the Republic of Azerbaijan has been implementing varied projects in cooperation with a number of international organizations, along with national initiatives on climate change and climate change mitigation. The main international donor organizations with which Azerbaijan cooperates on climate change are the Global Environment Facility, the Green Climate Fund, the European Union, the Asian Development Bank, the German KfW Bank, the German Agency for International Cooperation (GIZ) and others.

One such project was the “Resource Efficient and Cleaner Production in Azerbaijan” (RSDI) project’s Demonstration Component, implemented since 2013 as part of the “Greening Economies in the European Union's Eastern Neighbourhood” (EaP GREEN) regional project. It was funded by the Union (EU), the Government of Slovenia and the Austrian Development Bank. The main objectives of the

[94] http://www.azpromo.az/investments/industrial-parks
[95] http://files.preslib.az/projects/azereco/az/eco_m4_7.pdf

RSDI Demonstration Component of the EaP GREEN program in Azerbaijan, supported by the United Nations Industrial Development Organization (UNIDO), are as follows: development of human resources and institutional capacity for RSDI; Raising awareness of the RSDI methodology and the benefits of its application; demonstration and dissemination of experience in priority areas (chemical products, construction materials and food production); mobilization of investment in RSDI technologies. During its implementation, significant results were achieved in the field of production, which takes into account the support to resource efficiency and the environment, as well as the benefits of RSDI in Azerbaijani enterprises. As part of the RSDLI component, UNIDO's assessments of eight businesses in Azerbaijan showed a reduction of up to 40 percent in emissions.[96]

Meanwhile to reducing GHG emissions, such projects are important in bringing effective international experience to the country and increasing the knowledge and skills of local professionals. Table 3-25 lists the projects implemented and currently being implemented by international donor organizations in relation to climate change.

Project	Donor and implementing agency
Strengthening of CDM potential in Azerbaijan	Donor: Norwegian government Implementing entity: UNDP
CDM opportunities in the areas of industrial development and decreasing poverty	Donor: Norwegian government Implementing entity: ECON, NORSK Energy
Improving solid waste management	Donor: Norwegian government Implementing entity :UNDP
Capacity building on GHG emission in Caspian basin (regional project)	Donor: Canadian International Development Agency
Waste management in Eastern European partnership countries (a regional project)	Donor: European Union
Improvement of forest legislation and management in Eastern European Partnership countries (a regional project)	Donor: European Union
Management of atmosphere air in Eastern European Partnership countries (a regional project)	Donor: European Union
Increasing sustainability of forest ecosystems in Southern Caucasus countries in regards to climate changes (a regional project)	Donor: European Union
Energy efficiency initiative in the building sector in Eastern European and Central Asian countries	Donor: European Union
Baku initiative on supporting Eastern European energy objectives, INOGATE technical support programme	Donor: European Union
Improving normative and legal acts related with alternative energy in Azerbaijan	Donor: European Union
Technical support for South Caucasus countries and Moldova in meeting their obligations related with climate change issues	Donor: European Union TACIS program
Capacity building in GHG inventory	Donor: GEF
Supporting the National Forest Programme and forestry legislation in Azerbaijan	Donor: GEF
Development of renewable energy (biomass) project	Donor: Asian Development Bank (ADB)
Economics of climate change in Central and Western Asia (a regional project)	Donor: Asian Development Bank (ADB)
Forest expansion activities in Kish village of Sheki district, in order to prevent floods	Donor: ADB
Sustainable management of solid household waste	Donor: World Bank
Capacity building on nationally appropriate mitigation activities in Southern Caucasus countries (a regional project)	Donor: German Agency for International Cooperation
Supporting development of renewable energy in Azerbaijan	Donor: KfW
Improving solid household waste management in Ganja city	Donor: KfW
Forest expansion pilot Project in Ismayilli-Zagatala region	Donor: KfW
Supporting energy efficiency projects in Azerbaijan	Donor: International Finance Corporation

[96] https://recpaz.files.wordpress.com/2017/10/recp-primer-az.pdf

Project	Donor and implementing agency
Optimization of the electricity system in Azerbaijan	Donor: World Bank
Reconstruction and modernization of AzDRES Thermal Power Station	Donor: European Bank for Reconstruction and Development
Development of energy efficiency in Azerbaijan, as a component of the Caucasus Energy Saving Programme	Donor: European Bank for Reconstruction and Development
Climaeast: Supporting mitigation and adaptation to the effects of climate change in Russia and Eastern Partnership countries	Donor: European Union
Coordinating water and flood management, along with climate change risks in vulnerable mountainous communities in the Greater Caucasus region of Azerbaijan	Donor: GEF Implementing entity: UNDP
Sustainable land and forest management in the South Caucasus landscape	Donor: GEF Implementing entity: UNDP
Nationally Appropriate Mitigation Actions (NAMAs) for low-carbon end-use sectors in Azerbaijan	Donor: GEF Implementing entity: UNDP
Capacity building to improve forest monitoring and inventory	Donor: GEF Implementing entity: FAO
Preparatory Support Program for Cooperation with the Green Climate Fund	Donor: Green Climate Fund

Table 3-25. Implemented and ongoing projects in climate change

As mentioned above, the sources and categories of GHG emissions in the Republic of Azerbaijan in industrial processes and product use in the Republic of Azerbaijan are mining products, chemical industry, metal industry, other industries, production of halogenated carbon and sulfur hexafluoride, production of halogenated carbon compounds and sulfur hexafluoride, use of solvents and other products.[97]

According to the relevant inventory results, GHG emissions during industrial processes in 2016 increased almost 2.5 times compared to 1990, which is an intermediate trend for the above-mentioned industrial development in the country, especially for cement production since 2011. The expansion of clinker production as raw material, as well as the production of methanol since 2013. Overall, GHG emissions in this sector accounted for about 5.45 percent of total emissions (excluding removals) in 2014, and 6 percent in 2015. In 2016, due to the known recession in the country's economy, GHG emissions in the industrial processes and product use sector accounted for only 5.13% of total emissions. Interestingly, this figure was only 1.82 percent in 1990.

In this sense, in terms of diversification of the structure and regional coverage of the industry, determined efforts have been done in recent years to put into operation new production facilities in the field of heavy industry and mechanical engineering. In this regard, establishment of Sumgayit Technology Park, Sumgayit Aluminum Plant, including Ganja Aluminum Semi-Finished Products Plant, gold, copper processing plants in Sumgayit, Gadabay and Dashkasan, Garadagh Cement Plant, Sumgayit Urea Plant, agricultural machinery and automobile plants in Ganja, Nakhchivan Automobile Plant, Large-Scale Transformers Plant of ATEF Group of Companies, Norm Cement Plant, Sumgayit Plastic Processing Plant, Mingachevir Electronic Equipment Plant, enterprises of steel pipe, solar panels and metal structures are significant events for the country's economy.

For example, work continued in the Sumgayit Chemical Industrial Park to create external and internal infrastructure, office, consulting, laboratory examination, business incubation, training and vocational training services, and other necessary infrastructure facilities for the effective implementation of entrepreneurial activities. The implementation of the Polymer project by SOCAR in the Park is the largest project of its kind and scale in the petrochemical industry of Azerbaijan for the last 40 years. Meanwhile, the Park produces special purpose large-diameter corrugated polyethylene pipes, steel pipes, mechanical and hydraulic equipment, glass panels based on "Float" technology (hot rolling), plant

[97] http://files.preslib.az/projects/azereco/az/eco_m4_7.pdf

protecting agents - pesticide production enterprises have started operating as residents for the first time in the country.

Meanwhile, recycling plants were registered in Balakhani Industrial Park, and modern shipbuilding complex was put into operation in Garadagh Industrial Park. Work is underway to attract science-driven and innovative productions to the High Technology Park. joint ventures with Iran Khodro of the Islamic Republic of Iran have been launched to produce cars in Neftchala Industrial Park.

It is planned to build new production facilities for the pharmaceutical industry in Pirallahi Industrial Park. Preparations are underway to create the necessary conditions and infrastructure for local entrepreneurs working in light industry and other areas in Mingachevir Industrial Park and Masalli, Sabirabad, Hajigabul, Neftchala Industrial Parks.

Information was collected on industrial wastes released into the atmosphere from fuels used in the production of construction materials, in construction and installation works and burned during the operation of buildings and from other sources. As it is known, industrial wastes are residues of raw materials, materials, substances, semi-finished products, goods, and other products, which are formed in the process of production or performance of works (services) and which completely or partially lose their original consumer properties, as well as items and substances of the same origin that are not the production object and are not included in the technological process due to the characteristics of their use.

At this stage, taking into account modern challenges and new initiatives, the implementation of a number of actions to modernize the industry and diversify the non-oil industry, as well as the involvement of existing natural and economic resources in the economic turnover, creation of new priority production areas, industrial parks along with traditional industries, strengthening industrial potential in the regions, and formation of opportunities that will ensure the development of the industry on the basis of innovations. In fact, in order to achieve the planned progress in the heavy industry and engineering industry in the medium term, the full use of assets and natural resources in industry will be provided by 2025, the application of effective work experience in enterprises will be fully implemented. The elimination of gaps in production at all stages of the value chain will be a key factor for the efficient use of the country’s natural resources. Enterprises operating in the Republic of Azerbaijan will act as a model enterprise for neighboring countries in terms of efficiency. Naturally, all this will contribute to achieving the country’s mitigation target under the Paris Agreement by 2030.

The following sections describe **two mitigation actions**, which consist of the reduction of natural gas used in the reforming process at the SOCAR Methanol Plant and the utilization of carbon dioxide emissions, and the reduction in GHG emissions from both actions was calculated in the LEAP software according to the Baseline Scenario.

3.1 Processing operations - optimization

Action to lead to energy efficiency in production at SOCAR Methanol Plant

Implemented by - “SOCAR Methanol” LLC

The current mitigation action is to reduce GHG emissions by reducing the amount of natural gas used in the reforming process during production at the SOCAR Methanol Plant (SOCAR Methanol LLC Baku, Garadagh district, 25th km of Salyan Highway). The action was implemented in 2018 and SOCAR Methanol LLC’s own internal financial source was used for its implementation.

In fact, during the mitigation action, 4 heat exchangers inside the furnace used in the reforming process of production at the Plant were replaced with new ones, which resulted in savings of 25 m^3 of gas used in the production of one ton of methanol. If we take into account that 231186,852 tons of methanol were produced in that year, then the amount of gas saved was 5779.6713 thousand m^3.

According to the relevant classification, this mitigation action is a **WM scenario** action, as it is implemented entirely by the internal capacity of SOCAR (SOCAR Methanol LLC).

Other effects of this mitigation action include the reduction of pollutant emissions, as well as the saving of raw materials.

3.2 Processing operations - Utilization of carbon dioxide emitted into the atmosphere in the production process

Implemented by - "SOCAR Methanol" LLC

The current mitigation action consists of the utilization of carbon dioxide emitted from the production process at the SOCAR Methanol Plant (SOCAR Methanol LLC Baku, Garadagh district, Salyan highway, 25th kilometer). In fact, the amount of carbon dioxide and other gases emitted from production is reduced by eliminating the problems in section "B" of the CO2 plant and by increasing the productivity of the plant. The action covers the years 2019-2030 and SOCAR Methanol LLC uses its own internal financial source for its implementation.

According to the relevant classification, this mitigation action is a **WM scenario** action, as it is implemented entirely by the internal capacity of SOCAR (i.e., SOCAR Methanol LLC).

Other effects of this mitigation action include improving air quality by reducing emissions of pollutants and saving natural gas as raw material.

3.3 Petrochemical industry

Alternative and Renewable Energy Use action at the Ethylene Polyethylene Plant of SOCAR's "Azerkimya" Production Unit

Implemented by – SOCAR's "Azerkimya" PU and UNDP (under NAMA project)

The mitigation action consists of the use of alternative and renewable energy in the production of polyethylene at the Ethylene Polyethylene Plant (Sumgayit City) of the SOCAR's "Azerkimya" Production Unit. This action covers the years 2016-2017.

In fact, the administrative building of the polyethylene production plant of the Ethylene Polyethylene Plant of SOCAR's Azerkimya PU was included in the "Green Buildings Program" under the NAMA project jointly organized by SOCAR and the UN. Within the framework of the Program, solar panels with capacity of 10 kW were installed in the administrative building of the Ethylene-Polyethylene plant to provide indoor and outdoor lighting. Meanwhile, solar panels with capacity of 23 kW were installed at the Kimyachi Palace of Culture under the NAMA project in order to use alternative energy sources and increase energy efficiency. With the installation of solar panels as alternative energy source in the "polyethylene" production, 5800 kWh electricity was saved in 2017 and 19,400 kWh in 2018. In total, 13,356 tons of carbon dioxide (CO_2) was cut during 2017-2018:

Years	2017	2018	Total
Decrease in electricity consumption (MW.s.)	5,8	19,4	25,2
Decrease in GHG emissions (tons of CO_2 eq.)	3,074	10,282	13,356

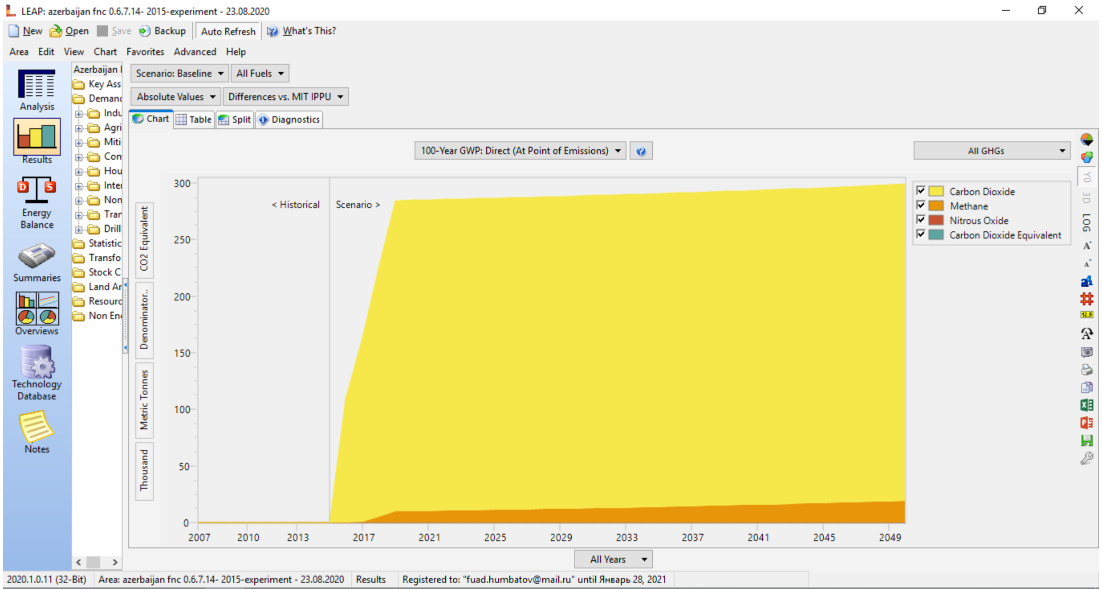
Table 3-26. Energy savings and reductions in carbon emissions in 2017-2018

According to the relevant classification, this mitigation action is a **WM scenario** action, as it is implemented entirely by internal capabilities of "Azerkimya" Production Association (SOCAR).

Among the other social and economic effects of the mitigation actions, it is to note that 13 office rooms (for engineering and technical staff), 10 shower cabins, wardrobes, toilets, which meet modern requirements for 457 workers in polyethylene production, were repaired as part of the repair work. , canteen, warehouse, workshop were reconstructed, command center was overhauled. Asphalt was laid on field roads, greenery was planted around the administrative building and roadside areas, trees and shrubs were planted.

3.4 Total effect and projection of actions to reduce GHG emissions in the IPPU sector

In order to assess the overall effect of the above mitigation actions in the IPPU sector and their projection until 2030, in the current paragraph, it's necessary to analyze them comparatively over the years with the volume of GHG emissions generated during the development of the economy according to the **Baselineline Scenario**, i.e., during the development without any mitigation measures. Again, after modeling all mitigation actions in this sector, MIT-IPPP scenario was inserted and corresponding GHG emissions were calculated in the LEAP by the Base Line Scenario to determine their cumulative effect and projection for respective years:



Graph 3-12. Dynamics of reduction in GHG emissions over the years compared to the Baseline Scenario which resulted from all mitigation actions in the IPPU sector (MIT-IPPP) (LEAP)

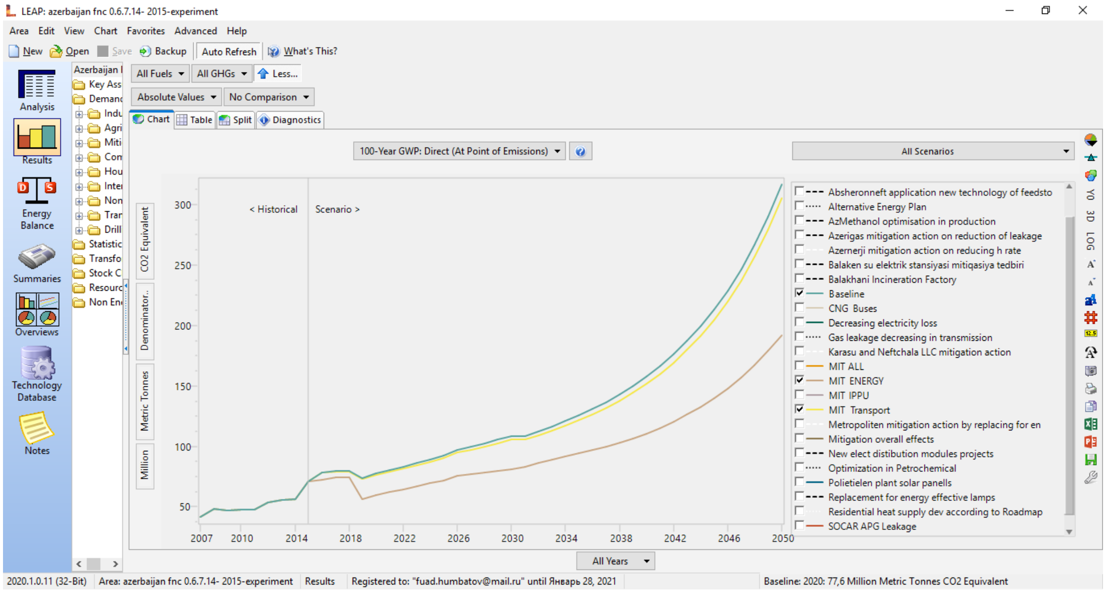
The table corresponding to the mentioned graph is described below:

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO_2	108,9	163,4	219,0	274,8	274,9	275,0	275,2	275,3	275,4	275,5	275,7	275,8	275,9	276,1	276,2
CH_4	0,2	0,4	5,2	9,7	9,9	10,1	10,3	10,6	10,8	11,0	11,3	11,3	11,8	12,0	12,3
N_2O	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Other GHG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**109,1**	**163,8**	**224,3**	**284,5**	**284,8**	**285,2**	**285,5**	**285,8**	**286,2**	**286,6**	**286,9**	**287,3**	**287,7**	**288,1**	**288,5**

Table 3-27. (thousand tons of CO_2 equivalents)

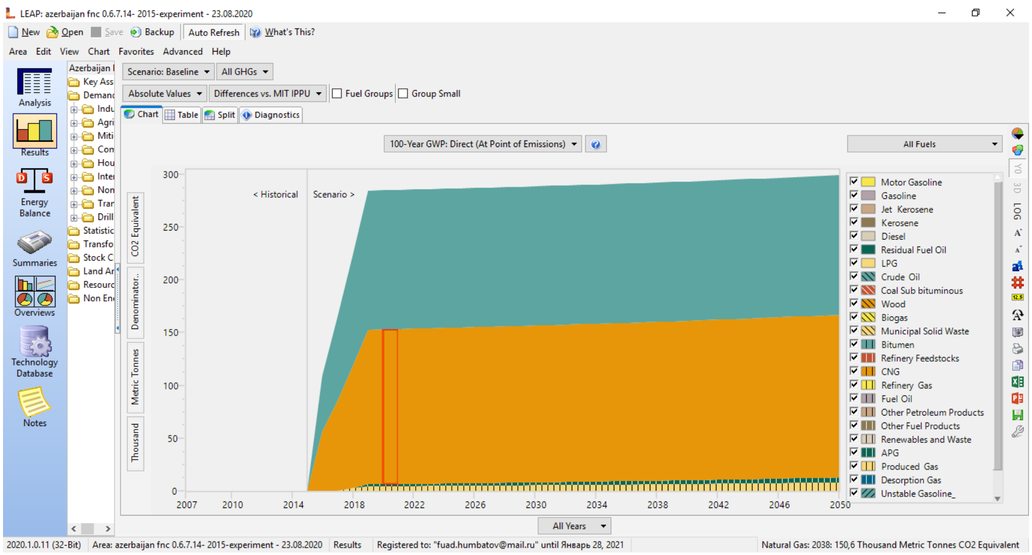
The last table and graph show that as the result of current mitigation actions in this sector, GHG volumes are declining compared to the Baseline Scenario and will increase to 288.5 thousand tons of CO_2 equivalents (including removals) by 2030.

The graph below shows the volume of GHG emissions in the Graph for the scenario (**MIT-Energy**) containing all mitigation measures in the energy sector (in brown), the Graph (in yellow) for the scenario (**MIT-Transport**) containing all mitigation measures in the transport sector, the graph for all mitigation actions in the transport sector (yellow), as well as the Graph (in gray) of the scenario (**MIT-IPPP**) containing all mitigation measures in the IPPU sector, and the Graph (in green) for the **Baseline Scenario**:



Graph 3-13. MIT-Energy (brown), MIT-Transport (yellow), MIT-IPPPU (gray) and Baseline Scenario (green) graphs (LEAP)

The graph below shows which fuels resulted in GHG emissions reduction as the result of all mitigation actions in the transport sector, according to the Baseline Scenario:



Graph 3-14. Impacts of different fuels on GHG reductions according to the Baseline Scenario as the result of the general application of all mitigation actions in the industrial sector (LEAP)

As can be seen from Graph 3-14, all mitigation actions in this sector lead to significant reduction in GHG emissions as the result of reduction in natural gas and reduction in non-energy use of fuel:

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Non energy	52,6	79,1	105,3	131,8	131,8	131,8	131,8	131,8	131,8	131,8	131,9	131,9	131,9	131,9	131,9
Natural gas	97,0	84,4	115,7	146,2	146,4	146,6	146,8	147,0	147,1	147,3	147,5	147,7	148,0	148,2	148,4

Table 3-28. (thousand tons of CO_2 equivalents)

AFOLU sector

Agriculture

In order to reduce GHG emissions in this sector, first, it is necessary to reduce and collect methane emissions from livestock in agriculture, to take measures that will have a positive impact on crop protection and adaptation, increase the number of smart farms in terms of climate change, construct modern irrigation systems, etc., expand the use of alternative and renewable energy sources and implement other actions.

In this sense, as noted, among the economic sectors, agriculture is the most sensitive to natural and anthropogenic factors. Every year, floods, hail, drought, frost, propagation of dangerous parasites, various accidents, inefficient management, and other emergencies seriously damage agriculture around the world. This was proved by the damage caused to the agricultural sector in Azerbaijan in 2020 due to water shortages and other problems caused by the lowering of the Kura and Araz rivers.

In fact, inefficient organization of production activities in agriculture has serious negative impact on land, water resources and climate. According to the inventory, GHG emissions in this sector in 2014 amounted to 8.584 million tons of CO_2 equivalent, which is about 14.34% of total emissions (without removals). In 2015 it was 8.644 million tons of CO_2 equivalent and about 14.12 percent of total emissions (without removals). In 2016, despite the recession in the country's economy, GHG emissions in this sector amounted to 8.666 million tons of CO_2 equivalent, and its share in total emissions increased slightly compared to the previous year and amounted to 14.17 percent. With these indicators, the agricultural sector ranks second in the country in the total share of GHG after the Energy category. Interestingly, this figure was only 7.58 percent in 1990.

Also, the process of non-compliance with agrotechnical requirements in agricultural activities, excessive use of chemicals, inefficient and wasteful use of irrigation water, unsatisfactory condition of some irrigation and collector-drainage networks and other factors have accelerated agricultural lands become unusable. Desertification, salinization, soil erosion, loss of plow layer of land, thinning of natural grass cover, improper use of winter and summer pastures, deterioration of the pastures quality as the result of failure to take the necessary measures, and other reasons are of serious concern. Meanwhile, according to the former State Committee for Property Affairs (now called the State Service for Property Affairs under the Ministry of Economy), the area of irrigated lands increased from 1426.0 thousand hectares (ha) to 1445.8 thousand hectares during 2000-2017. Lands suitable for agricultural use increased from 1423.0 thousand hectares to 1442.4 thousand hectares thanks to the implementation of various reclamation works.[98.]

Over the past 17 years, the number of violations in land management has decreased by 40% thanks to the strengthening of state control over the protection of land resources by the bodies of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan.[99] This mainly involves the degradation of the plow layer of lands. The development of this sector is reflected in a number of government programs and varied normative documents mentioned in the previous chapter.

As noted, in relation to GHG emissions in the agricultural sector, these emissions consist mainly of CH_4 and N_2O gases, and their source is mainly fermentation manure, incineration of agricultural soil and residues. For example, as the result of the agricultural activities, CH_4 emissions in 1990 were 129 Gg. Meanwhile, GHG (mainly N_2O) emissions have decreased significantly over the past period due to reduced fertilizer use. Although GHG emissions declined in 1990-2000, there has been a steady increase in subsequent years. This can be explained by the development of livestock in order to meet the growing needs of the population, which is observed in parallel with the natural increase in the number of population. After Azerbaijan regained its independence and the country started the process of transition to market economy, rooted structural changes took place in agriculture. Although total arable lands declined by 2000, the agricultural sector has been steadily expanding since 2000 due to the development of the private sector and extensive production, and the total sown area in 2015 was even 8,4 percent higher than in 1990. As the result of extensive livestock expansion, the number of both cattle and small ruminants has increased steadily since 1995, and the number of poultry has increased steadily since 2000. As the result, the number of cattle and small ruminants in 2015 increased by 47.9 percent and 60.1 percent, respectively, compared to 1990.

[98] https://www.stat.gov.az/source/environment/
[99] https://www.stat.gov.az/source/environment/

Currently, about 33-35 percent of the active workforce of the Republic of Azerbaijan is engaged in agriculture, as well as due to the development of this sector against the background of relevant state programs and incentives for the development of this sector to ensure food security in the country, overall increase is observed in GHG emissions (CH_4).

In general, policy actions to mitigate the climate change impacts in this sector were less implemented than in other sectors during the reporting period. In fact, although the private sector in the agricultural sector started to expand by 1997 land reforms, the sector's knowledge and skills in mitigating the climate change impacts have been underdeveloped in recent years. In the following years, pilot projects on the use of biogas plants at the direct initiative of a number of government agencies, including the Ministry of Ecology and Natural Resources (MENR), as well as awareness-raising measures to prevent the burning of agricultural waste in arable lands have led to relative decline in the growth rate of emissions in this area. Meanwhile, the involvement of the private sector in the utilization of methane gas in the relevant sector by the use of biogas plants has not been achieved, which is due to the lack of stimulating regulatory framework on relevant issues.

As mentioned above, Goal 7 in the "Strategic Roadmap for the Production and Processing of Agricultural Products in the Republic of Azerbaijan" [100] envisages the implementation of activities in four priority areas in 2016-2020. The implementation of the Strategic Roadmap will create favorable business environment by improving the relevant regulatory system, including increasing the effectiveness of public assistance and further improving market competition. Goal 7 in the Strategic Roadmap focuses on environmental protection, sustainable use of natural resources and management of the impact of natural factors on agriculture.

As part of the priority of improving environmental protection mechanisms in the agricultural sector, indicators to meet modern requirements for compliance of agricultural production with environmental standards will be developed and assessed, carbon emissions in the agricultural sector will be reduced, forest shelterbelts will be planted, and other relevant actions will be implemented.

The Strategic Roadmap mentions that if the economic and financial feasibility of Priority 7.2 (Improve environmental protection mechanisms in agriculture) is positive, through its implementation the compliance of agricultural production with environmental standards will be assessed, the application of waste-free production technologies in agriculture will be expanded, the compliance of agricultural production with environmental standards will be ensured, the use of toxic chemicals in agriculture will be limited, carbon emissions will be reduced in crops and livestock, forest shelterbelts will be planted, economically viable plant species will be used in planting greenery, environmental pollution by plastic bags will be reduced, action plan to protect agrobiodiversity will be developed. **In general, the use of toxic chemicals in agriculture will decrease by 30% in 2016-2020, carbon emissions in crop production and livestock will decrease, the use of economically viable plant species in both forest shelterbelts and greenery will increase by 30%, use of alternative resources in heating in greenhouses will increase by 20 percent.**

It is to note that one of the main strategic goals of the document is the application of economic tools and appropriate approach to environmental protection, based on which the use of economically viable plant species (olive, almond, pistachio, pomegranate, mulberry, fig, etc.) will be supported. Different types of fruit trees and perennial grass will be planted in existing terraces to enhance combating against erosion in mountainous and foothill districts. Greenery will be planted on non-agricultural non-forest lands using economically viable plant species, as well as the opportunities for application of dry farming in sensitive areas subject to impacts of exogenous geological processes will be studied. Meanwhile, negative impacts of mass use of plastic bags on plants, animals, land, and water resources will be assessed and relevant action plan will be prepared towards reduction of contamination in this field.

[100] http://iqtisadiislahat.org/store//media/documents/SYX/strateji_yol_xeritesi_kend_teserrufati_mehsullarinin_istehsalina_ve_emalina_dair.pdf

On the other hand, as noted in the document, potential on transition to “green economy” in agriculture will be assessed, preference to the use of composts manufactured from organic substances in greenhouses will be encouraged, opportunities on the use of solar collectors, biogas, and thermal water resources in heating supply of greenhouses will be studied and application potential will be reviewed.

In general, in recent years, extensive actions have been launched in the Republic of Azerbaijan to build modern agro-parks. First, agro-parks by combining agricultural production with non-agricultural activities in a single production space, as well as creating the basis for the proper use of resources, creates opportunities such as modern equipment, efficient application of information and communication technologies, minimization of costs, protection of the environment, efficient use of water and land resources. In general, it is planned to create **4 modern** agro-parks in **28 districts** of the country.

Such measures, like the use of more advanced methods of livestock management and the expansion of the use of biogas plants in remote rural areas, will lead to a reduction in emissions from the agricultural sector in the future. As an action to construct biogas facilities, a 1 MW biogas thermal power plant has already been constructed at the Gobustan Polygon in the Republic of Azerbaijan and put into operation in September 2011.

Meanwhile, In accordance with the Decree No 152 of the President of the Azerbaijan Republic dated 16 April 2014, to ensure transparency, accountability and efficiency of the state support of the agrarian sector, as well as to exercise more progressive practices and approaches in the field of agriculture, the Ministry of Agriculture provided implementation of activities on creation of **“Electronic Agriculture” Information System** (**EAIS**) according to the principles and innovative technologies applied in the European Union. [101] This will help to obtain quality statistics in the agricultural sector, the application of environmental norms, environmental protection, biodiversity conservation and the regulation of processes related to climate change in particular, as well as will create opportunities for realistic assessment to justify appropriate policy measures in the agricultural sector.

It is to note that, planting of orchards in agricultural lands is widespread in recent years. In fact, more than 60 thousand ha of new orchards has been created in agricultural lands of the country during 2010-2017 years. In addition, 2.500.000 young mulberry plants have been imported and planted in different districts of the country to stimulate development of silkworm breeding.

Meanwhile, the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan put into operation biogas plants with total capacity of about 500 kW and small-scale biogas plants in rural schools, public catering facilities in different districts of the country.

Forestry

In 2017, relevant works towards forest restoration, rehabilitation and afforestation were continued in non-forest lands, 504 003 different trees and plants were planted in Absheron peninsula and other arid zones adjacent to it, along highways, and all the areas were provided with drip irrigation system. In the same year, 75 601 and 18 200 trees and bushes of different types were planted along Zigh-Haydar Aliyev Airport Highway and Bayil hillside, respectively. 41 710 trees and bushes were planted on Alat-Hajigabul section of Baku-Gazakh highway, while 143 227 trees were planted at Alat-Salyan section of Baku-Astara highway, 92 349 trees along Baku-Shamakhi highway, and 88 470 trees along Baku-Guba highway.

In general, 175,000 hectares of degraded forest lands were restored in 2001-2018. In 2000-2018, the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan implemented afforestation works on a total area of 4338.5 ha, planted a total of 5,386,196 tree seedlings, established a modern drip irrigation system with a length of about 11,000 km, planted trees on 55,000 ha. 41,383.8 hectares of open lands from forest fund, 24,000 hectares of relatively small open fields in the forest fund, as well

[101] http://www.agro.gov.az/az/ekt

as 678 hectares of non-forest lands were identified and mapped, planting materials were supplied. The Ministry of Ecology and Natural Resources of the Republic of Azerbaijan plans to plant a total of 24,678 hectares of agroforestry by 2021.

Considering that, silkworm breeding is one of the priorities and its development is directly connected to expansion of mulberry gardens, in 2017, 948 850 young plants of mulberry were distributed for free to different districts to companies, farmers, individual farms, executive powers and municipalities involved in development of silkworm breeding for growing mulberry gardens.

Public sector has also supported landscaping and tree-planting campaigns in the country in recent years. It is worth noting that, IDEA (International Dialogue for Environmental Action) Public Union is more sensitive about expansion and protection of greenery. Since its establishment, IDEA Public Union has planted more than 5 million trees in the country.

Totally 1,493,891 pine, plane and oak trees were planted in 76 districts of the Republic of Azerbaijan under "Republic-wide Green Marathon" implemented in 2014 by IDEA Public Union in order to contribute environmental protection by preventing possible threats caused by decrease of green areas and encouraging towards tree-planting.

IDEA Public Union launched tree-planting actions in conjunction with the spring planting season of 2016, jointly with the Greenery Agriculture Association under the Executive Power of the city of Baku aimed at expanding green spaces of Baku and improving their quality. In the framework of the campaign, poplar trees, which are considered hazardous based on the assessment of the Examination Department of the Ministry of Ecology and Natural Resources, will be cut down and replaced with pine, cypress, olive, Japanese pagoda, ash, medlar, hackberry and other trees in accordance with soil and climate conditions of Baku and the Absheron peninsula.

IDEA, Ministry of Ecology and Natural Resources of the Republic of Azerbaijan, United Nations Food and Agriculture Organization (FAO), Regional Development Public Union of the Heydar Aliyev Foundation and "Cavan" Youth Movement Public Union launched a joint project on establishing fruit gardens in April 2017. A total of 10000 fruit trees such as hazelnut, pomegranate, apricot, feykhoa, date trees were planted in 18.2 ha area of 9 districts under the project.

The social and economic significance of the implemented projects is that the establishment of such gardens will improve the welfare of the population and reduce the country's dependence on imports of agricultural products.

In recent years, the implementation of projects related to the development of forestry in the Republic of Azerbaijan with the participation of a number of international donors has continued:

- Management plans were developed based on modern methodology on sustainable forest management under "Sustainable Land and Forest Management in South Caucasus landscape" Project (2013-2018) financed by Global Ecology Fund, local guidelines were developed on greenhouse gas absorption by the forests based on IPCC 2006 guideline and forest restoration and rehabilitation work was carried out in 70 ha area;

- An assessment of the climate change impacts on forest resources was conducted within the framework of the FLEG II - Forest Management and Improvement of Forest Legislation (2013-2016) project funded under the Eastern Partnership Program;

- Actions towards developing assessment and monitoring of forest resources were started under "the Project on monitoring and assessment of forest resources to strengthen knowledge about the forest fund of Azerbaijan" (2017-2019) financed by Global Ecology Fund and executed by the Ministry of Ecology and Natural Resources jointly with FAO. It is planned to carry out forest restoration and rehabilitation work in 600 ha area in following years under this Project. The project has contributed to the development of modern methodologies for data collection, evaluation and reporting in the field of forestry, the establishment of an operational national forest assessment and monitoring system, and the improvement of forestry planning in selected pilot areas. In addition to demonstrating and exploring opportunities for income-generating activities for local small farmers, ensuring sustainable forest management by increasing carbon reserves in degraded forest fund lands, providing updated information and directions on forest resources, disseminating gained experience and relevant regulations, ensuring sustainable forest management through dissemination of gained experience and relevant regulations are among the main results of the project. With the support of international and local experts involved in the Project, the staff of MENR were trained on modules on operation of forest assessment and monitoring system, inventory of forest and carbon resources, use of Collect Earth software, as well as Ex-Act carbon balance assessment system for carbon calculation. Practical trainings on forestry planning and Geographic Information System were also implemented throughout the project.

- SOCAR has taken tree-planting actions in recent years and has planted 756.497 numbers of trees, bushes and flowers in 502.67 ha area of its enterprises. In 2016, 48.869 different types of trees and bushes were distributed to enterprises and companies of SOCAR.

Among the activities planned in this sector, the following projects can be mentioned:

1. 2020-2022 - Upscaling of Global Forest Watch in Caucasus Region;
2. 2020-2022 - Capacity building to meet the requirements of the improved transparency mechanisms of the PS in the Republic of Azerbaijan;
3. 2021-2025 - Conservation and Sustainable Use of Biodiversity: Strengthening Network of Protected Areas through Advanced Governance And Management;
4. 2016-2021 - Conservation and Sustainable Use of Globally Important Agrobiodiversity;
5. 2020-2022 - Support Project for Adaptation Planning and Implementation in Azerbaijan;
6. Enhancing Climate Information and Multi-hazard Early Warning for Resilience in Azerbaijan.

The policy pursued in the development of the forest sector in the Republic of Azerbaijan gives grounds to argue that removals of emissions from the forest sector will increase in the coming years.

Waste sector

This section summarizes the results of the analysis of the daily amount and composition of solid waste per capita in the Republic of Azerbaijan in 2008-2020, compares the data provided by “Tamiz Shahar” OJSC and the State Statistics Committee with the relevant inventory data, identifies the trends for last 10 years. Taking into account the data on macroeconomic indicators of the country and their dynamics until 2030, the dynamics of change in the amount of solid waste until 2030 has been projected.

About “Tamiz Shahar” OJSC

At present, one of the main goals of the relevant state programs in the country is to ensure the utilization of 80% of solid waste in the short-term. For this purpose, in order to improve the institutional structure, “Tamiz Shahar” OJSC was established on March 12, 2009.

As an important activity to expand waste utilization, a waste incineration plant was constructed within the framework of the “Comprehensive Action Plan on improving the environmental situation in the Republic of Azerbaijan for 2006-2010” [102] approved by the Decree of the President of the Republic of Azerbaijan dated September 28, 2006. Collection and transportation of all solid wastes regardless of the source of generation is being implemented by Baku City Executive Power. However, in accordance with the Decree of the President of the Republic of Azerbaijan dated August 6, 2008 “On improving the

[102] http://www.e-qanun.az/framework/12395

management of household waste in Baku" [103], "Tamiz Shahar" Open Joint Stock Company implements the placement and disposal of household wastes in accordance with modern standards and improvement of environmental situation in Baku. "Tamiz Shahar" OJSC also receives and disposes solid waste generated in Baku (approximately 700,000 tons per year).

"Tamiz Shahar" OJSC receives and disposes solid waste generated in Baku (approximately 500,000 tons per year). [104] Built under the Clean Development Mechanism (CDM) project, the Balakhani Solid Waste Sorting Plant meets modern environmental and occupational safety standards.

"Tamiz Shahar" Open Joint-Stock Company, established to efficiently manage solid waste generated in Baku, has rehabilitated the Balakhani landfill to neutralize solid waste, which poses serious environmental problems in Baku, as the result of which environmental hazards have been eliminated, landfills for waste reception and disposal in the landfill area were expanded, internal roads were renewed, appropriate greening and landscaping works were implemented.

Meanwhile, as mentioned above, in order to recycle solid waste, Balakhani Solid Waste Sorting Plant was put into operation. Separation of paper, glass, plastic, ferrous and nonferrous metals, as well as other raw materials allowed to reduce the total amount of waste, to form additional raw material market and recycling in the country and, most importantly, to minimize the negative impact of waste on the environment.

Meanwhile, the Balakhani Industrial Park, founded in 2012 and commissioned in 2017, has been launched to develop solid waste recycling. The tax and customs incentives applied to enterprises operating in the park have encouraged them to be competitive, to operate on the basis of efficient and environmental safety criteria, and to apply high technologies.

Within the framework of the "Integrated Solid Waste Management" project implemented by the Government of Azerbaijan jointly with the World Bank, a number of studies were conducted in 2011-2014 to improve the system of solid waste collection and disposal in Greater Baku.

The situation in the country was analyzed for the development of the National Strategy for Solid Waste Management and for application of integrated waste management in the Republic of Azerbaijan. Proposals for the establishment of the network, as well as recommendations for phased legal, administrative, financial, institutional and technological reforms were prepared. Within the framework of the project, Garadagh and Surakhani landfills in Baku have been completely restored, numerous illegal waste areas have been identified and cleaned, new machinery and equipment have been procured, and initial information base on waste management has been established.

About Solid Waste Sorting Plant

The Solid Waste Sorting Plant located in Balakhani settlement near Baku was established on the basis of advanced German technologies and officially has started operating as of December 2012. [105] In accordance with the "Integrated Solid Waste Management" project jointly implemented by the World Bank and the Government of Azerbaijan, a 20-year strategy for solid waste management in Baku has been developed. As part of the project, more than 360,000 tons of waste was cleaned from 41 illegal landfills and neutralized at the Balakhani landfill.

The Plant, which was constructed to sort household waste and develop the recycling business, is the first pilot project in its field in Azerbaijan. The annual production capacity of the Plant, provided with modern equipment, is 200,000 tons. The efficient operation of the new plant will save natural resources and energy and reduce the negative impact on the environment. By sorting, paper, glass, plastic, non-ferrous metals, iron, and other raw materials that are suitable for recycling are separated, which reduces the total amount of waste, establishes cheap raw material market, creates grounds for recycling

[103] http://www.e-qanun.az/alpidata/framework/data/15/f_15230.htm
[104] https://cdm.unfccc.int/Projects/DB/RINA1349852899.64/view
[105] https://president.az/articles/6874

in the country, saves energy and most importantly reduces the negative impact of waste on the environment. Meanwhile, hazardous waste, such as batteries, accumulators and electronic waste generated in the household, is separated from the total mass and sent to the appropriate places for proper disposal.

The main benefits of the Project:

- Reduction of negative impacts on the environment and human health;
- Saving natural resources and energy;
- Market of useful and cheap raw materials for recycling;
- Stimulation of the recycling industry;
- Reduction of final waste;
- Creation of new jobs.

These activities will result in waste amounts cuts, which will lead to reduced GHG emissions.

It is to note that the Balakhani landfill has been fully restored in accordance with modern environmental and health standards within the “Integrated Solid Waste Management” project implemented under the “Environmental Rehabilitation Program of Absheron” implemented by the World Bank and the Government of the Republic of Azerbaijan in recent years. Construction work has been underway since early 2015 to transform the Balakhani Landfill into sanitary landfill that meets the highest international standards for the purpose of operation in the next 20 years. Although the landfill is located on the shores of Boyukshor Lake and in area with complex relief, restoration and construction work is currently underway successfully. As the result of the restoration work, earthworks were carried out on the area of about 60 hectares and 2.9 million m^2 of special purpose insulation layers were covered. In total, 26 special cells were built at the landfill to neutralize waste, and about 9.7 million tons of waste disposal was provided in the construction area.

Meanwhile, in order to collect sewage and rainwater and biogas at the Balakhani Landfill, a network of about 40 km of high-density polyethylene pipes of different sizes, 15 special holes, 2 pools with a capacity of 1,500 m^3 and 400 m^3, respectively, for primary wastewater treatment, 3-km network of trenches and more than 400 gas chimneys has been set up. Wastewater is collected in the Landfill area through drainage and is used for irrigation and as technical water after recycling by reverse osmosis wastewater treatment plant with a daily capacity of 80 m^3. In order to reduce the heat-generating gases in the Landfill’s territory, a station which consist of 2 MW generators to convert methane gas generated from waste decomposition into electricity has been installed. Methane gas generated in the cells built for waste disposal is transferred to the Station by special pumps, and methane gas is converted into electricity by generators at the Station.

In order to develop recycling in the country, Balakhani Industrial Park was established by the Order of the President of the Republic of Azerbaijan No. 1947 dated December 28, 2011, and the Park was inaugurated on September 22, 2017.

About Baku Solid Waste Incineration Plant

Baku Solid Waste Incineration Plant was also built in Balakhani Settlement near Baku, on specially allotted area of 20 hectares and put into operation on December 19, 2012. The total cost of its design and construction work amounted to 346 million euros. The Plant’s annual waste incineration capacity is currently 500,000 tonnes and is expected to operate for 20 years by French ‘Constructions Industrielles de la Mediterranee S.A.’ (CNIM S.A). The Plant consists of two lines, each with a capacity of 250,000 tons, and turbine that generates electricity. It is one of the largest plants of its kind in Eastern Europe and the CIS in terms of production capacity and was built in accordance with the strictest EU standards in the field of environmental protection with the application of fourth generation technology (4G). the

2006 “ex-ante” analysis of GHG emission reductions in this sector over the years as the result of the project, is shown in Table 3-29 and the corresponding chart:

Years	Annual decreasing trend of emissions (ton CO_2 eq.)
2012	-2133
2013	5161
2014	21697
2015	37431
2016	52406
2017	66658
2018	80224
2019	93139
2020	105434
2021	117141
2022	84304
Projected total reduction (tons of CO_2 eq.)	661462
Total crediting years	10

Table 3-29. 2006 Ex-ante analysis of projected GHG emission reductions for 2006 by the operation of Baku Solid Waste Incineration Plant

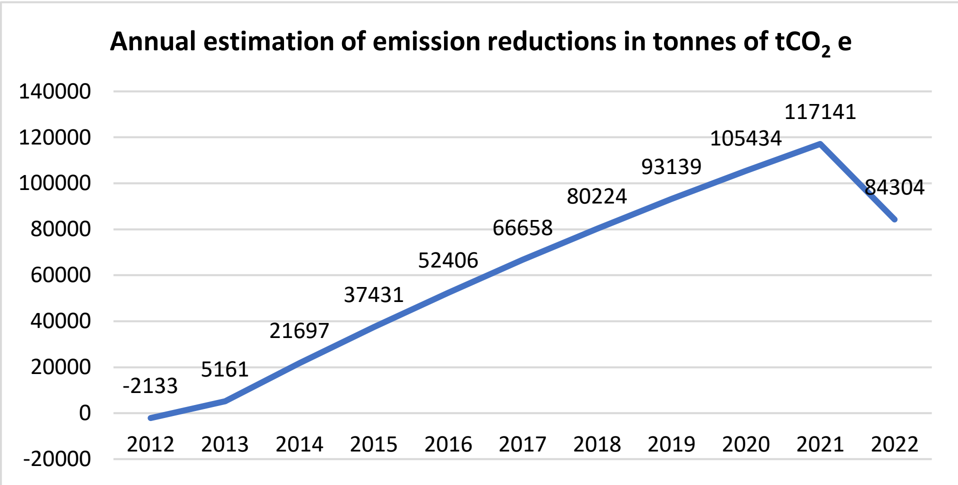


Chart 3-25. 2006 Ex-ante analysis of GHG emission reductions over the years by the operation of Baku Solid Waste Incineration Plant (2006 projection)

Apparently, during the planning period, it was initially projected that the Solid Waste Incineration Plant would prevent the generation of about 660,000 tons of greenhouse gases (CO_2) during its 10-year operation. However, in reality, as shown in Table 3-30 below, in terms of actual incinerated waste and electricity generation, the relevant ex-post analysis shows that the reductions are slightly lower and reach 24.2 thousand tons of CO_2 equivalent in 2030. The main reason for this was that the Plant was not working at full capacity, sorting work was insufficient and other elements of the production chain were not fully mobilized.

At present, a 37.5 MW electric power plant is operating at the Baku Solid Waste Incineration Plant to generate electricity by incineration. It produces 231.5 million kWh electricity per year, part of which is transferred to the public electricity grid to meet domestic demand. Meanwhile, 33 MW electricity is provided to the city electricity grid. This is mitigation action as the Baku Solid Waste Incineration Plant reduces GHG emissions in the waste sector through waste incineration. However, it should be added that the GHG emissions from the process of incineration of household waste should also be taken into account. They were also inventoried and listed in Table 3-30 below for the respective years:

	Units	Years				
		2013	2014	2015	2016	2017
Amount of incinerated household waste	TJ	2104.2	2628	3036.6	2773.2	2782.2
GHG emissions from household waste incineration	thousand tons of CO2 eq.	196.753	245.638	284.0331	259.453	260.253
	thousand tons CO2	192.95	240.9	278.4	254.3	255.1
	thousand tons CH4	0.063	0.078	0.0911	0.083	0.083
	thousand tons N2O	0.008	0.01	0.012	0.011	0.011
Actual electricity from waste incineration	million kW/hour	134,1	173,5	181,8	174,5	170,3

Table 3-30. GHG emissions from incineration at Baku Solid Waste Plant

In fact, the mitigation action for waste incineration and electricity generation at Baku Solid Waste Incineration Plant is implemented entirely by the Plant's own internal capacity. Therefore, according to the relevant classification above, this is a **WM scenario** action. The projection of the action until 2030 is modeled in the LEAP software in terms of relevant GHG emissions dynamics, and based on its comparative analysis with the Baseline Scenario (**baseline scenario**), the following reductions are projected until 2030:

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO2	5,6	7,9	7,9	7,9	7,9	7,1	7,1	6,5	6,5	6,0	6,0	5,6	5,2	4,9
CH4	14,0	21,2	23,4	23,4	23,4	22,7	22,7	22,1	22,1	21,7	21,7	21,3	20,9	20,6
N2O	- 0,1	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2	- 0,2
Other GHG Gasses	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**19,4**	**28,9**	**31,0**	**31,1**	**31,1**	**29,6**	**29,7**	**28,5**	**28,5**	**27,5**	**27,5**	**26,7**	**25,9**	**25,3**

Table 3-31. Year-on-year reduction volume of GHG emissions from waste incineration at Baku Solid Waste Plant (thousand tons of CO_2 equivalents)

It is to note that currently the Plant has only two production lines. However, with the commissioning of the third line in the future, the Plant will be able to utilize a total of 750,000 tons of waste per year, which will increase the reduction of GHG emissions by 1.5 times in the coming years. However, the projected growth in the country's population and industrial growth rates for the coming years suggest that GHG emissions from the waste sector will increase by about 60,000 tons of CO_2 equivalents each year. This makes it necessary to build waste processing plants in different regions and major cities of the country in the coming years in order to reduce emissions from the sector. As an action in this area, "Tamiz Shahar" OJSC plans to build waste sorting stations with annual capacity of 100,000 tons each in Garadagh and Khazar districts of Baku in future.

Interestingly, according to the relevant inventory data, in 2014, the GHG emissions from the waste sector as a whole amounted to 1.238 million tons of CO_2 eq. and accounted for about 2.07 percent of total emissions (excluding removals). In 2015, this figure was 1.251 million tons of CO2 eq. and accounted for approximately 2.04 percent of total emissions (excluding removals). In 2016, there was a slight decrease to 1.233 million tons of CO_2 eq. and accounted for approximately 2.02 percent of total emissions (excluding removals). Interestingly, this figure was only 0.091 percent in 1990.

Meanwhile, the Government of the Republic of Azerbaijan is cooperating with the well-known British company Mott MacDonald in the framework of actions for the effective management of solid waste to reduce GHG emissions. In fact, in accordance with the contract signed with the Company in June 2019, the first phase of the new concept of solid waste management in Baku has been completed. Thuswise, according to the concept, a Monitoring Center was established in Narimanov district of Baku, and in this center, 2 specialists sent by the company from the UK to Baku studied the composition of household waste collected in Narimanov district for 2 weeks. Meanwhile, works have been implemented to determine the types of household waste sorting from the collection area and to determine the most efficient routes for their transportation.

Meanwhile, it is planned to define the sizes, colors, and logos of special containers for the collection of household waste, and most importantly, to raise awareness among the population. Within the framework of the concept, new modern containers for household waste have been installed in 7 districts (Sabail, Narimanov, Yasamal, Nasimi, Binagadi, Nizami and Khatai), and new containers will be installed in other districts. Completion of the concept is scheduled for late 2019 - early 2020.[106]

As the result, these measures will enable to solve the household waste problem, improve the environmental situation in Baku and Absheron, eliminate the factors that threaten drinking water, the environment and the health of citizens due to harmful waste.

Meanwhile, with the exception of new systems operating in Baku, most of the waste in the regions is collected in open dumps, not fenced, pollutants from waste buried in these areas are mixed with groundwater, and some landfills are located directly along rivers and floodplains, which necessitates special attention to this area.

Scenarios for waste amount change and GHG emissions from this sector by 2030

Relevant expert studies have shown that the share of wastewater in GHG emissions from the waste sector in the Republic of Azerbaijan is at present less than 0.2%.[107] Therefore, only solid waste will be taken into account when preparing forecasts for this sector until 2030. These forecasts will be implemented by three main scenarios. The scenarios will be medium and long term, taking into account the country's key macroeconomic indicators, including GDP, population growth and other indicators.

1. **Baseline Scenario on solid household waste;**

2. **Scenario** for the implementation of actions planned in the **"National Strategy for Improving Solid Waste Management in the Republic of Azerbaijan for 2018-2022"** [108] **(hereinafter, the "National Strategy Scenario for Solid Household Waste Management");**

3. **Scenario for the implementation of additional actions for the solid household waste management (hereinafter, the "Additional Actions Scenario for Solid Household Waste Management").**

Let's analyze these scenarios separately.

3.4.1 Baseline Scenario on Solid Household Waste

No mitigation actions are envisaged for solid waste management under **Baseline Scenario on Solid Household Waste**. In this case, any change in their management and level is determined by only macroeconomic indicators, demographic changes, especially population growth and changes in living standards, and so on. The change rate in the social and economic condition of the population is determined mainly by changes in GDP in the country.

It shows that the per capita solid household waste in the Republic of Azerbaijan increased only by 10% between 2012 and 2019 (248-275 kg/year). In fact, the annual change rate in solid household waste amount per capita in last 10 years can be taken as 1.2-1.3%. If we take into account that the annual GDP growth rate in Azerbaijan is 2%, then the change rate in solid household waste amount per capita until 2030 will be as in Table 3-32.

[106] https://az.trend.az/business/3061145.html
[107] İ.Mustafayev.Məişət tullantıları və Ətraf mühit ."Adiloğlu"-2008 (I.Mustafayev. Household waste and environment). "Adiloglu" -2008
[108] https://president.az/articles/30566

Years	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Amount of solid household waste per capita, kg/person year	275	278	282	285	289	293	296	300	304	308	311
Population, thousand people	10060	10231	10323	10416	10509	10604	10699	10796	10893	10991	11090
Total amount of solid household waste, thousand tons	2766	2833	2898	2956	3025	3093	3154	3225	3298	3372	3434

Table 3-32. Projected change in the total amount and per capita amount of solid waste by 2030

Taking into account these figures, it can be predicted that by 2030 the total amount of solid waste generated will increase by 24%.

Meanwhile, taking into account all this, the emission of GHG gases from these emissions should be projected for the next 10 years. Demographic changes have to be taken into account for these calculations. In fact, in rural and urban areas, wastes are managed differently, as described above. Therefore, it is necessary to take into account the dynamics of population growth in rural and urban areas. It is to note that natural population growth in rural areas is faster than in urban areas. However, on the other hand, with the expansion of urbanization, there is a constant flow from villages to cities. These two trends have compensated each other for many years, and the rural-urban population ratio has remained unchanged at about 48:52 for the past 20 years[109]. The calculations have been continued considering that no sharp change in this trend is expected in the next 10 years.

In fact, the change of population in the 3 categories above and the generated solid household waste will be as shown in the tables:

		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baku	Population, thousand people	2277	2297	2318	2338	2359	2381	2402	2424	2446	2468	2490
	Solid household wastes (thousand tons)	626	639	653	666	682	697	711	727	744	760	774
Cities	Population, thousand people	2955	2981	3008	3035	3063	3090	3118	3146	3175	3203	3232
	Thousand tons/year	812	829	848	865	885	905	923	944	965	987	1005
Villages	Population, thousand people	4828	4911	4955	5000	5044	5090	5136	5182	5229	5276	5323
	Thousand tons/year	1327	1365	1397	1425	1458	1491	1520	1554	1589	1625	1655
Total population, thousand people		**10060**	**10231**	**10323**	**10416**	**10509**	**10604**	**10699**	**10796**	**10893**	**10991**	**11090**
Total solid household wastes (thousand tons)		**2766**	**2833**	**2898**	**2956**	**3025**	**3093**	**3154**	**3225**	**3298**	**3372**	**3434**

Table 3-33. Projections for the population number and the amount of solid household waste in different categories until 2030

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baku	626	639	653	666	682	697	711	727	744	760	774
Cities	812	829	848	865	885	905	923	944	965	987	1005
Villages	1327	1365	1397	1425	1458	1491	1520	1554	1589	1625	1655
Total solid household wastes (thousand tons)	**2766**	**2833**	**2898**	**2956**	**3025**	**3093**	**3154**	**3225**	**3298**	**3372**	**3434**

Table 3-34. Projections for the total number of solid household waste until 2030

[109] www.stat.gov.az

The figures in these tables refer to the waste generated. Most urban waste (90%) is transported to landfills, some metal, paper/cardboard and plastic waste is collected at collection points located in residential areas, but the entire biodegradable part is transported to landfills. It is burned at the Balakhani landfill in Baku after sorting (about 500,000 tons per year). In other cities, it is mainly biodegradable in the environment, and 10-15% of them are burned in chaotically in the open air. The organic part of the waste generated in rural areas is fed to animals and birds and added to the soil as compost. This reduces solid waste emissions into the environment by up to 30%[110]. If this factor is taken into account, the figures for the "Villages" category in Table 4-35 will be reduced by 30% and will be as follows:

Years	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baku	626	639	653	666	682	697	711	727	744	760	774
Cities	812	829	848	865	885	905	923	944	965	987	1005
Villages	945	963	987	1007	1029	1053	1073	1096	1121	1147	1169
Total solid household wastes (thousand tons)	**2383**	**2431**	**2488**	**2538**	**2596**	**2655**	**2707**	**2767**	**2830**	**2894**	**2948**

Table 3-35. Projections by considering the use of food waste collected in villages related to the total amount of solid household waste

In fact, the chart of the solid household waste change by 2030 according to the Baseline scenario is shown in chart 3-26 below. Solid household wastes from all categories grow monotonously in response to changes in macroeconomic and demographic indicators.

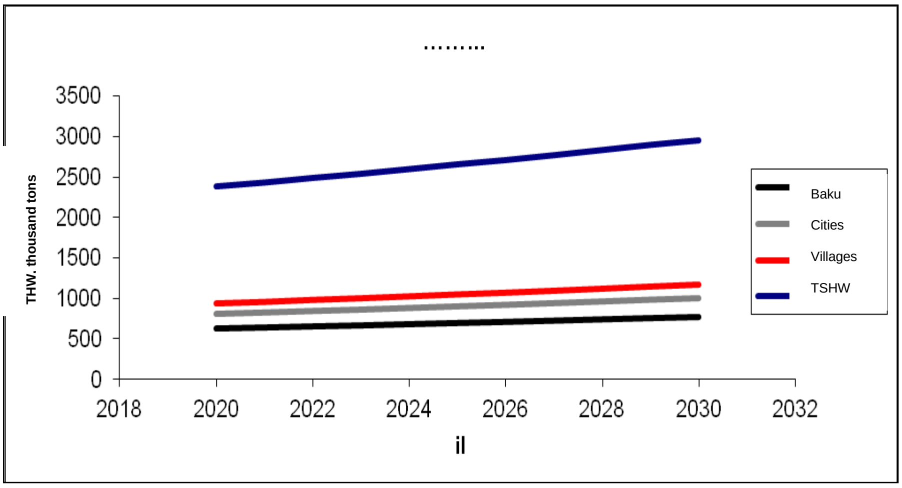


Chart 3-26.

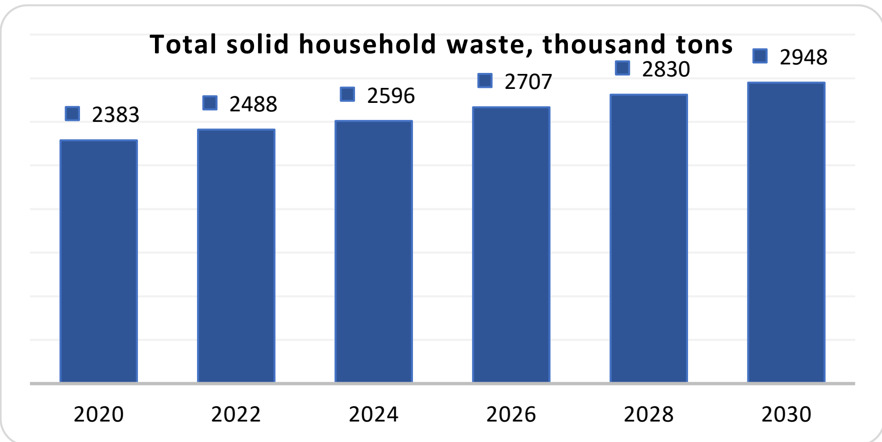


Chart 3-27. Change in the amount of all wastes by different categories and as per the baseline scenario by 2030

[110] İ.Mustafayev.Məişət tullantıları və ətraf mühit ."Adiloğlu"-2008 (I.Mustafayev. Household waste and environment). "Adiloglu" -2008

The values calculated for the first scenario of emissions according to the above methods and the amount of waste for different categories are shown in Table 3-36 and chart 3-28:

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baku	286	291	297	303	310	318	324	331	338	345	351
Cities	1204	1231	1258	1285	1314	1345	1372	1401	1434	1466	1493
Villages	1401	1431	1466	1496	1528	1563	1593	1628	1666	1704	1736
Thousand tons of CO_2 equivalent in total	**2892**	**2953**	**3021**	**3054**	**3153**	**3226**	**3289**	**3360**	**3438**	**3515**	**3580**

Table 3-36. Projections of changes in emissions (thousand tons of CO_2 eq.) as per the baseline scenario by 2030

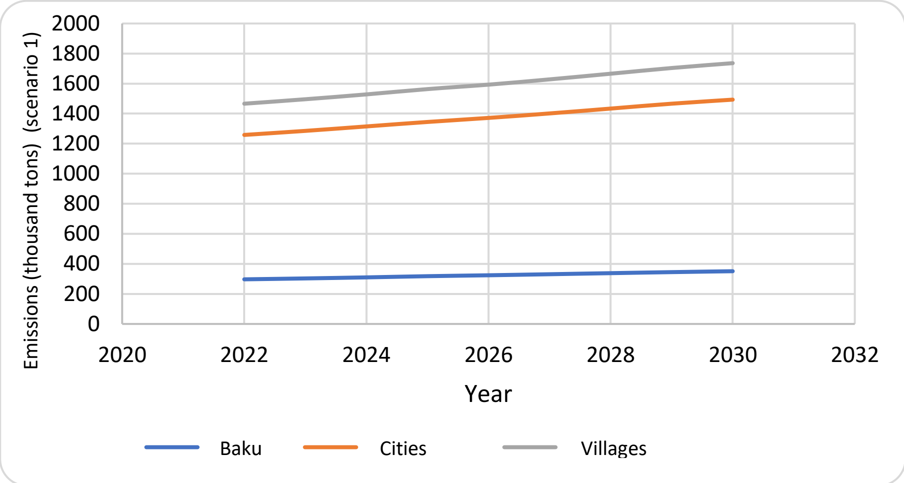


Chart 3-28. Change of emissions from different categories of sources by 2030 as per the baseline scenario

As can be seen from chart 3-28, by 2030, waste GHG emissions will also increase monotonically in proportion to the amount of solid waste in the Baseline Scenario.

3.4.2 National Strategy Scenario for Solid Waste

As noted, the current scenario envisages the implementation of measures in accordance with the "**National Strategy for Improving Solid Waste Management in the Republic of Azerbaijan for 2018-2022**" [111]. According to the general classification of mitigation actions to reduce GHG emissions given in the previous section, this scenario is not an Existing Actions Scenario (i.e., **WM** scenario). In fact, no financial allocations and other organizational issues for a number of mitigation actions listed in the Strategy have not yet been resolved. In the following national data, it is highly probable that these measures will be included in the **Existing Actions Scenario**.

In fact, the National Strategy envisages the establishment of Regional Solid Waste Management Centers for all regional centers and cities of the country. At these centers, the waste will be burned in incinerators, and this process will continue until 2030, with an additional 10% of the incineration rate each year. In this case, emissions from the "urban" category waste will decrease every year. The results of the calculations are given in Table 3-37 and chart 3-29.

Years	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baku	286	291	297	303	310	318	324	331	338	345	351
Cities	1204	1162	1120	1072	1019	974	918	862	801	738	670
Villages	1401	1431	1466	1496	1528	1563.3	1593	1628	1666	1704	1736
Total, thousand tons of CO_2 eq.	**2892**	**2884**	**2883**	**2871**	**2857**	**2855**	**2835**	**2821**	**2805**	**2787**	**2758**

Table 3-37. Dynamics of change in emissions as per the National Strategic Scenario for Solid Waste until 2030

[111] https://president.az/articles/30566

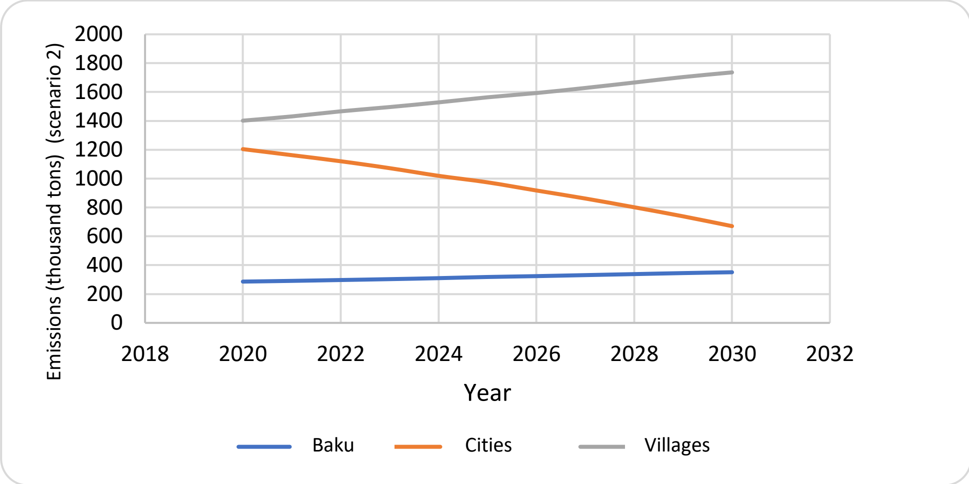


Chart 3-29. Dynamics of change in emissions as per the National Strategic Scenario for Solid Waste until 2030

As can be seen from the chart and the table, although emissions in the "cities" category have decreased, emissions for villages and Baku have remained the same as in the Solid Waste Base Scenario and, naturally, total emissions have decreased by 23%.

3.4.3 Additional Actions Scenario for Solid Waste

In the current scenario, along the measures in the previous scenario, the gradual (additional 10% per year) involvement of rural waste management in the Republic of Azerbaijan is envisaged as a new measure.

As per the similar calculations, the change in total emissions of solid household waste by years is shown in Table 3-38 and chart 3-30 below:

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baku	286	291	297	303	310	318	324	331	338	345	351
Cities	1204	1162	1120	1072	1019	974	918	862	801	738	670
Villages	1401	1352	1304	1249	1193	1134	1066	1000	930	859	780
Total, thousand tons of CO_2 eq.	2892	2806	2721	2624	2522	2426	2308	2193	2070	1942	1801

Table 3-38. Dynamics of changes in emissions in the Additional Actions Scenario for Solid Waste until 2030

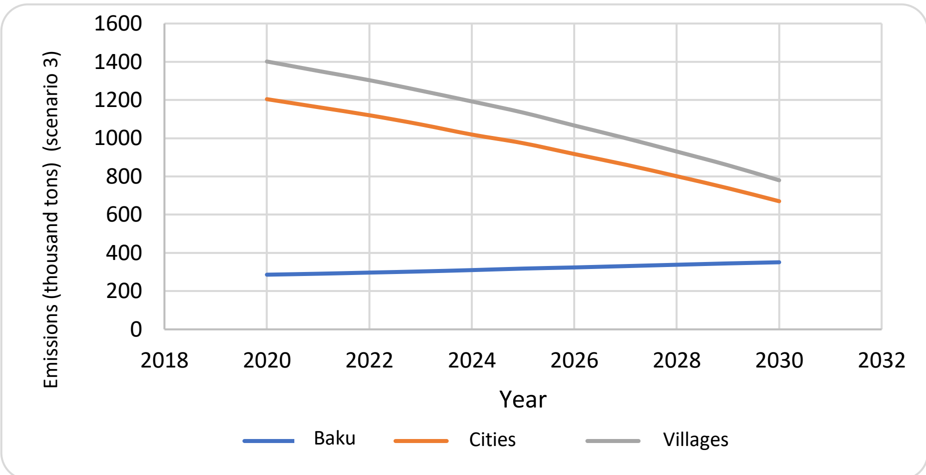


Chart 3-30. Dynamics of change in emissions by 2030 in the Additional Actions Scenario for Solid Waste

Thuswise, in the current scenario, emissions in cities and villages are already declining, but remain the same for Baku. The change in the amount of solid household waste by 2030 and the change in emissions for each of the 3 scenarios are presented in the final table (Table 3-39) and chart 3-31:

Years	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Solid household waste, thousand tons	2383	2431	2488	2538	2596	2655	2707	2767	2830	2894	2948
Emissions, thousand tons											
Scenario 1	2892	2953	3021	3054	3153	3226	3289	3360	3438	3515	3580
Scenario 2	2892	2884	2883	2871	2857	2855	2835	2821	2805	2787	2757
Scenario 3	2892	2805.5	2720.7	2624	2522	2426	2308.1	2193.3	2069	1942.1	1801

Table 3-39. Dynamics of changes in the amount of solid waste and emissions for all 3 scenarios by 2030

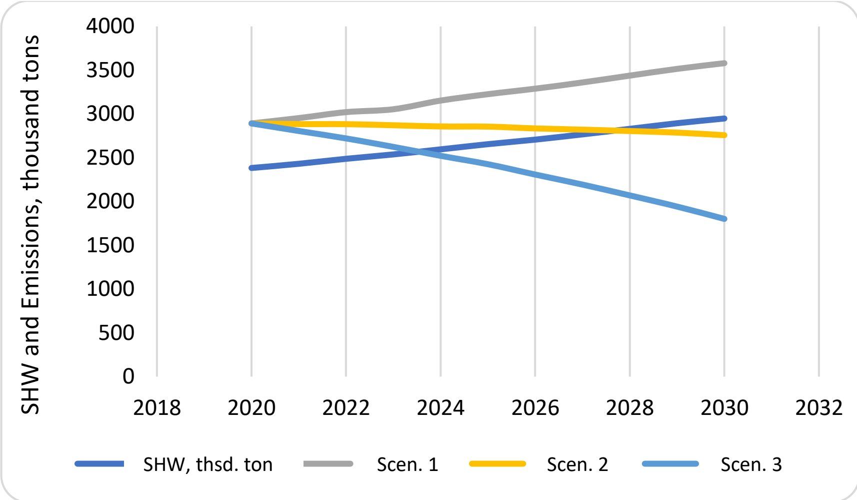


Chart 3-31. Forecasts of changes in the amount of solid waste and emissions for each of the 3 scenarios

As can be seen, if no action is taken on the management of solid household waste by 2030, the amount of these waste and relevant GHG emissions will increase by 24%, but if appropriate mitigation actions are implemented, emissions can be reduced by 23% under Scenario 2, and by 50% under Scenario 3.

Meanwhile, concerning the GHG emissions from sewage water, the factors that will affect the amount of these emissions by 2030 are as follows:

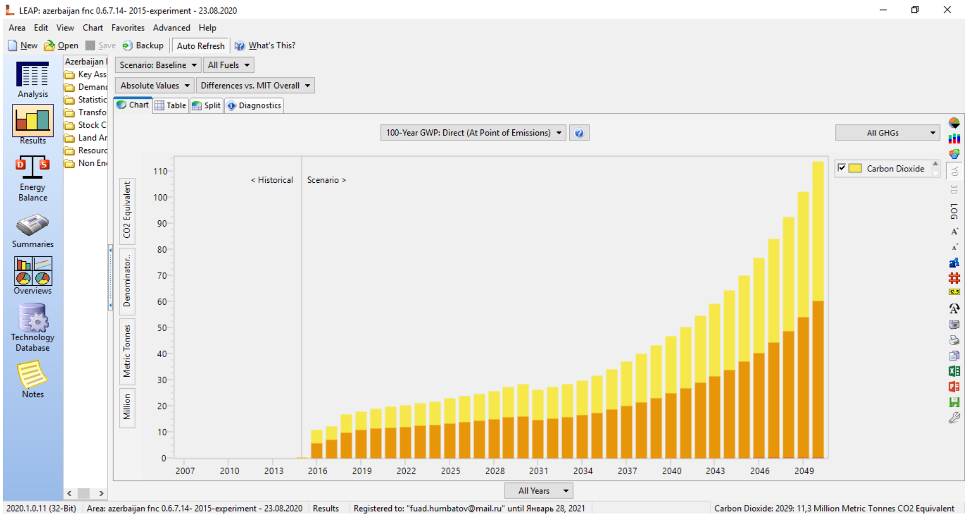
1. Demand for drinking water will increase due to natural population growth and sewage water will increase accordingly;

2. Managed (collected and treated) sewage water will increase; thuswise, at present, "Azersu" OJSC provides 289.2 million cubic meters of clean water to the population, but 224.4 million cubic meters of sewage is managed. The remaining 64.8 million cubic meters (28.8%) of sewage is managed individually. If these effluents are also managed, the amount of treated water and organized methane emissions will increase.

The collection and incineration of methane generated from sewage and discharged from organized source of waste to generate energy can ultimately reduce emissions. Existing legislation does not address these requirements, and in the current context, mitigation actions should include legislative improvements in this area.

3.3.2. Assessment and projection of the overall effect of GHG emission reduction actions in all sectors

This paragraph will include a scenario that comprises all the above mitigation actions for all of the above sectors to assess the overall impact and projection until 2030 and will be compared year by year with the GHG emissions volume corresponding to the **Baseline Scenario**. To this end, the LEAP software includes the **MIT-Overall** scenario, which includes all of the MIT-Energy, MIT-Transport, MIT-IPPU and Balakhani incineration (BAL1) scenarios in the previous sectors, to determine their cumulative effect and projection and calculated comparatively over the years in the LEAP:



Graph 3-15. Dynamics of reduction in GHG emissions over the years compared to the Baseline Scenario resulted from all available mitigation actions for all sectors (MIT-Overall) (LEAP)

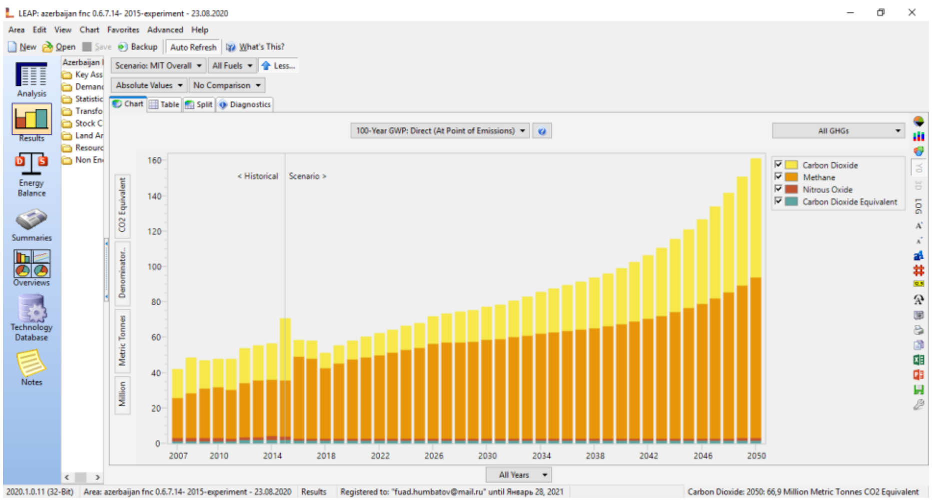
The table corresponding to the mentioned graph is described below:

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO_2	4,7	4,9	7,0	6,9	7,4	7,8	8,0	8,4	8,5	9,2	9,4	10,0	10,7	11,4	12,2
CH_4	5,6	7,1	9,6	10,7	11,3	11,7	11,9	12,4	12,5	13,2	13,6	14,2	14,9	15,6	15,9
N_2O	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**10,3**	**12,0**	**16,6**	**17,6**	**18,7**	**19,5**	**19,9**	**20,7**	**21,0**	**22,4**	**23,0**	**24,2**	**25,6**	**27,1**	**28,2**

Table 3-40. (million tons of CO_2 equivalent)

It is obvious from the last table and the corresponding graph that as the result of actual mitigation actions implemented in all these sectors, GHG volumes have reduced since 2016 compared to the Baseline Scenario, and these reductions will increase from 2016 to 2030 and be amounted to 28.2 million tons of CO_2 equivalent (including removals).

In the graph below and the corresponding table, information on the volume and composition of GHG emissions over the years according to the MIT-Overall scenario, which includes mitigation actions for all sectors, is calculated in the LEAP software:



Graph 3-16. Volume and composition of GHG emissions resulted from all available mitigation actions (MIT-OverAll) for all sectors (LEAP)

The following table provides information on the volume and composition of GHG emissions over the years as the result of mitigation actions in all sectors across the country in accordance with graph 3-16:

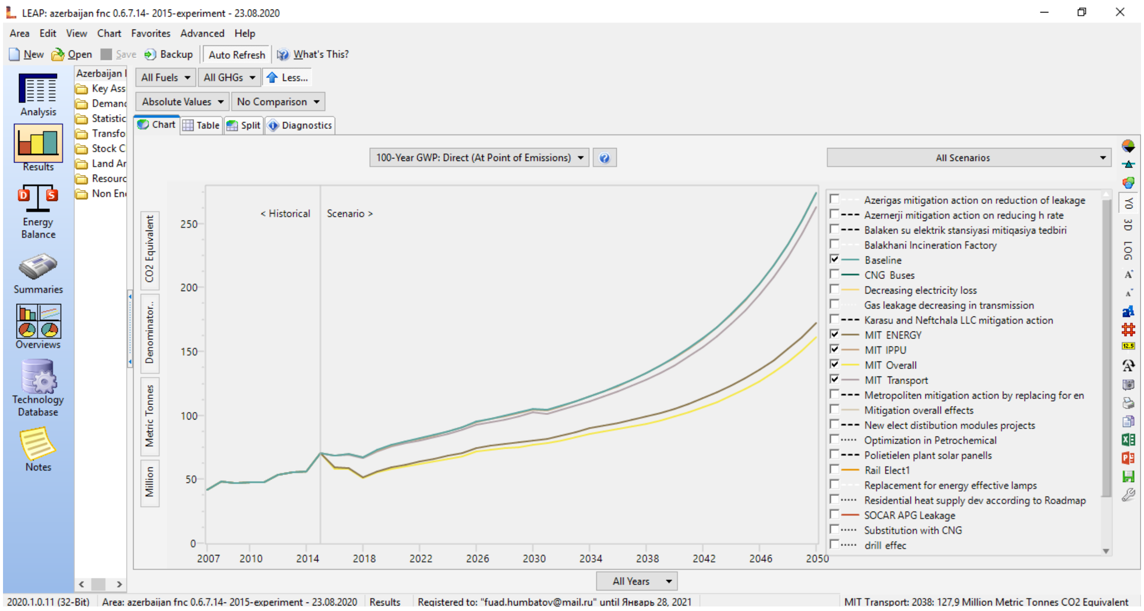
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
CO_2	19,8	20,4	35,0	9,1	9,7	8,2	9,8	10,5	11,4	12,0	12,7
CH_4	32,1	31,9	31,6	46,5	45,3	39,9	42,6	44,7	45,9	47,2	48,5
N_2O	1,3	2,2	2,1	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Other GHG	2,1	1,8	1,8	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
TOTAL	**55,3**	**56,4**	**70,6**	**58,3**	**57,8**	**50,9**	**55,2**	**58,0**	**60,1**	**62,0**	**64,0**

Table 3-41. (million tons of CO_2 equivalent)

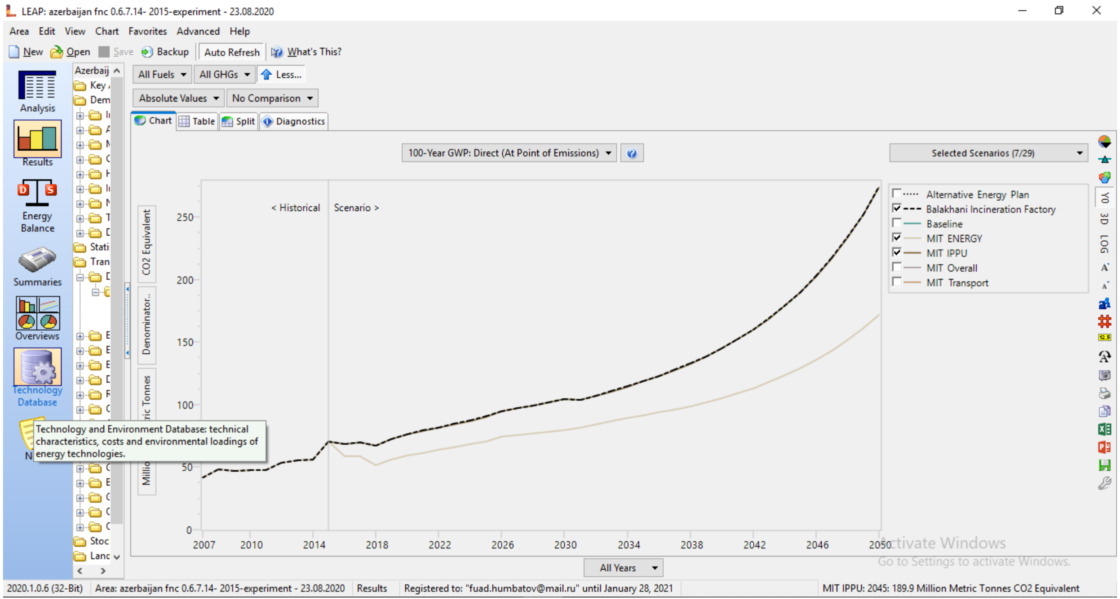
	2024	2025	2026	2027	2028	2029	2030	2031	2032
CO_2	13,6	14,1	15,3	16,3	16,9	17,5	18,3	19,2	20,4
CH_4	50,0	51,4	53,5	54,1	54,4	54,7	55,7	56,3	57,2
N_2O	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
TOTAL	**66,4**	**68,3**	**71,9**	**73,2**	**74,1**	**75,0**	**76,8**	**78,3**	**80,4**

Table 3-41 (continued). (million tons of CO_2 equivalent)

Graphs 3-17 and 3-18 below show the **MIT-Energy** scenario (brown), which includes all mitigation actions in the energy sector, the **MIT-Transport** scenario (pink), which includes all mitigation actions in the transport sector, the **MIT-IPPU** scenario (gray), which includes all mitigation actions in the industry sector, graph for mitigation actions scenario (dashed line) in the waste sector (**Balakhani incineration (BAL1)**), graph of **MIT-Overall** scenario for all mitigation actions (yellow, bottom) and the graph of the **Baseline Scenario** (blue, top) are shown:

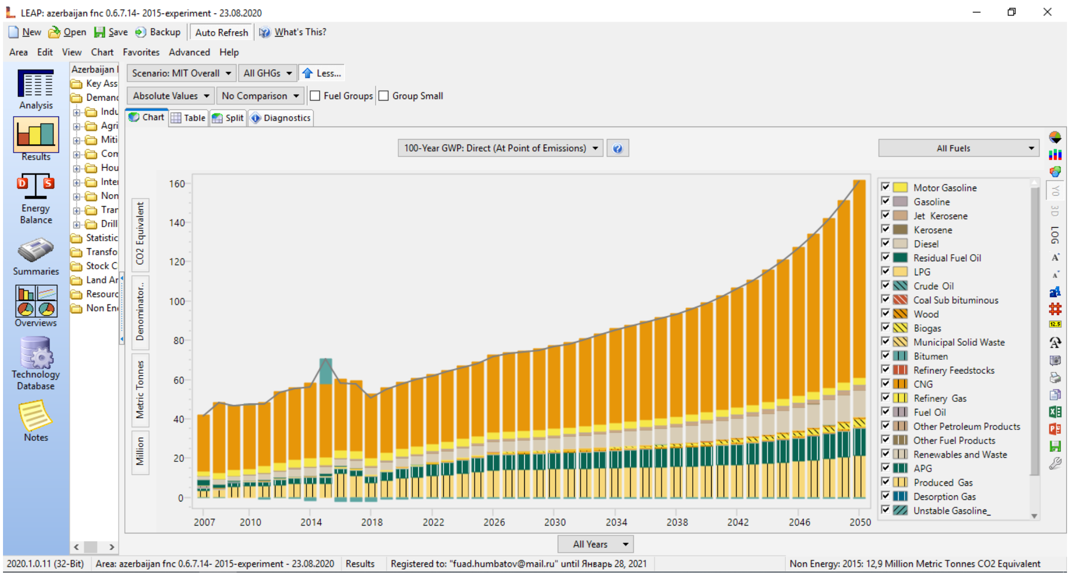


Graph 3-17. MIT-Energy (brown), MIT-Transport (pink), MIT-IPPU (gray), MIT-Overall (yellow) and Baseline Scenario (green) graphs (LEAP)



Graph 3-18. Comparative analysis of MIT-Energy (brown color) and Balakhani (Bal1) (dashed line) graphs for mitigation actions in the waste sector (LEAP)

The following graph shows the role of different fuels in generation of GHG emissions resulted from all available mitigation actions (MIT-OverAll) for all sectors:



Graph 3-19. The role of different fuels in generation of GHG emissions after reduction resulted from all available mitigation actions (MIT-OverAll) for all sectors (LEAP)

According to this graph, the following table shows the role of different fuels in the generation of GHG emissions as the result of all available mitigation actions (MIT-Overall) for all sectors:

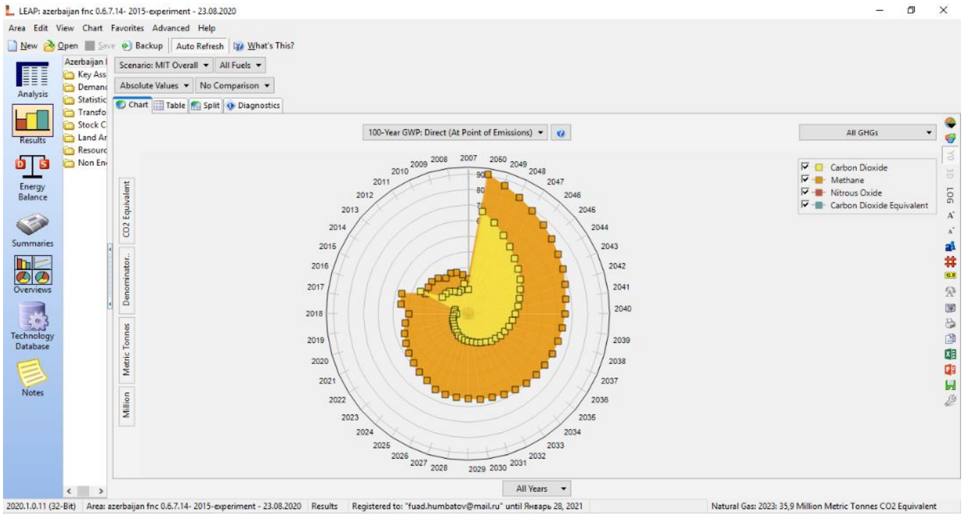
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
All Others	- 2,0	- 1,9	- 1,9	- 0,8	- 0,8	- 0,6	- 0,6	- 0,6	- 0,5	- 0,5	- 0,5	- 0,5	- 0,5	- 0,5	- 0,5
Natural Gas	36,1	36,0	32,6	33,2	34,0	34,6	35,2	35,9	36,7	37,2	38,9	40,0	40,6	41,2	42,0
Motor Gasoline	3,8	4,0	4,0	4,0	3,9	3,9	3,7	3,7	3,7	3,6	3,6	3,6	3,6	3,5	3,4
Jet Kerosene	0,6	0,6	0,7	0,7	0,7	0,7	0,8	0,8	0,8	0,9	0,9	0,9	1,0	1,0	1,0
Diesel	3,5	3,7	3,8	4,0	4,1	4,3	4,4	4,6	4,8	5,0	5,2	5,4	5,6	5,8	6,1
Wood	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Biogas	0,3	0,4	0,3	0,3	0,3	0,3	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,5	0,5
CNG	0,0	0,0	0,0	0,0	0,1	0,1	0,3	0,3	0,3	0,4	0,4	0,4	0,5	0,5	0,6

APG	2,6	2,7	2,9	4,3	5,0	5,4	5,8	6,2	6,7	7,1	7,7	7,8	7,9	8,0	8,1
Produced Gas	12,0	11,0	7,5	8,6	9,7	10,3	10,9	11,5	12,2	12,9	13,9	14,0	14,1	14,1	14,3
TOTAL	**58,3**	**57,7**	**50,9**	**55,2**	**58,0**	**60,1**	**62,0**	**64,0**	**66,4**	**68,3**	**71,9**	**73,1**	**74,1**	**75,0**	**76,7**

Table 3-42. (million tons of CO_2 equivalent)

As can be seen from Graph 3-19 and the corresponding table, the specific gravity of natural gas, gasoline, produced gas and related associated gases is high in the GHG emissions as per the Baseline Scenario and the MIT-Overall scenario.

The following graph shows the volume and composition of GHG emissions (including removals) in the spiral form according to the MIT-Overall scenario by years until 2050:



Graph 3-20. Volume and composition of GHG emissions by 2050 as the result of all available mitigation actions (MIT-OverAll) in all sectors (LEAP)

CHAPTER 4. CLIMATE CHANGE SENSITIVITY ASSESSMENT AND ADAPTATION MEASURES

4.1. Climate of the Republic of Azerbaijan and its change tendency

Modern climate changes on our planet are one of the most important challenges of our time. For the assessment of climate change in the Republic of Azerbaijan, the 2000-2020 air temperature indicators at the stations of the National Hydrometeorological Service under the Ministry of Environment and Natural Resources were studied. These studies have shown that the average temperature in the country for the last 20 years (compared to the temperature norms of 1971-2000) increased by 1.5°C in Sheki station, 1.3°C in Agstafa, 0.5°C in Ganja, 0.8°C in Gadabay, 1.2°C in Zardab, 1.3°C in Mingachevir, 0.8°C in Jafarkhan, 0.8°C in Maraza, 0.7°C in Baku, 0.4°C in Alat, 0.9°C in Lankaran, 0.9°C in Bilasuvar, 1.1°C in Gyryz, and 1.1°C in Guba.

The last 10 years have been the hottest decade in our country. For 10 years, the temperature norms have been 1.3°C higher in Sheki station, 1.7°C in Agstafa, 1.2°C in Ganja, 1.1°C in Gadabay, 1.3°C in Zardab, 1.9°C in Mingachevir, 1.1°C in Jafarkhan, 1°C in Maraza, 0.9°C in Baku, 0.3°C in Alat, 1°C in Lankaran, 1.2°C in Bilasuvar, 1.3°C in Gyryz, and 1.2°C in Guba compared to 1971-2000 years.

Annual temperature in 2001-2020 and annual precipitation anomalies in 2011-2020 were studied in 7 regions (Aran, North-East, North-West, Mountainous Shirvan, West, South, Absheron). Data from 32 stations were used to calculate the annual temperature and precipitation anomalies.

Average temperature anomaly in Aran Region for 20 years (compared to the norm of 1971-2000) was +1.1°C, while the maximum temperature anomaly was +6.7°C (Zardab, 2012), +5.8°C (Mingachevir, 2012). In the North-Eastern region, the average temperature anomaly varied approximately +1.1°C, and the maximum temperature anomaly in the range of +2.3°C (Guba, 2010), +3.0°C (Gyryz, 2019). During the last 20 years, the average temperature anomaly in the Southern region was observed at about +0.9°C, while the maximum anomaly at +1.9°C (Bilasuvar, 2018, Lankaran, 2010, +1.9°C). In the North-West region, the mean temperature anomaly for 20 years was approximately +1.5°C and the maximum anomaly was +2.9°C (Shaki, 2010). During this period, the average temperature anomaly in the Mountainous-Shirvan region was approximately +0.8°C, and the maximum temperature anomaly was +2.0°C (Maraza, 2010). The average temperature in the Western region was about +0.9°C above normal, and the maximum temperature anomaly was +2.6°C (Gadabay, 2019), +2.1°C (Ganja, 2018), +2.7°C (Agstafa, 2018). The average temperature anomaly in the Absheron region was approximately +0.5°C, and the maximum temperature anomaly was +1.8°C (Baku, 2010), +4°C (Alat, 2005) (Figure 4-1).

Rainfall indicators analyzed for 2010-2020 showed that the amount of precipitation was observed to be lower in most parts of the country for 10 years in comparison with the precipitation norms of 1971-2000: 52.0 mm at Sheki station, 49.1 mm at Agstafa, 32.5 mm at Ganja, 20.8 mm in Zardab, 41.9 mm in Mingachevir, 30.8 mm in Jafarkhan, 40.7 mm in Maraza, 0.1 mm in Alat, 2. 8 mm in Lankaran, 29.3 mm in Bilasuvar, 50.4 mm in Gyryz, 19 mm in Guba. The amount of precipitation increased in some places: 72.2 mm in Gadabay and 98.3 mm in Baku. Over the past 10 years, precipitation decreased by 31.1 mm in the Aran region, 34.7 mm in the North-East, 16 mm in the South, 52.0 mm in the North-West, 40.7 mm in the Mountainous-Shirvan region, and 3.2 mm in the West. In Absheron region, 49.1 mm increase in precipitation was observed. Thus, precipitation in the country as a whole decreased by about 3.4% over the last 10 years, compared to the climatic normal of 1971-2000 (Figure 4-2).

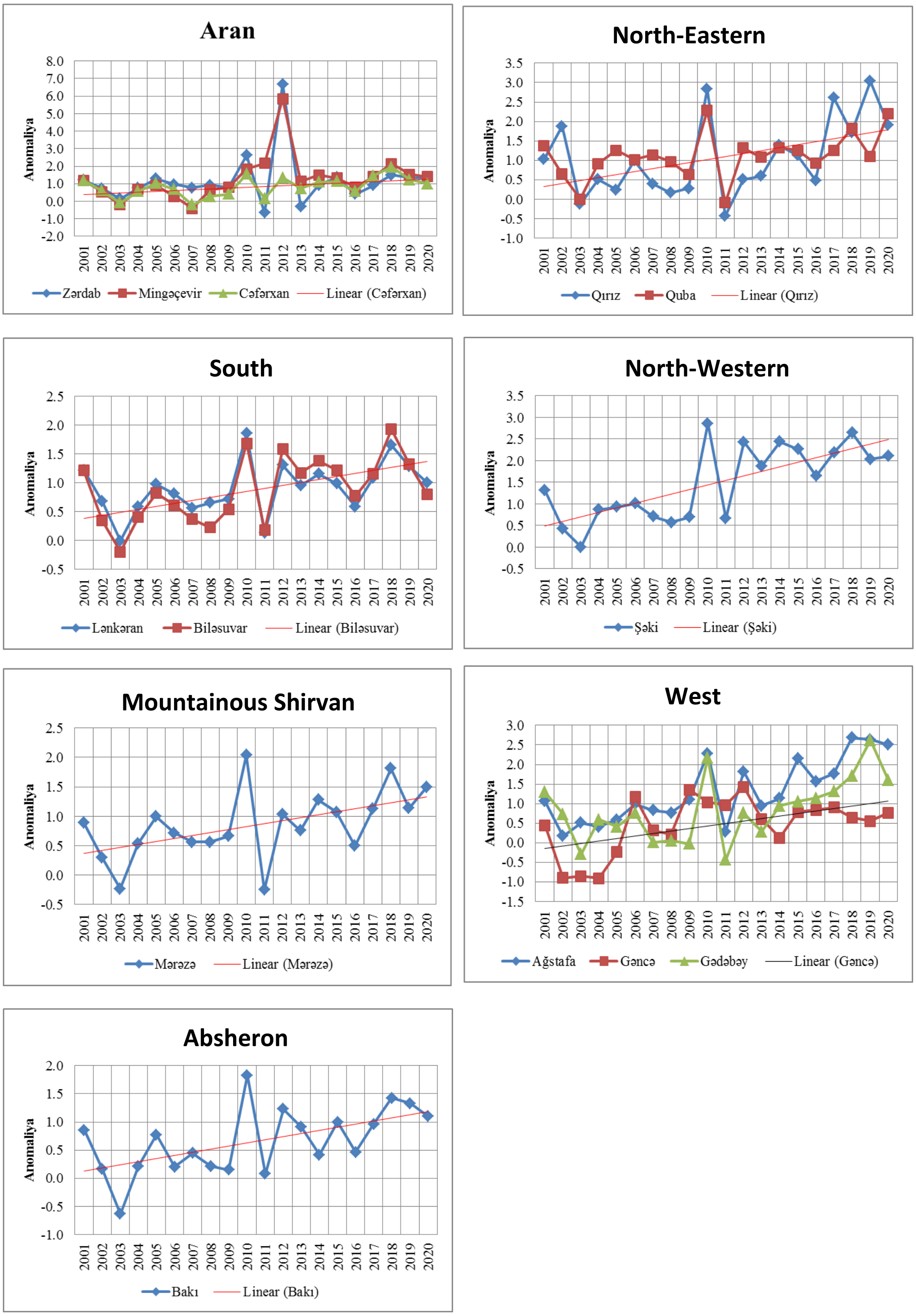


Figure 4-1. Temperature anomalies in Azerbaijan during 2001-2020 (compared to the norms of 1971-2000)

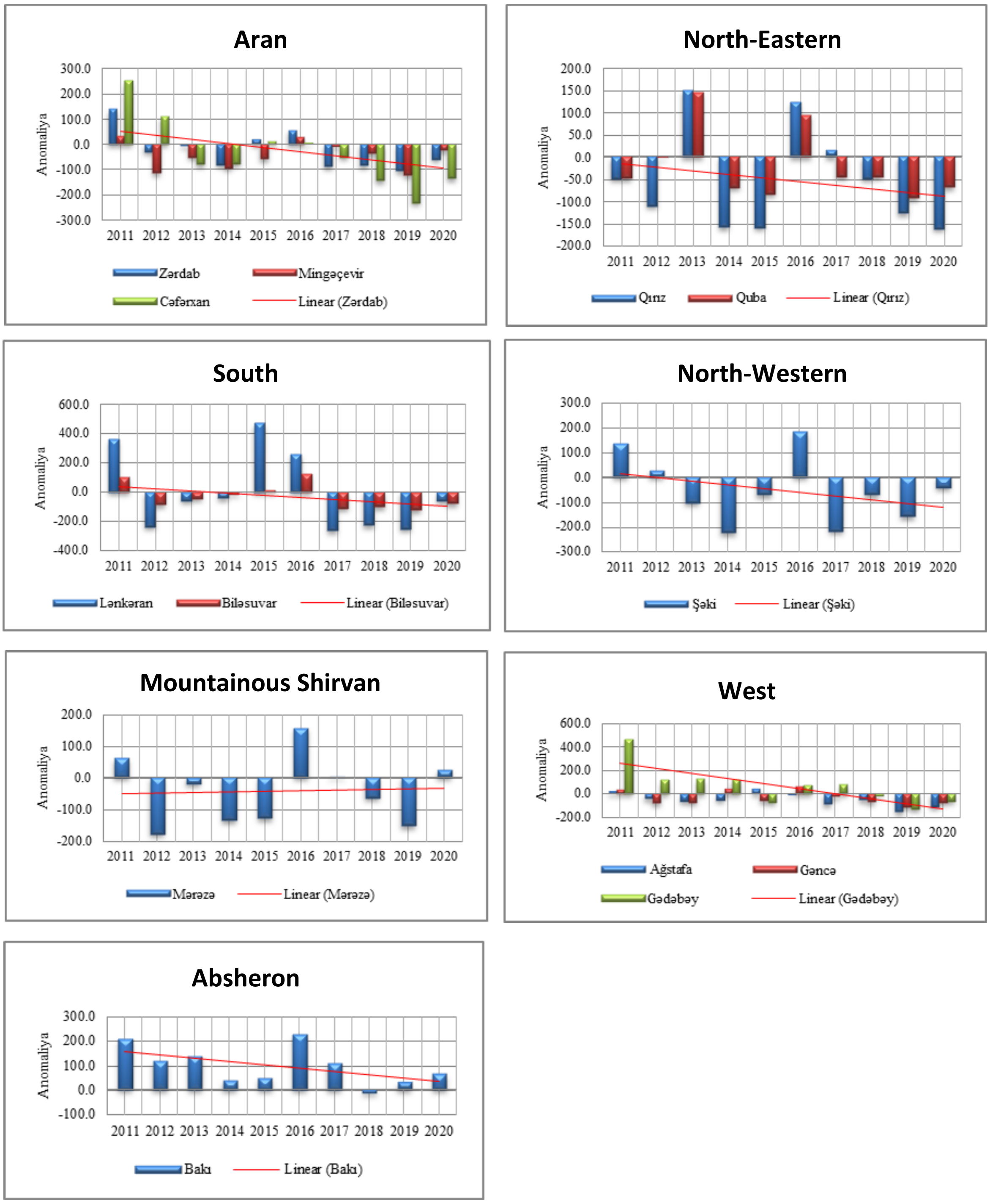


Figure 4-2. Precipitation anomalies in Azerbaijan during 2011-2020 (compared to the norms of 1971-2000)

4.2. Climate scenarios

Climate Scenarios were developed based on the HadGEM2-ES model by the Hadley Center for Climate Science and Services by the British Meteorological Organization, the MPI-ESM-MR model developed by the Max Planck Institute for Meteorology in Germany, and the GFDL-ESM2M model developed by the NOAA-GFD Laboratory in the United States. The Global Circulation Models used IPCC recommendations and future climate scenarios for Azerbaijan were developed with the support of experts from the Turkish State Meteorological Service. As a result of the calculations, perennial climate data were analyzed and the most peculiar climate scenarios were prepared on this basis. From all three models, calculations were made for 4 periods in 1970-2100 with RCP4.5 and RCP8.5 scenarios:

the first period covers the years 1971-2000 and acts as a base climate;

the second scenario period covers the 2020-2040 years;
the third scenario period covers the 2041-2070 years;
the fourth scenario covers the 2071-2098 years.

IPCC emission scenarios have been identified mainly in relation with demography, economy, technology, energy, and agricultural development.

4.2.1. Climate of 1971-2000 base years and testing of models

The models were tested based on the results of 1971-2000. For this period, the temperature distribution in the country is fairly accurately reflected by all three models. The model takes into account the decrease in temperature in the Greater Caucasus, Lesser Caucasus, Talysh Mountains. The average annual temperature in the highlands is minus 2°C to 0°C. The temperature in the plains is +12°C to +16°C, which is close to the actual observations.

The distribution of precipitation is approximately the same in all three models. However, in all three models, there are numerous uncertainties in the distribution of precipitation over the area.

4.2.2. RCP4.5 Cimate scenario for 2020-2040

According to the **GFDL model**, the average annual temperature in the country is expected to increase by 0.5-1.5°C in 2020-2040. In 2020-2040 (compared to 1971-2000), the amount of precipitation in the country is expected to decrease by 10-20%, mainly in the mountainous and foothill regions and the Absheron Peninsula, and increase by 10-20% in some regions, mainly in Lankaran-Astara. (Figure 4-3).

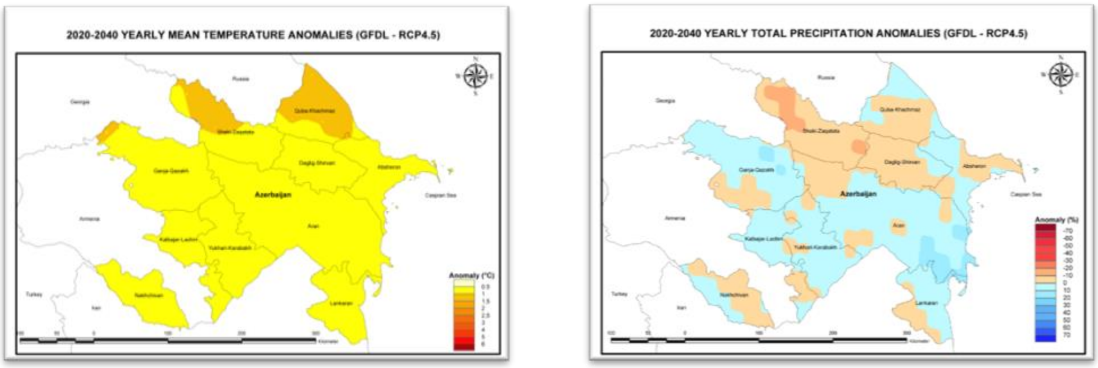


Figure 4-3. The average annual temperature and annual precipitation changes in the country in 2020-2040, according to the GFDL model

According to the **HADGEM model**, the average annual temperature in the country is expected to increase by 1-2°C in 2020-2040. In 2020-2040 (compared to 1971-2000), the amount of precipitation in the country is to decrease by 10-20% in some areas and increase by 10-40% in most areas (Figure 4-4).

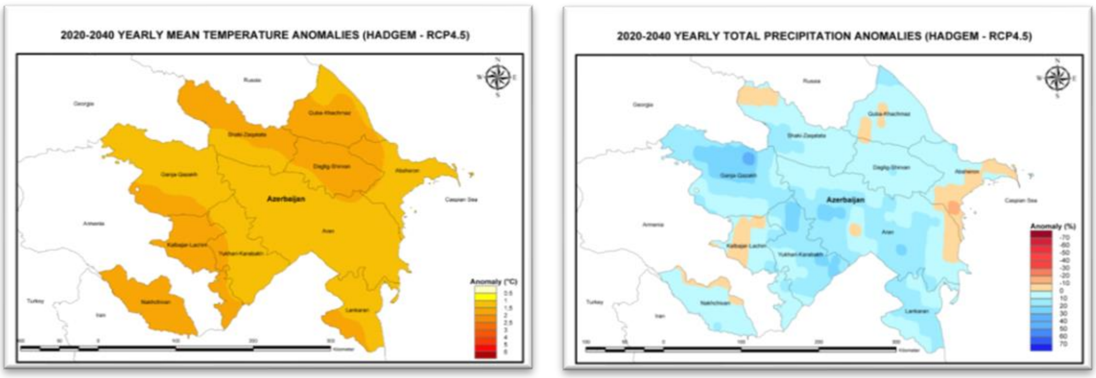


Figure 4-4. The average annual temperature and annual precipitation changes in the country in 2020-2040, according to the HADGEM model

According to the **MPI model**, the average annual temperature in the country is expected to increase by 0.5-1.5°C in 2020-2040. In 2020-2040 (compared to 1971-2000), the amount of precipitation in the country will decrease by 10-20% in most areas, and increase by 10-30% in some eastern areas. (Figure 4-5).

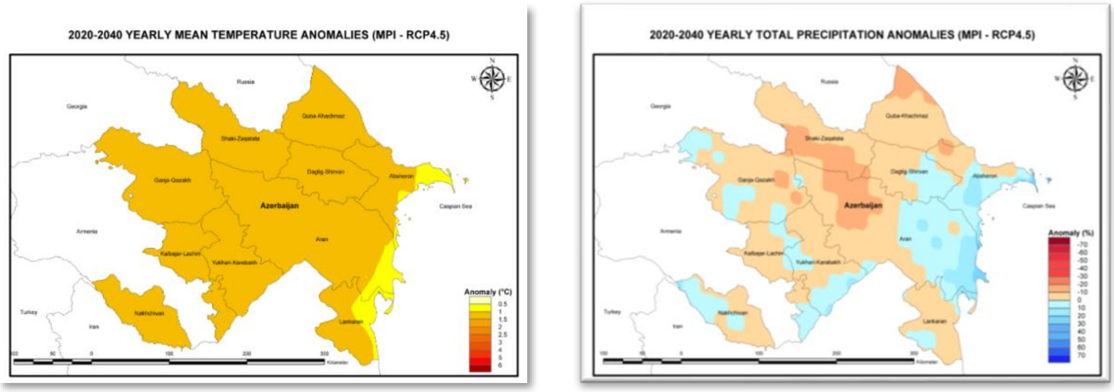


Figure 4-5. The average annual temperature and annual precipitation changes in the country in 2020-2040, according to the MPI model

4.2.3. RCP4.5 Cimate scenario for 2041-2070

According to the **GFDL model**, the average annual temperature in the country will increase by 1-2°C in 2041-2070. In 2041-2070 (compared to 1971-2000), the amount of precipitation in the country will decrease by 10-20% in some areas, and increase by 10-20% in the east of the country (Figure 4-6).

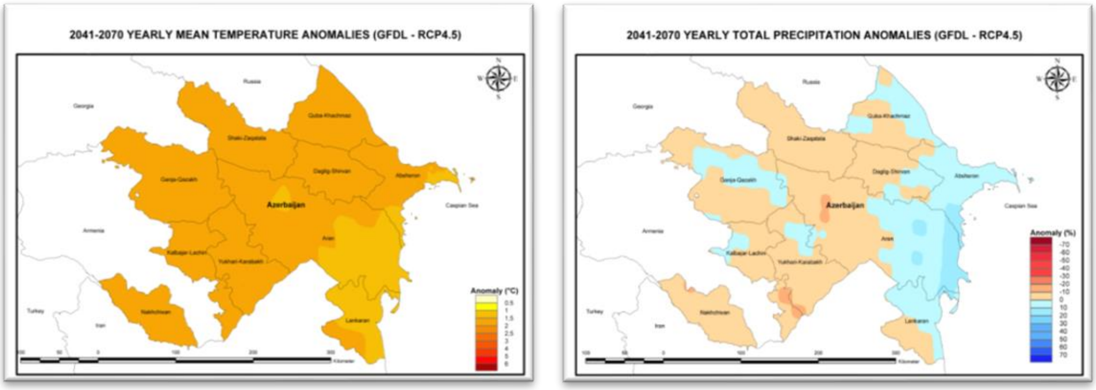


Figure 4-6. The average annual temperature and annual precipitation changes in the country in 2041-2070, according to the GFDL model

According to the **HADGEM model**, the average annual temperature in the country will increase by 2-3°C in 2041-2070. In 2041-2070 (compared to 1971-2000), the amount of precipitation in the country will decrease by 10%, mainly in the highlands of the Greater Caucasus, Shirvan and Nakhchivan, and increase by 10-30% in most areas (Figure 4-7)).

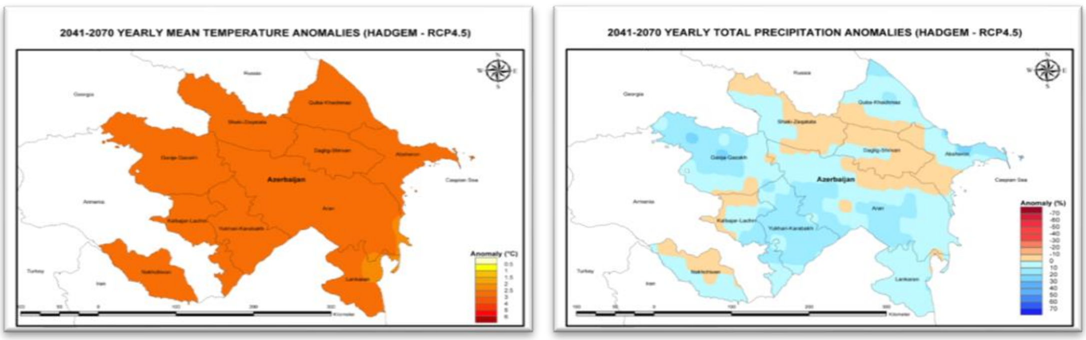


Figure 4-7. The average annual temperature and annual precipitation changes in the country in 2041-2070, according to the HADGEM model

According to the **MPI model**, the average annual temperature in the country is expected to increase by 1-2°C in 2041-2070. In 2041-2070 (compared to 1971-2000), the amount of precipitation in the country will decrease by 10-40% in most areas (Figure 4-8).

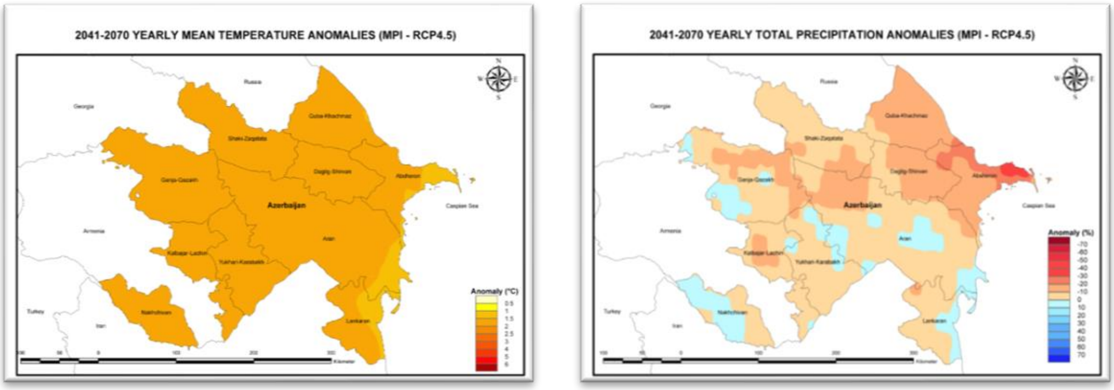


Figure 4-8. The average annual temperature and annual precipitation changes in the country in 2041-2070, according to the MPI model

4.2.4. RCP4.5 Cimate scenario for 1971-2098

According to the **GFDL model**, the average annual temperature is to increase by 1-2°C in 2071-2098. In 2071-2098 (compared to 1971-2000), the amount of precipitation in the country will decrease by 10-20% in mountainous areas and increase by 10-20% in other areas (Figure 4-9).

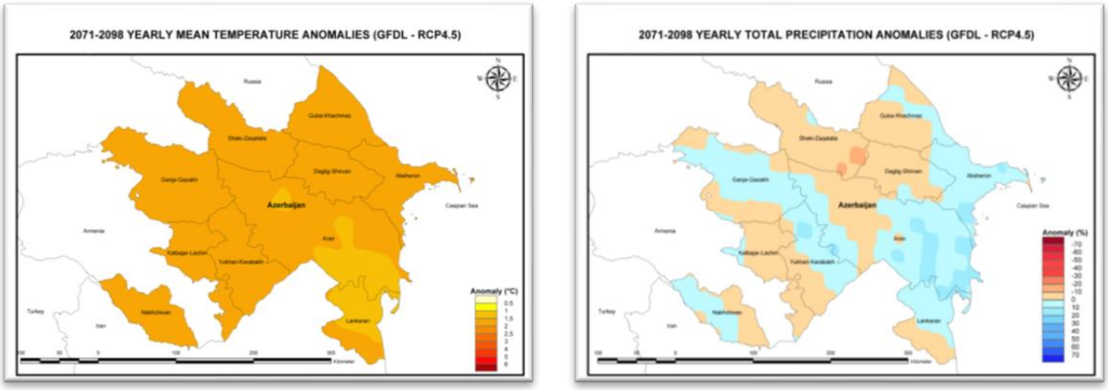


Figure 4-9. The average annual temperature and annual precipitation changes in the country in 2071-2098, according to GFDL modem

According to the **HADGEM model**, an average annual temperature increase of 3-4°C wil be observed in the territory of Azerbaijan in 2071-2098. In 2071-2098 (compared to 1971-2000), the amount of precipitation will increase by 10-20% throughout the country, and by 30-50% in the eastern part (Figure 4-10).

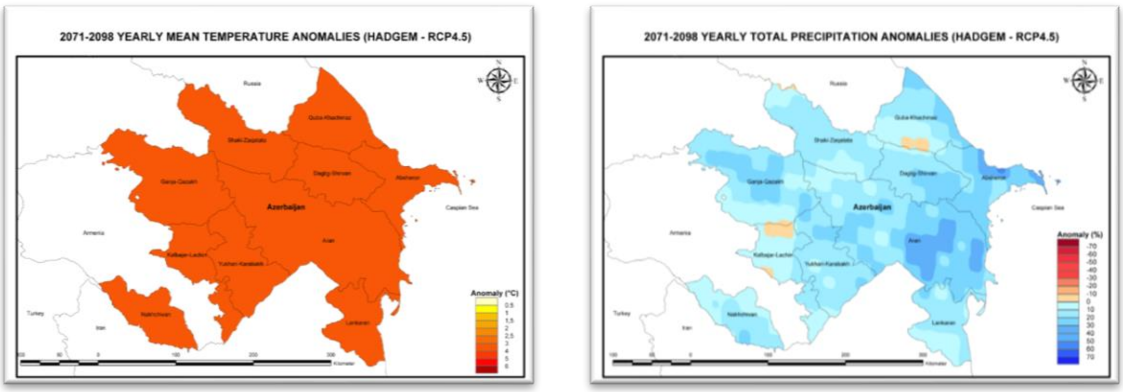


Figure 4-10. Average annual temperature and annual precipitation changes in the country in 2071-2098, according to the HADGEM model

According to the **MPI model**, the average annual temperature in the country is projected to increase by 1°C-2.5°C in 2071-2098. In 2071-2098 (compared to 1971-2000), the amount of precipitation in the country will decrease by 10-40% in most areas. (Figure 4-11).

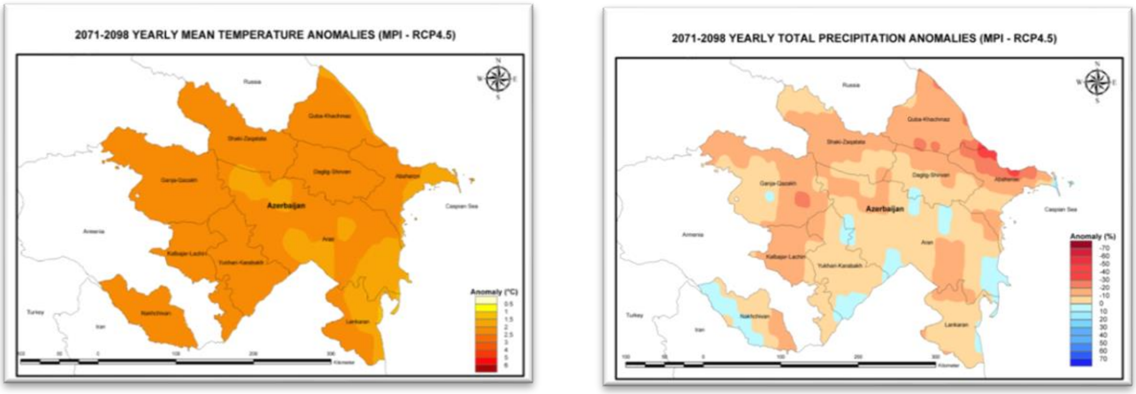


Figure 4-11. Average annual temperature and annual precipitation changes in the country in 2071-2098, according to the MPI model

4.2.5. RCP8.5 Cimate scenario for 2020-2040

According to **the GFDL model**, the average annual temperature will increase by 1°C-1.5°C in the country in 2020-2040. In the territory of the country in 2020-2040 (compared to 1971-2000), an increase in the amount of precipitation in the Far Eastern regions, except for the Absheron Peninsula, and a decrease of 10-20% in most areas is expected (Figure 4-12).

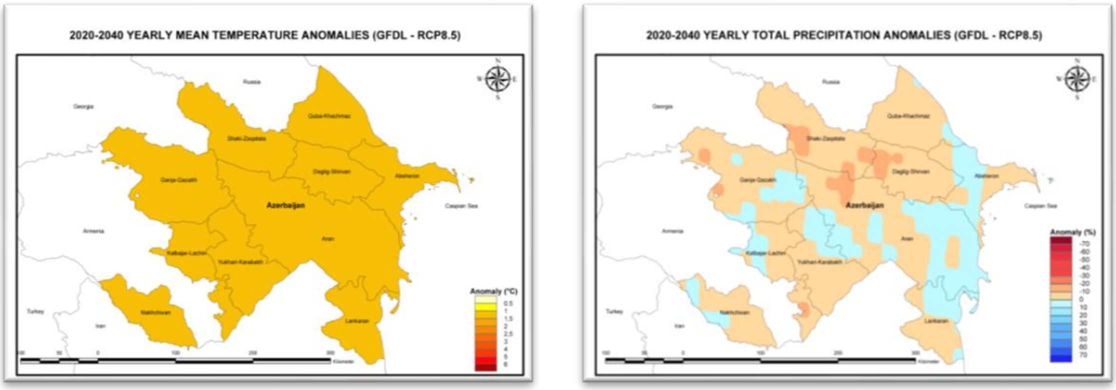


Figure 4-12. The average annual temperature and annual precipitation changes in the country in 2020-2040, according to the GFDL modem

According to the **HADGEM model**, the average annual temperature is expected to increase by 1.5-2.5°C in the country in 2020-2040. In 2020-2040 (compared to 1971-2000), the amount of precipitation is expected to increase by 10-30% in most areas of the country (Figure 4-13).

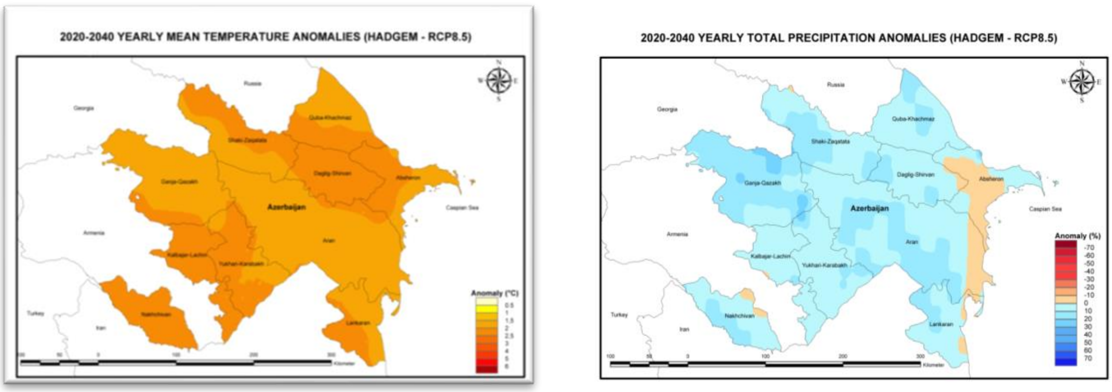


Figure 4-13. The average annual temperature and annual precipitation changes in the country in 2020-2040, according to the HADGEM model

According to the **MPI model**, the average annual temperature in the country is expected to increase by 0.5-1.5°C in 2020-2040. In 2020-2040 (compared to 1971-2000), the amount of precipitation in the country is expected to decrease by 20% in some areas and increase by 30% in some areas (Figure 4-14).

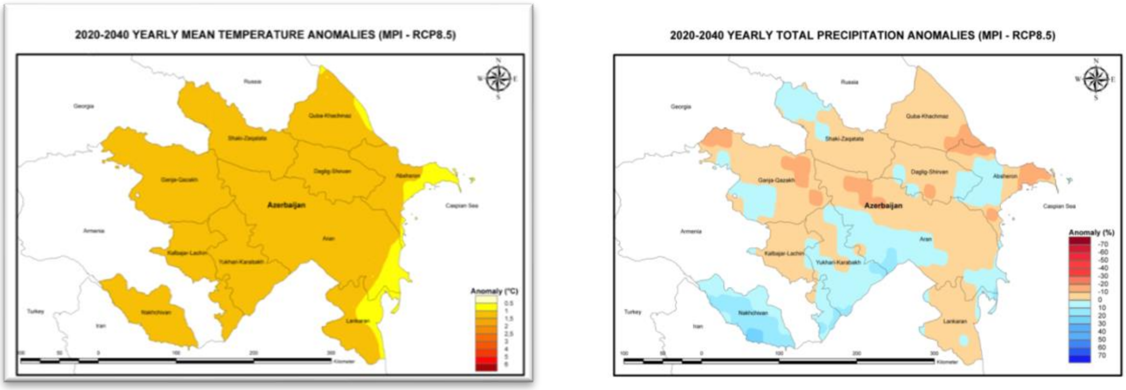


Figure 4-14. The average annual temperature and annual precipitation changes in the country in 2020-2040, according to the MPI model

4.2.6. RCP8.5 climate scenario for 2041-2070

According to the **GFDL model**, an average annual temperature increase of 1.5-2.5°C is expected in the country in 2041-2070. In the territory of the country in 2041-2070 (compared to 1971-2000), the amount of precipitation will increase by 10-20% in most eastern regions, and decrease by 10-20% in the remaining areas (Figure 4-15).

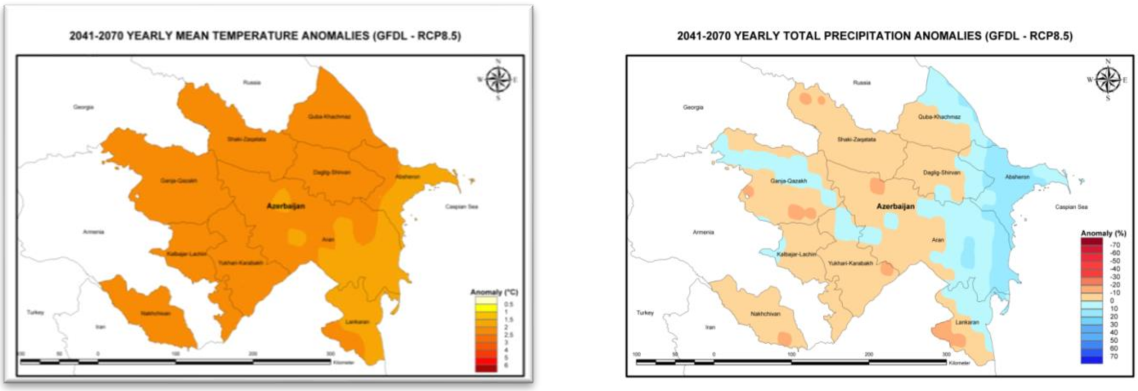


Figure 4-15. The average annual temperature and annual precipitation changes in the country in 2041-2070, according to the GFDL model

According to the **HADGEM model**, the average annual temperature increase in the country will be 3-4°C in 2041-2070. In 2041-2070 (compared to 1971-2000), the amount of precipitation in the country is to increase by 10-30% in most areas (Figure 4-16).

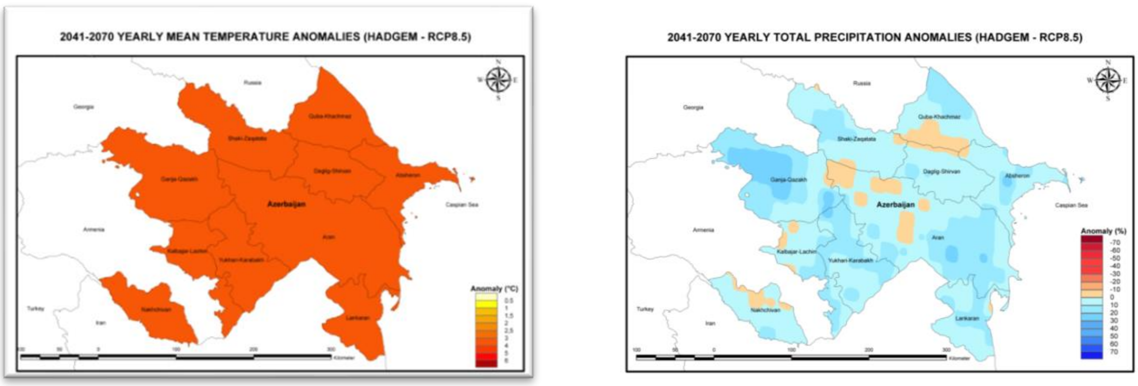


Figure 4-16. The average annual temperature and annual precipitation changes in the country in 2041-2070, according to the HADGEM model

According to the **MPI model**, the average annual temperature increase in the country will be 1.5-3°C in 2041-2070. In 2041-2070 (compared to 1971-2000), the amount of precipitation in most areas of the Republic will decrease by 10-40% (Figure 4-17).

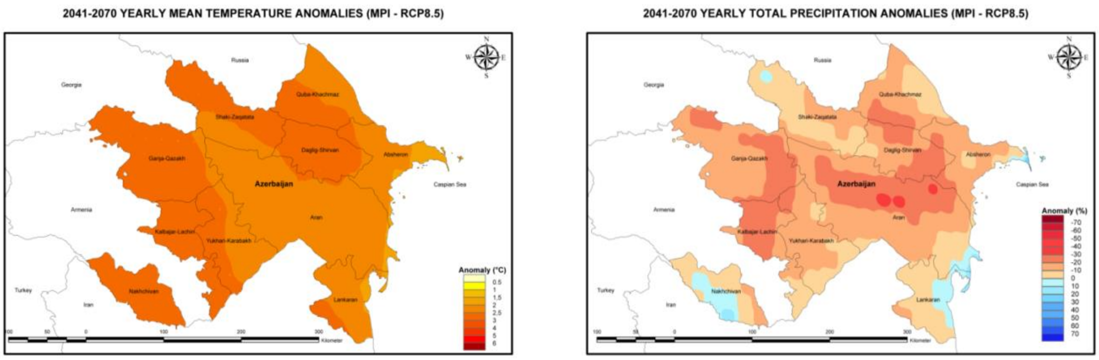


Figure 4-17. The average annual temperature and annual precipitation changes in the country in 2041-2070, according to the MPI model

4.2.7. RCP8.5 climate scenario for 2071-2098

According to the **GFDL model**, the average annual temperature increase in the country will be 2.5-4°C in 2071-2098. In 2071-2098 (compared to 1971-2000), the amount of precipitation in the country is projected to increase by 10-20% in the eastern regions, and decrease by 10-20% in other areas (Figure 4-18).

According to the **HADGEM model**, the average annual temperature increase in the country in 2071-2098 is 4-6°C. In 2071-2098 (compared to 1971-2000), the amount of precipitation in the country increased by 10-40% in most areas (Figure 4-19).

According to the **MPI model**, the average annual temperature is projected to increase by 2.5-5°C in the country in 2071-2098. With the exception of parts of the Babek and Julfa administrative districts, the amount of precipitation is expected to decrease by 40% in the whole country in 2071-2098 (compared to 1971-2000) (Figure 4-20).

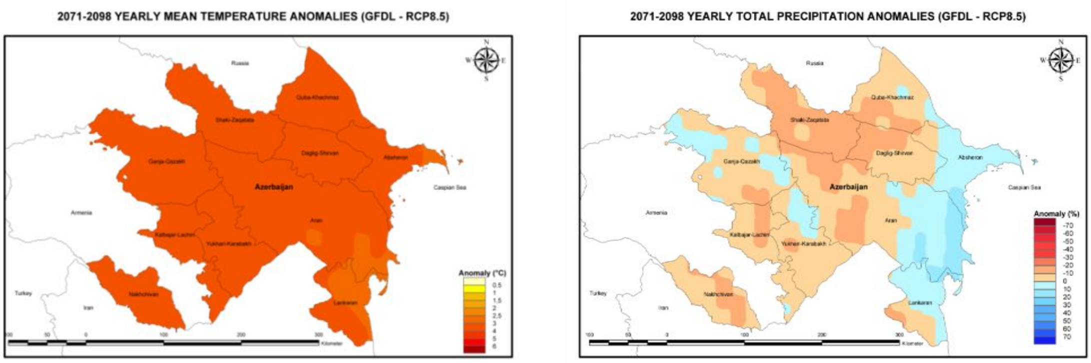


Figure 4-18. The average annual temperature and annual precipitation changes in the country in 2071-2098, according to the GFDL model

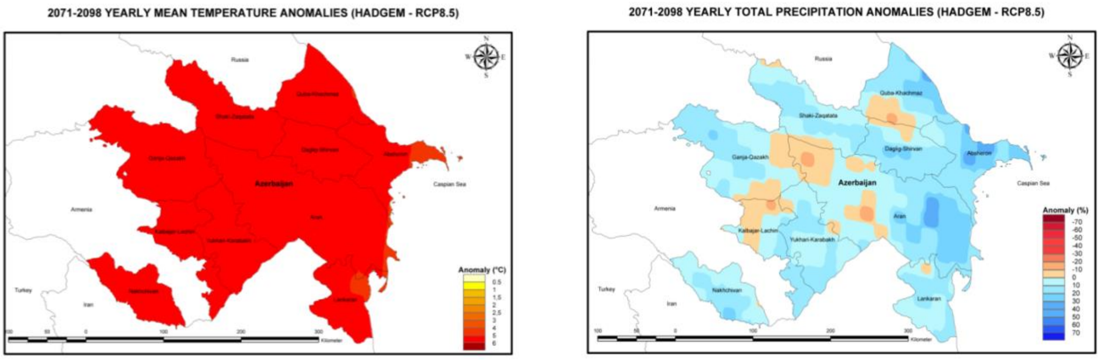


Figure 4-19. According to the HADGEM model, the average annual temperature and annual precipitation changes in the country in 2071-2098

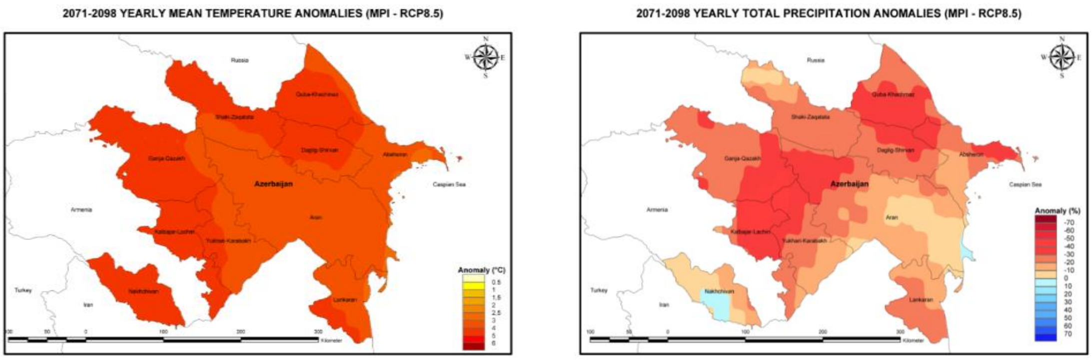


Figure 4-20. Average annual temperature and annual precipitation changes in the country in 2071-2098, according to the MPI model

4.3. Hydrometeorological observation system and development prospects

4.3.1. Hydrometeorological observation system

Article 6 of the Law "On Hydrometeorological Activity" approved by the Decree No. 747 of the President of the Republic of Azerbaijan dated August 19, 1998, defines the responsibilities of the State in the field of hydrometeorological activity as follows:

to organize observations and studies on hydrometeorology and pollution of the natural environment, preparation of information and submission to the relevant bodies in case of natural disasters, man-made accidents and emergencies caused by artificial influences;

to organize the preparation of operational forecasts on the occurrence, intensification and duration of hazardous hydrometeorological events and to notify the relevant authorities;

to provide relevant government agencies, the population, the media and various sectors of the economy with information on the regime, surveys, actual and forecast information, expected natural hazards and high levels and threats of environmental pollution;

to provide meteorological support to civil and military aviation;

to carry out active influence on atmospheric processes, protection of the state observation network;

to study the radiation balance of the earth's surface, to determine the degree of transparency of the atmosphere, to organize aerological and ozonometric measurements, actinometric and agrometeorological observations to determine the impact of meteorological conditions on the development of agricultural crops;

to ensure collection, analysis, brief and storage of meteorological, agrometeorological and solar radiation data;

to organize the study of the regime of the Caspian Sea (Lake), rivers, lakes, reservoirs, other water bodies, the state of water resources, to provide state bodies, mass media, economic entities, population with information and warnings about hazardous events (floods, mudslides, high waves, etc.);

to organize observations and studies on the physical and chemical composition of the atmosphere, water bodies, soils, the degrees of pollution;

In order to strengthen the legal framework of hydrometeorology in the country and ensure its integration into world hydrometeorology, a number of important laws, decisions and investments was adopted. Among them are the approval of the decision on Azerbaijan's membership in the World Meteorological Organization on September 3, 1993, and the signing of Decree No. 747 on the adoption of the Law "On Hydrometeorological Activities" on August 19, 1998.

In order to improve the structure and management of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan, the National Hydrometeorological Service under the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan was established on the basis of the National Environmental Monitoring Department, the National Hydrometeorology Department, the Hydrometeorological Research Institute, and Metrology and Standardization Center and Environmental Laboratory Center.

Meteorological, hydrological, agrometeorological, actinometric, radar and marine hydrometeorological observations in Azerbaijan are implemented in accordance with the guides recommended by the WTO. The Hydrometeorological Service studies the climatic and hydrometeorological conditions in the country, provides short-term and long-term hydrometeorological forecasts, as well as warnings about the expected hazardous hydrometeorological events.

Azerbaijan is distinguished by its unique history of three centuries for the organization of instrumental observations of the air among the countries of the world. Since 1830, initial instrumental observations have been made on the level of the Caspian Sea in Baku Bay (Bayil).

For the first time in Azerbaijan meteorological observations were launched in Nakhchivan in 1843, in Lankaran in 1847, and aerological observations in 1953, in Shamakhi in 1848, in Shusha in 1849, in Baku in 1847, in Ganja in 1871 and the first agrometeorological observations were launched in 1882.

The flood flow station in Sheki and meteorological observations in Zagatala were launched in 1872, the first meteorological observations in Goytapa in 1879, in Ismayilli in 1881, and in Goygol in 1886. The first hydrological observations on river waters in Salyan were launched at the Kur-Salyan station in 1861, and for meteorological observations in 1890, in Sabirabad, Goychay and Ordubad in 1891, in Kurdamir, Altiagaj and Alat in 1892, in Agstafa and Gadabay in 1893, in Guba in 1894, in Astara and Gazimammad in 1897.

The first meteorological observations in Khankendi and Mashtaga aerological stations were started in 1898. The station operated until 1992. The first meteorological observations were made in Julfa in 1912, in Maraza, Aghdam and Tovuz in 1913, and in Gabala and Tartar in 1915. The first meteorological observations were launched at Mingachevir Lake Station in 1914, in Barda in 1916, and in Jafarkhan in 1908.

Due to the expansion of the observation network in Azerbaijan and the growing need of the national economy for information, the Hydrometeorological Service Office was established in Baku in 1920, and it consisted of 64 stations and 12 stations by 1929.

In 1950, wave measurement stations were installed on the iron foundations installed in the Caspian Sea, and in 1952, for the first time on the basis of them, the offshore Oil Rocks hydrometeorological station was established.

For the first time in the country, observations on air pollution were started in 1969 in Baku and Sumgait, and in 1972 in Ganja and Mingachevir.

Hydrometeorological observation network and climate data in Azerbaijan

Agrometeorological observations

Studies show that one of the sectors most vulnerable to climate change is the agricultural sector. The Agrometeorology Center was established by the order of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan No. 344/Ü dated 04.06.2020. While one agrometeorological station operated in the previous hydrometeorological network, now taking into account the requirements of the Strategic Road Maps and other state programs, the purpose of some hydrometeorological stations was changed and became 10 agrometeorological stations and 7 agrometeorological points.

Stations located in high mountainous areas:

Taking into account the unique relief of Azerbaijan, observations are made in the country's all climate zones. The stations in the highest points are Tufandag 4172 m, Kabash 3500 m, Shahdag 2700 m, Khaltan 2301.1 m, Aghdara (Nakhchivan AR) HMS 2217.7 m, Gyryz 2006.2 m, Saribash HMS 1680 m, Dashkasan HMS 1654.7 m, Kelvaz HMS 1567.2 m, Alibey HMS 1540 m.

Shahdag Hydrometeorological Research Center: In order to ensure the implementation of the 2008 Order of the President of the Republic of Azerbaijan "On measures for complex hydrometeorological and ecological study of the Bazarduzu-Shahdag-Tufandag ecosystem of the Greater Caucasus", the "Complex Hydrometeorological and Ecological Research Center" has been established to study climate and meteorological conditions, examine glaciers, background air pollution, observation of flora and fauna and perform other relevant works. The main base of the center is located at an altitude of 2,700 meters in the area called Shahduzu, surrounded by Bazarduzu in the west, Shahdag in the north and Tufandag ranges in the south. There are 2 residential buildings and 1 administrative building, and all conditions are established for about 25-30 people to live and work here. The center is located 20 km from Khinalig settlement. In addition to administrative and residential buildings, a meteorological platform has been installed at the Center for continuous meteorological observations in the area (Figure 4-21).

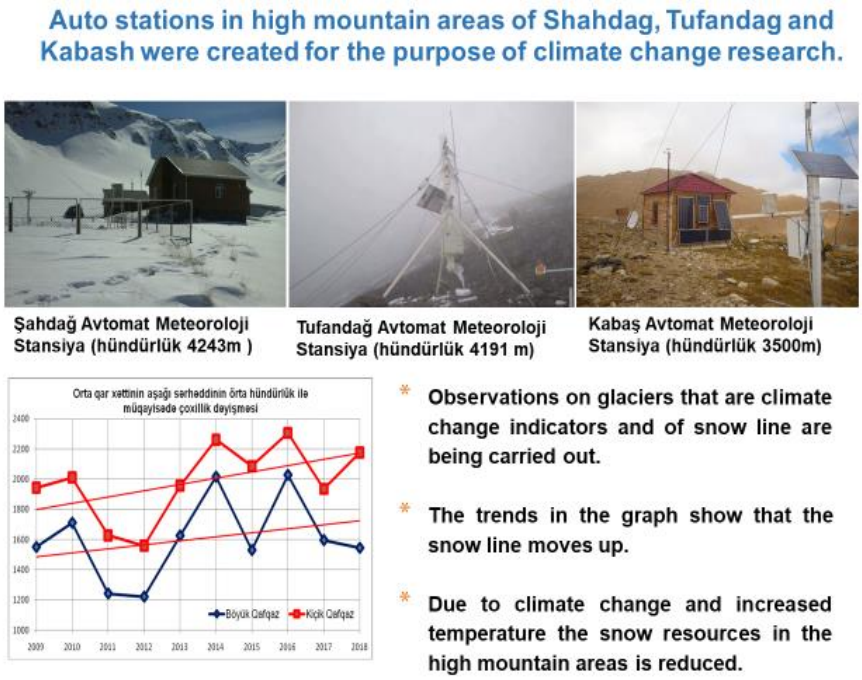


Figure 4-21. Mountainous stations

Stations below sea level:

Astara - 28.0 m, Pirallahi - 25.8 m, Neftchala - 25.2 m, Shirvan - 22.0 m, Salyan - 21.5, Sumgait - 20.5 m, Neft Dashlari - 17.3 m, Alat - 17.1 m, Chilov - 17.0 m, Sabirabad - 16.5 m, Nabran -16.0 m, Jafarkhan - 14.5 m, Gazimammad -6.0 m, Zardab -5.1 m, Aggol -9 m

On the establishment of the Early Warning System in Azerbaijan

Being one of the world's areas facing the most hazardous hydrometeorological events, Azerbaijan is increasingly and more sensitive to the effects of future climate change and climate-related threats. The country has recently witnessed an increase in water stress, floods, and heat waves. The population, farm areas and infrastructure are exposed to the climate-related dangers. Areas such as agriculture, tourism and health are increasingly facing climate risks, and consequently, this process is leading to reduced harvests, increased damage to tourism infrastructure, and increased heat-related health problems. Communities in mountainous and coastal areas are particularly vulnerable to floods and mudslides. Azerbaijan needs accurate, timely and effective weather, climate and human-centered early warning systems to adapt to the effects of climate change and respond to climate-related threats.

However, the coverage of Azerbaijan's current hydrometeorological network is inadequate, and partial automation does not allow for timely hydrometeorological warnings. The radar network is weak and there is no sustainable technical software. The national weather forecasting model, flood forecasting model based on operational impact, and surface water modeling software packages are not available. In addition, Azerbaijan's current weather forecast and production process are insufficient to ensure efficient and timely dissemination of information and adequate risk knowledge, disaster preparedness and responsiveness to protect the lives, infrastructure and assets of population.

To solve this problem, the Government of Azerbaijan treats the modernization of the National Hydrometeorological Service (NHS) of the Ministry of Ecology and Natural Resources as a priority. Azerbaijan submitted a project concept to the Green Climate Fund. The proposed YUIF (GCF) project will support the Government to significantly develop and strengthen climate information services and create a healthy, effective and sustainable multidisciplinary early warning system (EXS). By taking preventive measures at the community and national levels, it will significantly increase the resilience of the most vulnerable people and communities to climate-related hazards, thereby contributing to improved well-being, human health, food and water security. This can be achieved through the following components:

Strengthening climate information services through the establishment of an inter-ministerial and multilateral partner coordination platform for climate services and early warning;

Development of national policy and financial base for effective climate services in Azerbaijan;

Creating climate information system and user interface platforms for Azerbaijan.

Clear communication lines between different agencies, standard procedures, and communication protocols between agencies responsible for the different elements of the early warning system will allow for better decision-making.

Modernization of the National Hydrometeorological Service (NHS) for extended observations, monitoring, modeling and forecasting the climate and its impact on Azerbaijan.

The project is fully in line with national needs and priorities, including the National Development Strategy "Azerbaijan 2020: Vision for the Future", which states that "flood-prone areas will be identified and forecasts will be made which will be used regularly by relevant organizations." The strategy also states that "the development of an early warning system against climate change to reduce the damage caused by hydrometeorological events" is important.

Azerbaijan's Third National Communication to the UNFCCC also stated the need to "develop an early warning system to reduce the damage caused by climate change related hydrometeorological events."

Some work is underway in this area in the country.

Modernization of observation systems. One of the tasks before us is to develop a Hydrometeorology Development Strategy, which includes, first of all, medium and long-term goals to ensure the sustainable development of hydrometeorology in Azerbaijan. The Strategy will cover the period 2025-2030 and should be developed in order to ensure the provision of information in the protection of the population from hydrometeorological emergencies, monitoring of the natural environment, planning and implementation of measures to increase the effectiveness of the activities of air-conditioned sectors of the economy (water management complex, agricultural sector, transport, energy and others).

The strategy should identify the main directions of development of activities in the field of hydrometeorology (meteorology, climatology, agrometeorology, hydrology, environmental monitoring, as well as the provision of information on the environmental state and hazardous natural phenomena).

Timely and accurate information on the actual and projected environmental state is the basis for making decisions to ensure hydrometeorological safety.

Highly scientific activity in the hydrometeorology field requires all kinds of observations and other work carried out by employees of the hydrometeorological service with constant scientific and methodological support.

Operations on observation systems are based on the following principles:

continuity of observations;

unity and comparability of observation methods, collection, processing, storage and dissemination of information;

ensuring the accuracy, accessibility and efficiency in the use of information on the environmental state;

Compliance with public health, environmental protection, ecological and hydrometeorological safety.

Major issues. Against the background of the growing demand of the population and the developing economy for hydrometeorological and other information on the environmental state, inconsistencies are considered to be the problem of the current system due to the discrepancies of the technical, technological and personnel base of hydrometeorological support. This discrepancy increases the imbalance between the demand for the information provided and the opportunities for its formation and presentation.

Priority issues and measures for the development of activities in hydrometeorology. It is necessary to solve the issues of modernization, technical update of all interconnected elements of the system and raise them to the modern level of the global technology. These include obtaining, collecting, analyzing, processing and archiving information on the environmental state, as well as the formation of information products and delivery to consumers. Furthermore, it is important to continue institutional changes aimed at optimizing the structure, improving the scientific-methodological and staffing issues of its activities and the further development of international cooperation in this area. The main requirements for these areas are formed in the World Meteorological Organization and must comply with its recommendations.

Prospects for the development of the observation network. The basis of the system for obtaining information on hydrometeorology and the environmental state is a network of ground observation points.

The development of the observation network can be achieved through a comprehensive solution to the issues of expanding various types of observations. In this case, observations on hydrological, meteorological, radiological and aerological, as well as on atmospheric composition and environmental pollution, which are more important in terms of observations, will be significantly developed.

In order to ensure the modernization and development of the observation network, it is necessary to address the following:

Optimization of the composition of observation network points;

Restoration of hydrometeorological network and environmental monitoring in the liberated territories of Azerbaijan (taking into account WMO recommendations);

Equipping the network with modern automated means of observation, devices, analytical and auxiliary equipment;

Providing a reliable communication system;

Gradually reduce dependence on the State Budget by attracting additional revenues to the extra-budgetary fund by improving the quality of services to consumers;

Creating conditions for the involvement of highly qualified specialists.

The development of the observation network should be linked to the country's socio-economic development programs and strategic roadmaps.

Ground meteorological observation system. In world practice, one of the main characteristics of ground meteorological observation systems is the dense location of meteorological observation points. Given the complex terrain of the country, the difference in altitudes, it is necessary to apply a differential approach to the density of the observation network to solve problems related to the development of ground meteorological observation systems. To do this, it is necessary to optimize the existing points to the minimum number required in accordance with the recommendations of World Meteorological Organization (WMO).

In this case, it is important to take into account the scientific and methodological justification and economic factors that determine the geography of meteorological observation points. It should also be considered important to ensure the continuity of observation rows at stations with an age-old history.

It is necessary to ensure a complete technical modernization of surface meteorological observation systems through automated meteorological complexes, modern means of communication and data processing at meteorological stations.

Through the popularization of the hydrometeorology, creating a network of volunteers with involvement of schoolchildren, students, farmers, etc. may be of interest.

Hydrological observation systems. Against the background of climate change in the country, water resources are declining. For this reason, there is a need to expand the hydrological observation network in order to keep accurate records of water resources and organize their efficient use. For this reason, 7 new hydrological stations were established in 2020.

The required number of hydrological observation points in different regions is determined in accordance with WMO recommendations. During the development of hydrological observation systems, the following is envisaged:

restoration and automation of the hydrological network in the liberated territories;

equipping most hydrological observation points with modern technical means, including automated devices for measuring water consumption and level;

opening of multifunctional hydrological stations in small rivers, which include hydrological and hydro-physical observations;

proper forecasting of hydrological events;

ensuring participation in the complex inventory of water bodies.

Automation of hydrological observations. The breadth of the river network, especially the hydrological observation network, the number of points and the importance of observations, as well as the role of hydrological observations in the development of agriculture, especially irrigation have made the automation of the hydrological observation network issue especially relevant. Although some modern mobile devices are used in the hydrological monitoring network, there is a great need to automate the monitoring network.

Modernization of the hydrological network will result in enrichment of the database and in better quality of hydrological forecasts. It will also allow more accurate calculation of water resources, water consumption of large rivers of Azerbaijan Republic and more accurate results in the calculation of water balance of reservoirs.

At present, measurements are conducted at 63 hydrological points in the country, including in water bodies - rivers, lakes and reservoirs.

25 of these stations will operate as automatic hydrological stations. Of them, 17 new automatic hydrological stations were constructed with state investment, and 8 hydrological stations within the framework of the EU's Water Initiative Plus Project. This will contribute to the accurate assessment of water resources, forecasting of hazardous hydrological events and the establishment of early warning systems.

Along with the level, speed and temperature of water, air temperature, rainfall and evaporation will be monitored at the new automatic hydrological stations that will be constructed.

Daily data from the points will be important in terms of estimating the inflow of water into reservoirs on large and small mountain rivers and forecasting the expected flow of those rivers.

The information to be received from transboundary rivers will play an important role for proper accounting of the country's water resources. The data from the station, which will be installed on glacier-fed river streams and other mountain rivers will be used in water management, design, climate and climate change assessment, as well as in assessment of anthropogenic impacts on water of rivers, and daily data by being included the database, will guarantee better hydrometeorological services to organizations.

Meteorological radiolocational observation systems. There are early warning systems for timely detection, identification of and protection from hazardous weather conditions. It is planned to continue the installation of new meteorological radar systems. Comparing the data obtained from them with the data of the ground observation network will have a significant impact on improving the quality of short-term forecasts of hazardous natural phenomena.

The task set is to create a single meteorological radar network that can cover the entire territory of the country. Its creation will ensure the safe operation of weather-dependent sectors of the economy (urban works, agriculture, transport, especially air transport, etc.) by improving the quality and timeliness of hazard prediction. It is planned to increase the number of radar systems to 5.

New Doppler radars. Azerbaijan procured two sets of Doppler radar systems in 2019 and installed in Shamakhi and Goygol in order to detect real-time hydrometeorological processes in the atmosphere and related atmospheric phenomena such as strong hurricanes, showers, hail, floods and landslides within the framework of state investment projects. The installation of radar observation systems in the country, which is a step of the early warning system, has been identified as a priority (Figure 5-22). The expert assessment shows that it would be advisable to purchase at least 3 more Doppler radars to ensure the country's hydrometeorological security.

Figure 4-22. Modern Doppler radars installed in Goygol and Shamakhi districts

Aerological observation systems. The first aerological observations were made in Baku in 1926. One of the most important issues related to the development of aerological observation systems is the atmospheric sounding twice a day. Consequently, based on the information obtained for the forecasting of hazardous weather events, the safety of flights, the needs of the country's defense sector, as well as environmental monitoring will be ensured. The number of remote sensing points can be 1-2.

Environmental pollution monitoring system. Since 1938, systematic observations have been made on the chemical composition of surface waters, on their pollution since 1966, and on the radioactivity of the environment since 1965 in the country. In 1969, for the first time in Baku and Sumgait, and in 1972 in Ganja and Mingachevir, observations on air pollution and in 1980 on rainwater were launched.

The development of the environmental pollution monitoring system envisages the solution of targeted issues related to air pollution, surface water, soil quality, and monitoring of specially protected natural areas.

Activities in the area of protection of the environment from radioactive pollution are implemented by the laws of the Republic of Azerbaijan "On Ecological Safety", "On Radiation Safety", "On Environmental Protection" and the "Rules for Monitoring the Environment and Natural Resources" developed for the implementation of these laws (Approved by Resolution of the Cabinet of Ministers No. 90 of July 1, 2004).

Fully automated online early radiological warning monitoring monitoring systems on radiation background have been installed in Agstafa, Sadarak (Nakhchivan AR), Beylagan, Astara, Guba districts and Pirallahi Island which border with countries using nuclear technologies within the framework of the project "Development of infrastructure in the field of radioactivity monitoring in the Republic of Azerbaijan" with the participation of the UN International Atomic Energy Agency (IAEA) with participation of the Ministry of Ecology and Natural Resources. The obtained monitoring data is transmitted every half hour to the Environmental Monitoring Center of the National Hydrometeorological Service under the Ministry of Ecology and Natural Resources as well as to the Crisis Management Center of the Ministry of Emergency Situations.

4.3.2. The place of the observation system in future modernization plans

It is important to establish an Early Warning System in order to ensure the hydrometeorological security of the country and to provide accurate information to the population and areas of the economy that depend on weather conditions. At present, 67 automatic weather stations have been installed in the regions of the Republic. 34 of them are modern VAISALA MAWS-310 automatic meteorological stations. 17 are VAISALA MAWS-301 automatic meteorological stations, 16 are VAISALA WXT-520 automatic transmitters.

However, the configurations of MAWS-301 automatic meteorological stations have to be changed and fully automatic operation must be ensured. To do this, some sensors, modems, including loggers must be replaced with new ones, WXT-520 transmitters must be replaced with modern automatic weather stations. There should be enough spare parts and spare sensors for automatic weather observation stations.

The role of a modern system in adapting to the effects of climate change while minimizing potential losses is unique. Therefore, full automation of the hydrometeorological network, expansion of agrometeorological observations to meet the needs of the agricultural sector, adaptation of databases to modern requirements, application of local weather forecasting models with local characteristics to increase the accuracy of forecasts, restoration of aerological observations are considered priorities.

The database. In October 2016, the French COROBOR installed the COROBOR system, consisting of MESSIR-COMM and MESSIR-CLIM (MESSIR-NET) software, 4 servers, and a Synology NAS network memory device for the automatic exchange, analysis, archiving of meteorological data and the transfer of the necessary information to the international broadcast (RMDCN - Regional Meteorological Data Communication Network) in accordance with the WMO requirements.

Currently, data from VAISALA MAWS-310 automatic meteorological stations are automatically transmitted to the FTP server of the COROBOR system, and the data is automatically archived on the Synology NAS server.

Data from VAISALA MAWS-301 and VAISALA WXT-520 stations are transmitted by the observer via GSM modem or e-mail, and this information is archived by the Center’s specialists via MESSIRCOMM software. The data transmitted to the servers is archived on a Synology NAS network device. There is a need to improve the process of fully automatic data transmission from all automatic meteorological stations, as well as automatic archiving of data on servers.

Hydrometeorological observation posts in the occupied and liberated areas. 10 hydro-meteorological and 3 radio-meteorological stations, 16 hydrological and 2 agrometeorological, 1 meteorological, 16 points of active influence on atmospheric processes were located in the territories then occupied by Armenia functioned until the 1990s (Figure 4-23). As a result of the occupation, the activity of these points stopped and the devices, installations and equipment were completely destroyed.

The restoration of hydrometeorological observations in the liberated territories is of great importance in the study of the hydrometeorological conditions in the Republic, especially in meteorological forecasts and assessment of water resources. The forced suspension of hydrometeorological observations in these areas has created serious problems not only in Azerbaijan, but also at the regional level in the study of hydrometeorological conditions, hydro and meteorological forecasting.

The above-mentioned 16 hydrological points made observations on the hydrological regime of the following rivers and reservoirs located in areas which were occupied as a result of the Armenian aggression against Azerbaijan.

- The part of the Araz River in the occupied territories and 2 reservoirs and water junctions were located there
- Tartarchay and 2 reservoirs on it
- Khachinchay and 1 reservoir on it
- Gargarchay and 1 reservoir on it

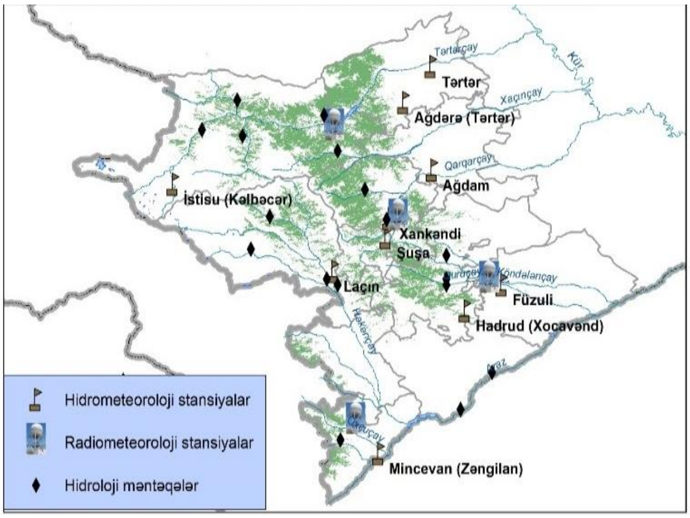


Figure 4-23. Hydrometeorological stations and points destroyed during the occupation of territories

- Kondalanchay and 3 reservoirs on it;
- Guruchay;
- Hakarichay;
- Zabuxchay;
- Bargushad (transit river flowing from Armenia);
- Oxcuchay (transit river flowing from Armenia);
- Khachinchay (transit river flowing from Armenia).

After liberation of these territories the hydrometeorological observations and monitoring works on the environmental state are being restored.

4.4. Assessment of sensitivity of agriculture to climate changes and adaptation measures

4.4.1. Information on lands under crop and irrigated lands

Azerbaijan’s geographical position allows the cultivation of a number of agricultural crops. 4.77 million hectares of the total area of the Republic (8.66 million hectares) are suitable for agriculture, of which 1.89 million hectares are agricultural lands. The country’s water resources are very limited. Surface water reserves are 32.2 billion m^3, which in drought years decrease to 23.2 billion m^3. Only 10 billion m^3 of water resources, or 30%, are formed in the territory of the Republic, and the remaining 70% in the territory of neighboring countries. Consequently, the Republic of Azerbaijan possesses 14% of the water resources of the South Caucasus.

There is an opportunity to accumulate 21.5 billion m^3 of water in the existing artificial reservoirs in the country. Most of them are used for hydropower and irrigation purposes. In general, 11-12 billion m^3 of water is used annually in the country, of which 67% is used to meet the needs of agriculture, 20-25% of industry and the rest for household and drinking water. Of the 3,200,000 hectares that can be irrigated in the country, 1,405,000 hectares are irrigated. These lands are equipped with permanent irrigation and collector-drainage networks.

Agriculture plays an important role in Azerbaijan's economy and 48% of the population lives in rural areas. 38% of the Country’s population is employed in Agriculture. Despite the country’s comparative advantage in the production of traditional agricultural products, as well as in the field of high-value commodities for its favorable soil and climatic conditions, the agricultural sector provides less than 6 percent of GDP. Given the severe degradation of lands, Azerbaijan suffers from low productivity of the agro-pastoral production system, and limited natural resources are deteriorating. In order to rehabilitate degraded lands, the agricultural sector must be modernized both for sustainable management of the country's natural resources and for increasing productivity. It should be noted that due to the difficult physical and geographical conditions and anthropogenic impact, 43.3% of the Country's lands have been eroded to certain degree.

Especially in the Kur-Araz lowland, where irrigated agriculture is widespread, soils are saline. The area of saline soils there is more than 600,000 hectares, and although a large part of this area is provided with a collector-drainage system, these systems have been out of order due to neglect for a long time. Although washing is required to desalinate these soils, additional freshwater resources are required to carry out this process. In irrigated lands, mainly plants with high water demand are grown, and agricultural crops are irrigated twice instead of the required 6-7 irrigations due to lack of water. On the other hand, in some cases, improper land reclamation measures affect the rise of groundwater levels. As a result, crop yields are declining.

The existence of different soil and climatic conditions in the country requires different approaches to solving agricultural problems. In particular, the uneven distribution and shortage of irrigation water in the country complicates this process. Until 1990, Azerbaijan was one of the main producers of cotton, grapes, tobacco, wine, fruit and canned goods. Due to the transition to a market economy, the structure of arable lands has changed. At present, cereals cover an area of 1.5 million hectares, and their productivity is 2.8 million tons. Cotton fields have been expanded over the past four years due to market demand.

Along with soil erosion and salinization, desertification is also observed in our country. Such lands are in the Absheron Peninsula, Kur-Araz lowland and Nakhchivan AR.

One of the most important areas of agriculture in Azerbaijan is crop production. Cereals and legumes dominate in providing the population with food products. In changing climatic conditions, it is required to create and select varieties of these plants that are resistant to drought, high temperature and salt which are peculiar with specific ecological region. The successful solution of this problem depends on the creation of more sustainable cereals and legumes varieties adapted to adverse environmental factors.

The total area of the Republic of Azerbaijan is 8655481 ha, of which 1445834 ha are irrigated lands. Of these lands, 1891280 ha are arable lands. Perennial plantations are 179,312 ha, of which 102,245 ha are orchards, 54,265 ha are vineyards, 11,751 ha are mulberry orchards, 7,473 ha are tea plantations, 3,578 ha are other subtropical orchards. The fallow lands are 39,786 ha. Hayfields are 108,813 ha, and pastures are 2,327,410 ha. In general, the soils suitable for agriculture, including smallholdings and other lands in circulation, are 4777473 ha.

1084,570 hectares or 77% of irrigated lands are saline soils. 155943 hectares of soils in these areas are weakly saline, 55796 hectares are moderately saline, 26218 hectares are severely saline and 11089 hectares are extremely saline. More saline soils are found in southeastern Shirvan, where saline soils cover a large area.

594,801 hectares of irrigated agricultural lands are drained soils. Of this, 312,201 hectares are open, 269,400 hectares are closed and 13,200 hectares are vertical drainage. However, insufficient attention paid to the operation and irrigation of these systems in the long run and for other reasons have led to their gradual out of order and demolition, deterioration of land reclamation and ecological condition, rising groundwater levels, and the gradual salinization of some irrigated lands and their withdrawal from crop rotation.

During the construction of land reclamation and irrigation facilities, in some cases, the engineering-geological and hydro-geological reclamation conditions of the areas were not properly assessed, and their negative effects on the environment have begun to manifest themselves in recent years. Thus, the ground water levels rose to the surface and flooded some areas in the farms located in the central and eastern part of the Tartar District, in the farms and settlements located in the west of the Barda District, in Shamkir, Gazakh and Aghstafa districts, in Alazan-Ayrichay valley, in Tuntul Village, Gabala, as well as in a part of irrigated farms of Sharur district of Nakhchivan AR.

Observations in recent years show that in the irrigated areas of the Kura-Araz plain, which is the main agricultural region of the Republic, despite being covered with horizontal collector-drainage networks and although their project depths vary between 2.5-3.5, the groundwater level does not fall below 1.0-1.5 m in 75-80% of the area and during the growing season of plants settles at a level of 0-1.0 m. This leads to re-salinization of irrigated lands. Groundwater levels are high mainly during irrigation period. The main reason for the rise of groundwater as a result of irrigation is the loss of water from canals and fields, which leaches into the lower layers of the soil and increases its level and volume. In saline areas, groundwater usually retains a lot of salt, so salinization increases very quickly.

The main part of lands suitable for agricultural use is located in lowland areas. These zones are characterized by their warm climate and low level of atmospheric precipitation (200-300 mm per year). The area evaporates 800-1000 mm per year. Irrigation and land reclamation measures are required in these areas to harvest high and stable yields.

In 1970-1990, a large complex water management system consisting of irrigation systems that distribute and regulate the flow of water, collector-drainage networks, pumping stations and reservoirs was created in the Republic. In those years, new irrigation systems were constructed or re-installed on 875,000 hectares of irrigated land. As a result of these measures, the length of irrigation canals has reached 73,000 km.

However, due to the lack of proper attention to their operation, these systems gradually collapsed and fell out of order. This has led to certain problems in the water supply of agricultural crops.

A long-term soil-erosion studies have shown that 43.3% of the territory of the Republic of Azerbaijan (3743.5 thousand ha) has been eroded to certain degree. In the mountains and foothills, more than 300,000 hectares of arable land have been severely eroded, rendering them unusable for crop production.

In order to protect and effectively use lands for the production of agricultural products in the Country, soil fertility, topography, climate, etc. factors must be taken into account.

The scale of soil erosion is very wide. As a result of the erosion process in various countries of the world, 430 million hectares of land have become unusable. As a result of the erosion process in Azerbaijan, an average of 750 million tons of soil is washed away every year, losing 1.8 million tons of humus, 1125,000 tons of nitrogen, 68.5 thousand tons of phosphorus, 1350,000 tons of potassium.

The global economic analysis shows that investments in agricultural and land reclamation studies should be considered as a key strategic factor in the development and growth of agriculture, poverty reduction, as well as strengthening the competitiveness of agricultural producers.

At present, one of the main priorities of the agricultural science in Azerbaijan Republic is the development of scientific bases for soil protection.

In this regard, it is significant to develop and implement measures to combat soil, water, wind and irrigation erosion by using advanced experience and the latest achievements of science and conducting new research in order to increase agricultural culture, increase soil fertility.

4.4.2. Areas sensitive to climate change

It is impossible to get high yields from agricultural crops in Azerbaijan without irrigation. That is why the main part of agricultural production in Azerbaijan falls on irrigated lands. The total area of these lands is

1.4 million hectares, which have been degraded to varying degrees due to both natural and anthropogenic impacts. At the same time, in the current situation of water shortage, agricultural crops do not receive the required water norm. Irrigated lands are located in the Kur-Araz lowland which are considered to be the most sensitive areas to climate change. Cultivation of agricultural crops in these areas should be approached taking into account various factors. Sufficient reserves of mineral groundwater have been accumulated in this area, which can be used for irrigation of agricultural crops by taking various utilization measures. The Kur-Araz, Lankaran, Samur-Davachi lowlands, the Araz plains of Nakhchivan, as well as winter pastures, which serve as the fodder base for livestock, are particularly vulnerable to climate change.

The main agricultural regions for the cultivation of agricultural crops in Azerbaijan in the context of climate change are the mountainous agricultural regions of the Republic. One of the important issues is the establishment of agriculture on a scientific basis, especially in the foothills and areas of medium-altitude mountains. In these areas, soil conservation farming methods should be applied, as well as the discovery of alternative water sources, especially the creation of artificial reservoirs to collect atmospheric precipitation for irrigation, as well as the cultivation of long-growing, heat-loving, drought-resistant crops in climate change conditions, the creation and zoning of new varieties are required. It is also required to implement agro-technical, agro-chemical, forest reclamation and hydro-technical measures to protect soils from erosion and increase their fertility, and most importantly, and most importantly, to address organizational issues of farming.

Due to agricultural specialization in Azerbaijan, soils are mainly divided into irrigated agricultural regions (Kur-Araz, Lankaran, Samur-Davachi lowlands, plains of Nakhchivan along Araz River); dry-farming lands located in the foothills and areas of medium-altitude mountains; pasture and livestock regions. Cotton, fruit growing, viticulture, vegetable growing and tobacco growing are the most specialized fields in agriculture in Azerbaijan.

Cotton growing. Although cotton is a profitable and strategic crop in Azerbaijan's economy, the area under this crop has sharply decreased recently. In 2014, the country produced about 40,970 tons of cotton from 22,918 hectares, and in 2015, cotton was planted in 18,684 hectares and about 35,192 tons of cotton was produced, and in 2016, cotton was planted on 51,369 hectares, and the raw cotton produced amounted to 89,442 tons. In 2017, the sown area was 136,413 hectares, the production was 207,525 tons, but later there was a decrease in productivity in this trend. Thus, the 17.9 dt/ha trend of productivity per hectare in 2014, 18.8 dt/ha in 2015, 17.3 dt/ha in 2016 and the decline to 15.3 dt/ha in 2017 shows the importance of addressing the above issues.

However, due to the fact that the cotton plant is resistant to salinization, is grown in hot climates and is a heat-loving plant, as well as a strategic product, there is a need to expand its planting area and to take timely and proper reclamation measures.

According to the CFDL and MPI models of the RCP4.5 climate scenario, an increase of 1-2^{o}C is expected in 2041-2070 compared to the base period (1971-2000). According to the HADGEM model, the temperature rise is expected to be 2-3^{o}C. Consequently, during the growing season, the duration of days with air temperatures above 10^{o}C is expected to increase significantly, heat reserves are expected to increase to 400-450^{o}C according to CFDL and MPI models, and 600-700^{o}C according to HADGEM model. This creates favorable conditions for the cultivation of higher quality long-staple varieties. However, the lack of moisture may increase, which will create a greater need for optimal irrigation of plants.

Grain growing. Grain growing is dominant in Azerbaijan's agriculture. This is the oldest plant-growing field in Azerbaijan. Dry-farming in the mountainous and foothill regions of the Republic, and irrigated grain growing and, in the lowlands, have developed. At present, 60% of arable land in the country is sown with cereals, and it is planned to further expand these areas. The goal is to meet the country's demand for grain through domestic options. In 2016, the area sown with autumn and spring wheat in the Republic was 590,645 ha, productivity was 31.3 dt/ha, in 2017 it was 596,126 ha, and productivity was 30.5 dt/ha. In general, although this sector is widely developed thanks to government subsidies and comprehensive support for this sector, there are challenges to meet the domestic demand due to low productivity.

As a result of global warming in 2041-2070, the actual vegetation period of winter wheat is expected to be shortened, which will lead to a faster grain harvesting. Consequently, it will be possible to get 2-3 crops a year by re-sowing (fodder, orchard crops, vegetables) in those areas.

In 2041-2070, against the background of rising temperatures, decrease precipitation in most areas may lead to drought, which may result in lower productivity. A number of measures are required to increase productivity. These include the application of new technologies in cultivation (no-till technology), the use of modern methods of irrigation and, most importantly, the creation of heat-loving varieties with a long growing season, more resistant to adverse environmental factors (drought, salinity). Amid the climate change, one of the most important issues is the optimization of the optimal sowing time and periods of this plant.

Viticulture. Viticulture has been one of the priority areas in Azerbaijan, it has had a large industrial character since ancient times with a special weight among the agricultural sectors. That is why the State Program on the Development of Viticulture was adopted, which reflects the measures to be undertaken to develop the sector. Recently, vineyards have been planted in large areas in Khanlar, Samukh, Tovuz, Gabala, Yevlakh and other districts.

According to the CFDL and MPI models, the boundaries of industrially important vineyards may increase by 200-400 m towards the mountains in 2041-2070, depending on the region, compared to the base period due to favorable temperature conditions. According to the HADGEM model, the expected temperature increase may make it possible to further expand the area of viticulture towards the mountains, but at certain heights there is a factor of limitation of lands suitable for viticulture. Warming of the climate can also have a positive effect on the quality of grape juice. Rainfall is expected to decrease in summer, which increases the need for additional irrigation of vineyards.

4.4.3. Assessment of impact on agricultural sectors and adaptation measures

The solution to Azerbaijan's agricultural problems and the way to achieve the sector's goals is to ensure the sustainable development of agriculture, which both increases productivity and prevents land degradation. The establishment of research and technology is very important in ensuring the sustainable development of agriculture. Azerbaijan is a unique country with nine different climatic zones and promises unique opportunities both to develop its great potential and to serve as an innovation platform for testing and evaluating the best intervention options.

Successful application of research innovations and best practices in selected locations increases productivity and the incomes of farmers in Azerbaijan.

The fact that the resource-saving farming method is especially beneficial for farmers, the application of the innovative irrigation method allows saving 30-35% of irrigation water and a significant amount of irrigation time. Rational use of water is of great importance in Azerbaijan as well as in dry farming systems.

Improved plant varieties increase the incomes of small farmers and contribute to food security. These varieties are highly productive and have valuable properties such as resistance to salt, frost and drought, and the created varieties are resistant to rust disease.

Adaptation measures. It is important to take the following adaptation measures to mitigate and reduce the negative effects of expected climate change:

- cultivation of long-growing, heat-loving, drought-resistant agricultural crops in the conditions of climate change in Azerbaijan, creation and zoning of new varieties in this regard;

- application of advanced irrigation methods in case of water shortage, use of alternative water sources;
- taking into account the widespread water and wind erosion in the country, the establishment of field-protective forest strips around the soils, registration of eroded and saline soils, mapping, etc.
- creation of artificial water basins to capture atmospheric precipitation and use them for irrigation;
- improving irrigation and drainage systems to combat salinization on farms;
- establishment of small processing enterprises for perishable products in rural areas;
- continue the works on improvement of storage systems for agricultural products (warehouses, refrigerators, etc.) and create new ones.

4.5. Assessment of water resources sensitivity to climate change and adaptation measures

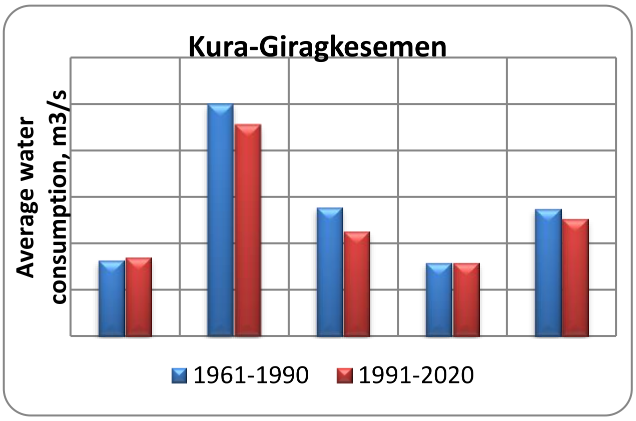
Domestic water resources in Azerbaijan are relatively small compared to the countries of the region and make up 15% of the water resources of the South Caucasus. Due to climate change, our water resources have declined in recent decades, and according to climate models, they are likely to decline in the future. Demand for water is growing due to population growth, the development of various sectors of the economy and the expansion of irrigated agriculture.

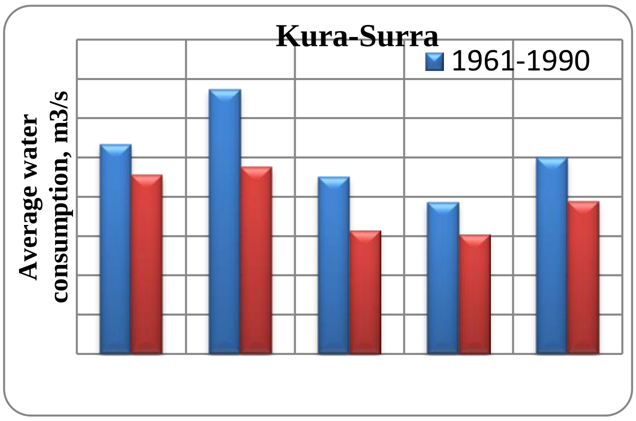
The country's surface water resources are rivers, lakes, reservoirs and glaciers. Surface water resources are mainly concentrated in rivers. 67-70% of river water resources are formed in the territory of neighboring countries, and the rest (local flow) is formed in the internal rivers of Azerbaijan. The total natural resources of river water are 28.5-30.5 billion m^3, of which 19.0-20.5 billion m^3 is formed in the transboundary rivers entering the country from the territories of neighboring countries, and the flow of local rivers is 9.5-10.0 billion m^3.

During drought years, natural water resources decrease to 22.6-27.0 billion m^3. Accordingly, 17.1-14.3 billion m^3 of these waters belong to transboundary rivers.

As 25% of transboundary waters are taken by these countries for various purposes, only 13.5-14.0 billion m^3 of water enters the territory of Azerbaijan. Therefore, the existing water resources in the Country are 23.0-24.0 billion m^3.

Over the last 30 years, the water level in different parts of the Kura, Araz and Ganikh rivers, which are the main transit rivers, has changed. The change in water content in 1991-2020 compared to 1961-1990 is given below (Figure 4-24). As can be seen, the annual decline during this period is between 4% and 24% compared to the climatic normal.





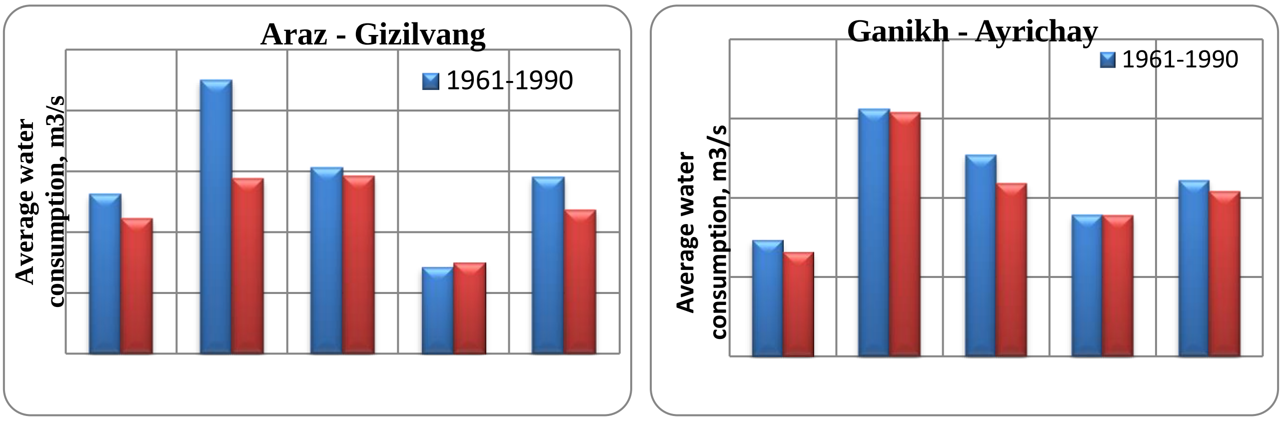


Figure 4-24. Comparative change of water content in Kura, Araz and Ganikh rivers in 1991-2020 compared to 1961-1990 (MHS)

Floods. The territory of the Republic of Azerbaijan is one of the most flood-prone areas in the world. The formation of floods in the Greater and Lesser Caucasus mountain systems, which cover about half of the country's territory, is more intensive. Most floods occur on the southern slopes of the Greater Caucasus and in the highlands of the Nakhchivan Autonomous Republic. The following flood zones can be distinguished in these mountain systems:

- The southern slope of the Greater Caucasus;
- North-eastern slope of the Greater Caucasus;
- North-eastern slope of the Lesser Caucasus (Shahdag and Murovdag ranges);
- South-western slope of the Lesser Caucasus;
- Territorial rivers of Nakhchivan.

Based on the data of the National Hydrometeorological Service of the Ministry of Ecology and Natural Resources and the Institute of Geography named after academician H.Aliyev under the Azerbaijan National Academy of Sciences, a flood map of Azerbaijan was prepared (Figure 4-25).

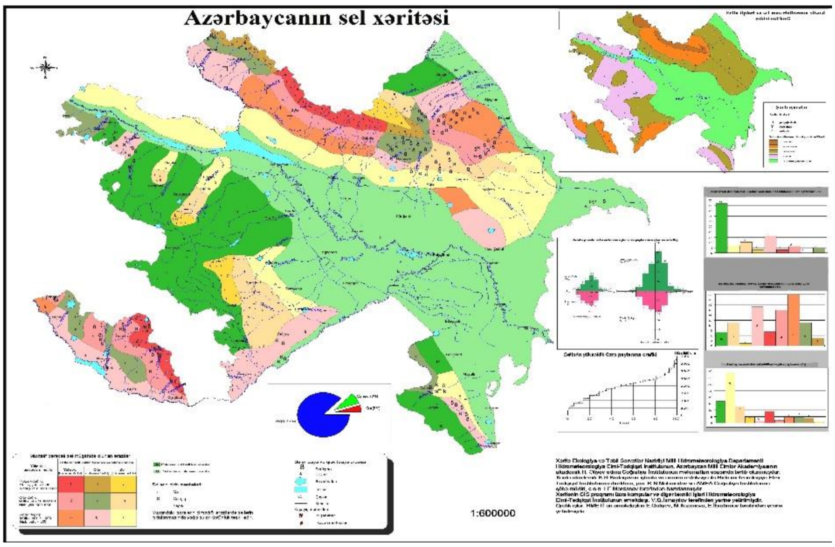


Figure 4-25. Flood map of Azerbaijan

Most floods occur in the high mountainous areas of Sheki-Zagatala and Nakhchivan. 85-87% of floods in the country are formed from rainwater. The trend of floods in the country's rivers in 1966-2020 was as follows (Figure 4-26).

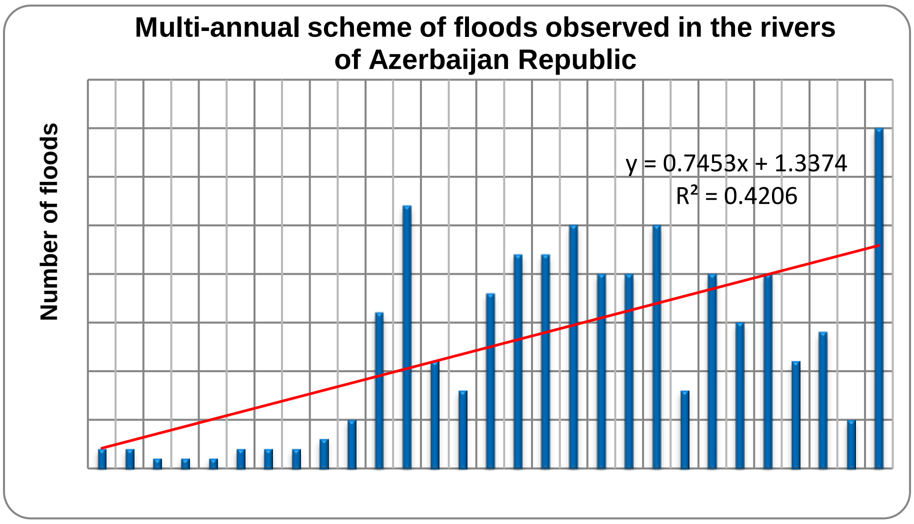


Figure 4-26. 3 Flood Trends observed in 1996-2020 (NHS)

During the high-water level period, floods are observed in the Kura River, the southern slope of the Greater Caucasus and in the rivers of the Lankaran-Astara region.

Given that, according to climate change models, any increase in water resources is not expected, and that large rivers need regulated reservoirs, there will be no difficulty in maximizing water flows discharge.

In the future, the construction of planned reservoirs on small rivers could help reduce flooding and act as an active tool in the fight against natural disasters.

The assessment works have shown that during 1991-2020, compared to 1961-1990, water consumption in most of the country's internal rivers decrease due to rising temperatures and decreased precipitation in the country. The decline occurs mainly during the summer (Figure 4-27).

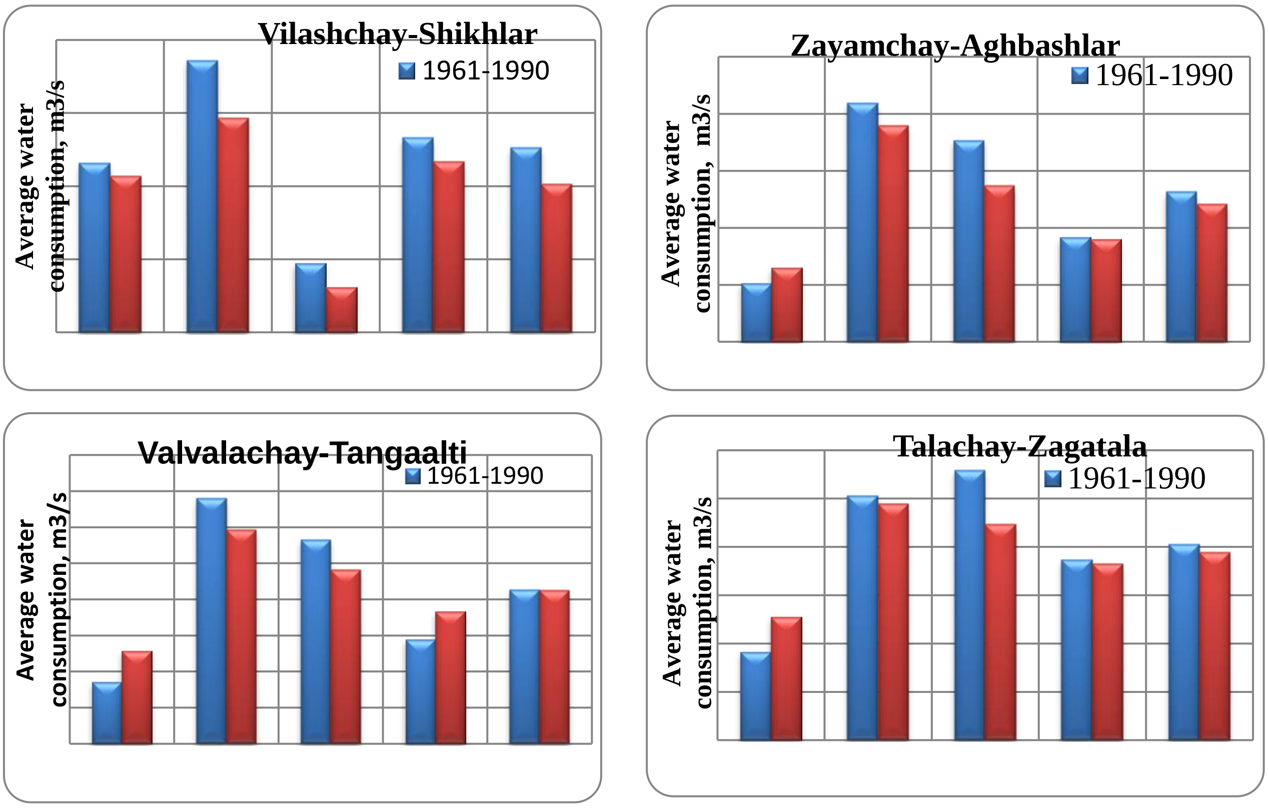


Figure 4-27. Comparative change of water level in the domestic rivers of Azerbaijan Republic in 1991-2020 compared to 1961-1990 (MHS)

A trend of changing water levels in various parts of domestic rivers over the past 30 years is given. A comparative water level changes for 1991-2020 and 1961-1990 is given. As can be seen, the annual decline during this period is 9% to 27% compared to the climatic normal.

Summary integral curves have been developed to identify any changes or trends in the course of multi-year fluctuations in water resources, especially to determine the period in which economic activity and other anthropogenic factors intensively affect the water flow. Using these curves, whether these changes are related to human activities and climate change were studied.

In order to assess the impact of meteorological elements on the flow, the previously defined regularities between water resources and meteorological elements were checked again, adding the data of the last 6 years.

It should be further noted that in order to quantify the impact of climate change on water resources, especially in strongly anthropogenically affected rivers such as the Kura, Araz and Ganikh, it is necessary to analyze data on climatic factors in relation to water use data.

Sensitivity of water resources to climate change. The above studies show that the water resources of the country's main rivers are declining. Especially in river basins, there is a decrease in winter precipitation and snow water resources, as well as spring precipitation. This has led to a reduction in both surface and ground waters. According to the analysis of data observed in the period after the first and second and third National Communications, the downward trend in water resources in most rivers of the country continued.

In these data, the relationship between the flow and the meteorological elements was obtained and was evaluated based on the obtained relationship equations and the Model scenario.

Even if the temperature rises 2^0C and the precipitation does not change and the temperature rises 4^0C and the precipitation decreases by 10%, the water resources will change as follows.

According to GFDL, HADGEM and MPI models, if the air temperature rises 2^0C and precipitation does not change: water resources in the Lesser Caucasus rivers are expected to decrease by 10% in 2020-2040, 15% in 2041-2070, and 20% in 2071-2098.

Water resources in the Greater Caucasus rivers are expected to decrease by 5% in 2020-2040, 10% in 2041-2070, and 15% in 2071-2098.

Water resources in the rivers of the Lankaran-Astara region are expected to decrease by 5% in 2020-2040, 10% in 2041-2070, and 15% in 2071-2098.

Water resources in the Kura River are expected to decrease by 10% in 2020-2040, 15% in 2041-2070, 20% in 2071-2098; in Araz River: by 10% in 2020-2040, by 15% in 2041-2070, by 20% in 2071-2098, in Ganikh river: by 10% in 2020-2040, by 15% in 2041-2070, and by 20% in 2071-2098.

Water resources in the country is expected to decrease by 5-10% in 2020-2040, 10-15% in 2041-2070, and 15-20% in 2071-2098.

According to GFDL, HADGEM and MPI models, if the air temperature rises by 4^0C and precipitation decreases by 10%:

Water resources in the Lesser Caucasus rivers are expected to decrease by 15% in 2020-2040, 25% in 2041-2070, and 35% in 2071-2098.

Water resources in the Greater Caucasus rivers are expected to decrease by 10% in 2020-2040, 20% in 2041-2070, and 30% in 2071-2098.

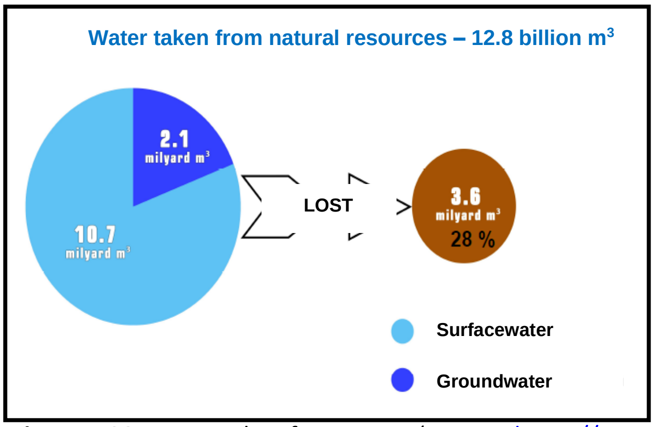
Water resources in the rivers of the Lankaran-Astara region are expected to decrease by 10% in 2020-2040, 20% in 2041-2070, and 30% in 2071-2098.

Water resources in the Kura River are expected to decrease by 15% in 2020-2040, by 25% in 2041-2070, by 35% in 2071-2098; in the Araz River: by 15% in 2020-2040, by 25% in 2041-2070, by 35% in 2071-2098; in Ganikh River: by 15% in 2020-2040, by 25% in 2041-2070 and by 35% in 2071-2098.

Water resources in the country:

It is expected to decrease by 10-15% in 2020-2040, by 15-25% in 2041-2070, and by 30-35% in 2071-2098.

In 2017, 12.8 billion m^3 of water was taken from water sources. Of this, 10.7 billion m^3 was taken from surface sources and 2.1 billion m^3 from underground sources. In total, 3.6 billion m^3 (28%) of the taken water was considered as loss (Figure 4-28).



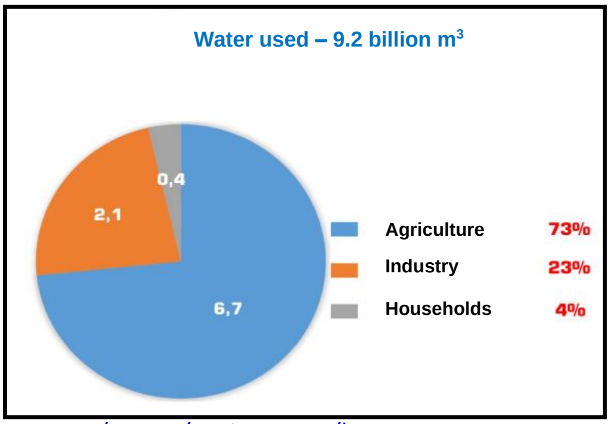


Figure 4-28. Water taken from water (sources https://www.stat.gov.az/source/environment/)

According to the distribution of the remaining 9.2 billion m^3 of water by sectors, 6.7 billion m^3 (i.e. 73%) of the water was used in agriculture, 2.1 billion m^3 (i.e. 23%) in industry, 0.4 billion m^3 (i.e. about 4%) for household needs.

Multiple variations of water consumption by sectors are given (Figure 4-29). It should be noted that the main water losses occur in the main irrigation canals constructed in the ground and on-farm irrigation networks.

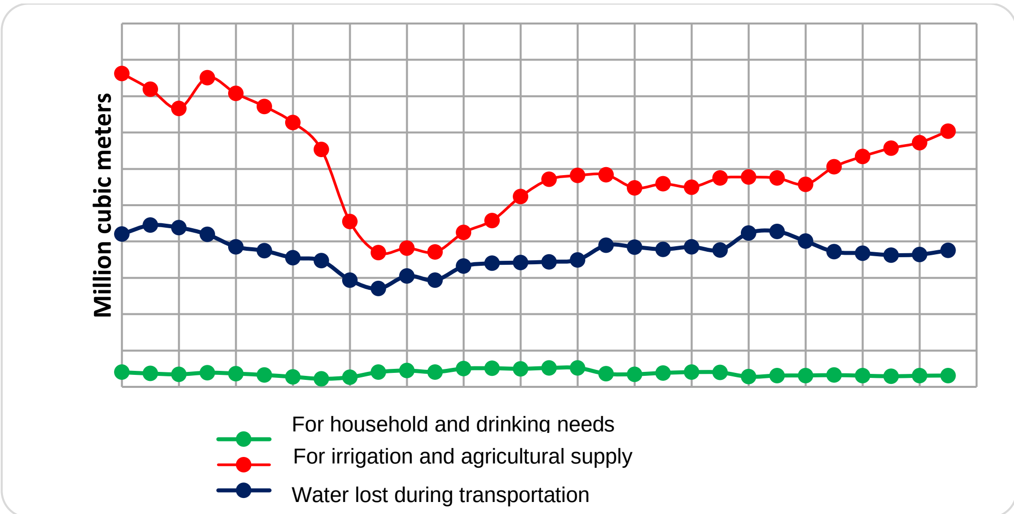


Figure 4-29. Multi-year variation of water consumption by sectors (https://www.stat.gov.az/source/environment/)

The expansion of irrigated agricultural areas leads to more water being taken from water basins, which results in lower water levels in rivers, lower water levels in reservoirs, and ultimately the destruction of the aquatic ecosystem.

If 13.0-14.0 billion m^3 of water is taken from the river in the future, and according to climatic scenarios, If we consider the water decrease in the rivers by 10-15% in 2020-2040, by 15-25% in 2041-2070, and by 30-35% in 2071-2098, we will see that it will not be possible to supply so much water. This can lead to decrease in water levels in rivers and the drying up of some. Therefore, water must be used efficiently, water losses must be prevented and modern technologies must be applied.

As can be seen, water resources are declining and there is a shortage of water in the country, and this trend will continue in the future. It is known that in modern conditions, most of the water shortage is formed due to losses in water systems. If these losses are not prevented, the situation may worsen in the future.

As now, the most sensitive areas in the future will be agriculture, hydropower and water supply to population:

- As a result of increasing water scarcity, if irrigation technologies and water supply facilities are not replaced by modern ones, water scarcity can manifest itself more sharply in 10-15% of irrigated lands in 2020-2040, 15-25% in 2041-2070, and 30-35% in 2071-2098, which can sharply decrease the harvest amounts;
- The expected decrease in river flow may reduce electricity generation at HPPs by 10-15% in 2020-2040, 15-25% in 2041-2070, and 30-35% in 2071-2098;
- Fresh water supply during the studied period may worsen when the amount of water per capita will decrease 1.5 times in 2020-2040 compared to 1961-1990 and will reach 650 m^3, 1.75 times in 2041-2070 and reach 575 m^3, and 2 times in 2070-2098 and reach 500 m^3. The existing water pollution situation will get worse.

Adaptation measures. Adaptation measures should be taken in the following areas to mitigate and minimize the expected adverse effects of climate change on water resources:

- Reconstruction of existing water facilities in order to reduce water loss;
- Involving additional water sources such as use of rainwater and treated seawater, etc.;
- Use of recirculated water, including groundwater and water reuse;
- Flow regulation and economical use of water in times of scarcity;
- Conduct reforestation measures in torrent and flood prone areas;
- Implementation of protective engineering measures in basins and in floodplains of rivers;
- Construction of HPPs on mountain rivers and new reservoirs;
- Construction of small HPPs on existing irrigation canals;
- Purify and reuse water;
- Use of modern irrigation technologies and methods.

4.6. Assessment of coastal areas sensitivity to climate change and adaptation measures

The coastline length of the Azerbaijani sector of the Caspian Sea is 850 km. At present, the territory of 10 administrative districts of the Republic (including the Absheron Peninsula) is located on the coast. According to unofficial data, more than 4 million people live here. The largest cities of Azerbaijan, Baku and Sumgait, as well as more than 75% of the country’s industrial potential are located on the Caspian coast.

According to historical data, there have always been significant fluctuations at the level of the Caspian Sea (Figure 4-30).

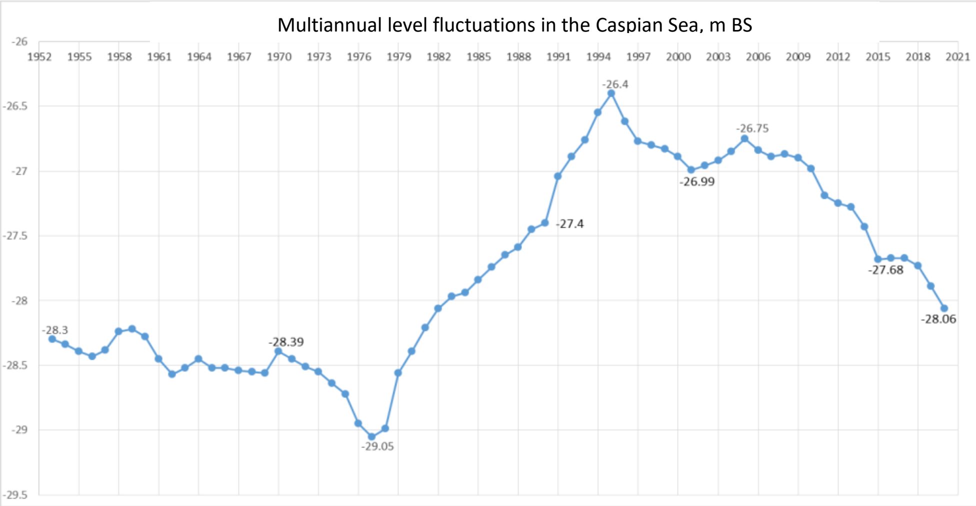


Figure 4-30. The multiannual level fluctuations in the Caspian Sea

There are numerous forecasts of the Caspian Sea level in the literature. These forecasts were made mainly during the period of level drops, i.e. in the 1960s and 1970s. At present, attempts are made to make various predictions. Some of them predicted a drop in sea level up to –31,0 m, while others predicted a rise of level to -25,0 m and above. Over time, the predictions were not confirmed. All this shows that it is impossible to predict future changes in the Caspian Sea level. Therefore, instead of giving an accurate long-term forecast of the sea level, more attempts are made to determine the tendency of the sea level change, which meets the relatively practical needs.

Given the fluctuations in the Caspian Sea level, the following adaptation measures are recommended:

- no major construction work should be carried out in the coastal zone;
- protective engineering concept of coastal zone should be developed.

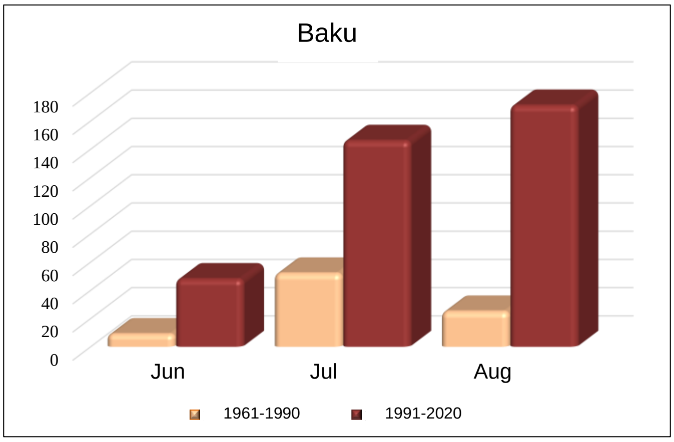
4.7. Assessment of sensitivity to climate change in terms of public health and adaptation measures

Modern climate changes are having negative impact on the health of the population in Azerbaijan, along with many other areas. These effects can be made by global warming, as well as by floods, mudslides, droughts, storms and other hazardous hydrometeorological events.

4.7.1. Extreme heat, heat waves and public health

Against the background of modern climate change in Azerbaijan, there is a significant increase in the number and duration of extreme hot days and heat waves in the summer months due to global warming. In June-August 1991-2020, the total number of days with a maximum air temperature of 35ºC and higher compared to 1960-1990 increased from 86 days to 365 days in Baku (semi-desert and arid steppe climate) and from 67 days to 203 days in Sheki (temperate-hot climate). The maximum duration of such days in Baku during the base period was 5 days, and 25 days in recent decades, and in Sheki - 8 days during the base period, and 9 days in recent decades. The increase in the number of extreme hot days was mostly observed in June and August (Figure 4-31).

While only 2 events of heat waves, one of the risky effects of climate changes in the summer months, were recorded in Baku and 6 in Sheki during the summer period, their number increased to 27 in Baku and 34 in Sheki over the next 30 years (Figure 4-32).



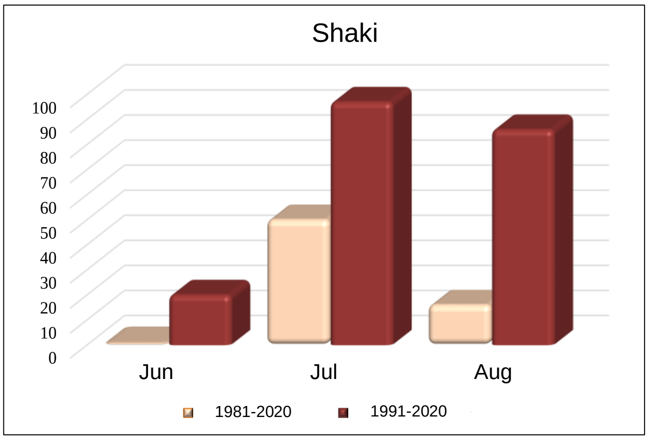


Figure 4-31. The total number of days with a maximum air temperature of 35°C and higher in the period of 1961-1991 and 1991-2020

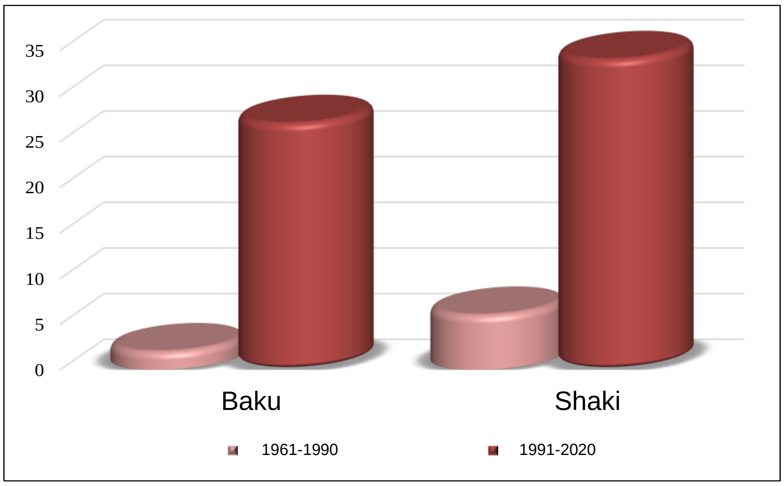


Figure 4-32. Number of heat wave events

While during the base period the average number of extreme hot days in Baku with a maximum summer temperature of 35°C and above was 3 days, in Sheki 2 days, according to the RCP 4.5 climate scenario and GFDL and MPI models, the number of extreme hot days in Baku in 2041-2070 is expected to increase to 25-32 days in Baku, 15-20 days in Sheki, and according to the HadGEM model, to 32-39 days in Baku and 20-26 days in Sheki. For sure, the number of heat waves in both cities can be expected to increase significantly.

Urban residents are more sensitive to extreme heat. During the constant extreme summer heats, people have a difficult process of adaptation, and complications arise. The number of calls to the first aid and emergency medical care station in Baku, the capital of the country, was investigated, and the number of calls in recent years for all diseases and diseases of the circulatory system in their seasonal course has been determined to be higher in winter and spring. Although the number of calls for some cardiovascular diseases has increased in the years of challenging hot summers, it has not exceeded the winter maximum. However, during the hot summer months, the number of some diseases and deaths increased: the total number of ambulance calls increased by 5.1%, calls for circulatory system diseases increased by 5.7%, and calls for the number of deaths by 4.4%. However, these figures are lower than in previous periods due to medical and meteorological forecasts of strong heat and heat waves and better preparedness of the public. The same is true of sun strokes, which are the direct result of strong heats. Analysis of data on emergency and urgent medical calls for sunstroke diagnosis in Baku shows that as the number and duration of challenging hot days increases, so does the number of ambulance calls for sunstroke. However, in the 1980s and 1990s, more than 250 sunstrokes were recorded when the temperature 35°C and above occurred for no more than 3-4 days, currently, despite the increase in challenging hot days, the incidences of sunstroke has decreased significantly due to medical and meteorological warnings of strong heats and heat waves.

Located in the north-west of Azerbaijan, on the southern slopes of the Greater Caucasus Mountains, in the foothills, the city of Sheki attracts tourists with its natural beauty, fresh air, ancient monuments, preservation of national traditions and multiculturalism.

An analysis of data from the Sheki First Aid and Emergency Medical Care Station for 2006-2015 shows that the number of calls for cardiovascular and respiratory diseases is slightly higher in the summer months (Figure 4-33), whereas it was recorded maximum in winter and spring seasons in the 1990s.

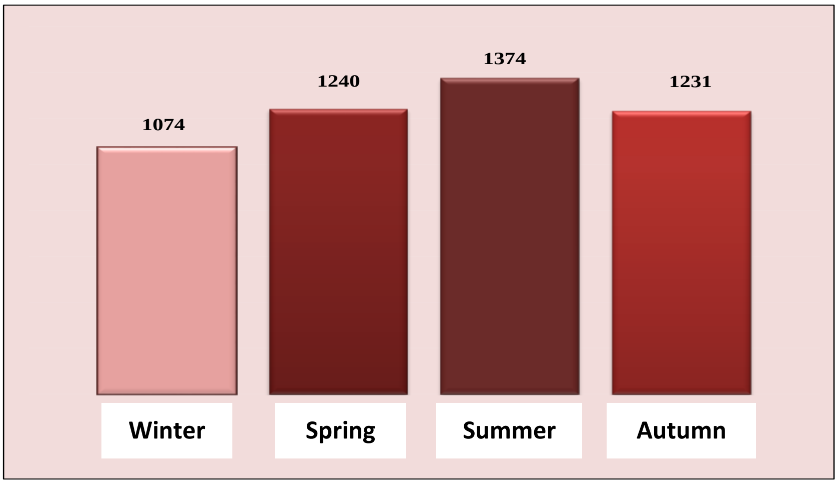


Figure 4-33. Seasonal course of the number of calls to the first aid and emergency medical care station for cardiovascular diseases in Sheki

One of the reasons why these calls are more during the summer months than in other seasons is the seasonal increase in the number of population due to the large number of tourists travelling here, and another reason is the heat waves, which has become more frequent recently. Unlike in Baku, Sheki has very few cases of heatstroke and sunstroke, even during heat waves. 2 cases of sunstroke were recorded in 2006, 1 in 2008, 1 in 2011 and 3 in 2015, and all of them occurred in August, when major temperature anomalies were observed in recent decades.

Despite the adaptation of the local population to hot weather conditions due to the prevalence of arid climates in most parts of Azerbaijan, the expected increase in strong heats and heat waves may overcome these adaptation processes and, consequently, the population will be exposed to the negative effects and risks of abnormal summer heats. The increase in the number of diseases, including circulatory system diseases and deaths among the population in 2041-2070 may be much higher than the above-mentioned figures. As the urban population is more sensitive to climate change, it is likely that the incidence of diseases, including cardiovascular disease and sunstroke, will increase significantly if no adaptation measures are taken against the intense heats during the summer months.

Measures to adapt to the negative effects of intense heat and heat waves:

improve the level of preparedness of the health system in all regions;

establish and expand green areas in cities;

design and construct buildings by taking into account the strong summer heats expected against the background of climate change;

install air cooling systems in buildings and all public transports;

take into account the strong summer heats when building bus stops in cities;

further improve the warning system for strong heats and heat waves;

raise awareness of the population about first aid in case of heatstroke and sunstroke;

inform the population through the media about the lifestyle (activity, nutrition, clothing, etc.) appropriate with the extreme heat and heat waves.

4.7.2. Climate change and common acute intestinal infections

Global warming and the increase in the hazardous hydrometeorological cases, as in many countries, pose a risk of an increase in some infectious diseases in Azerbaijan. One of the main infectious and parasitic diseases in the country is the common acute intestinal infections. The level of exposure of the population to intestinal infections depends mainly on the quality of water (both in water sources and in water pipelines) and food products. More than 16,000 people suffer from acute intestinal infections of known or unknown etiology in Azerbaijan every year. Although the incidence of these diseases has decreased significantly over a long period of time, there has been a continuous process of activation in recent years (Figure 5-34). Common acute intestinal diseases occur more often in areas with hot and dry climates and with major shortcoming of quality drinking water. Recent global warming as a result of climate change, the increase in torrents and floods in rivers, the problem of drinking water for the population living here as a result of sharp fluctuations in the downstream of the Kura, major problems in providing the population with quality drinking water and food products storage due to the drought in the summer months contribute to the prevalence of diseases.

In the future, against the background of significant global warming, the increase in the likelihood of hazardous hydrometeorological events such as floods, torrents, droughts may create risks in providing the population with quality drinking water. At the same time, global warming makes it necessary to improve the quality and control of storage conditions, especially for perishable food products.

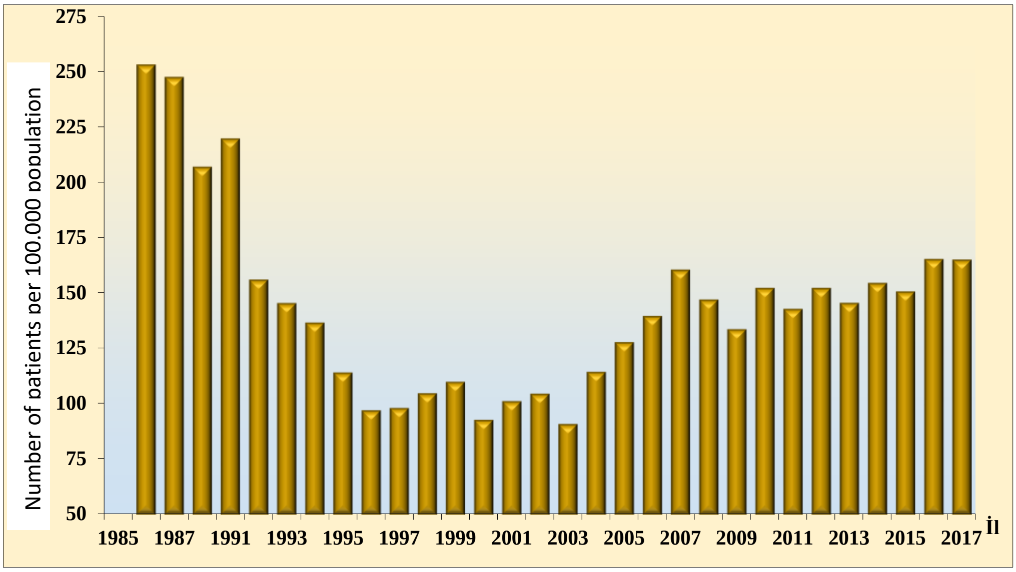


Figure 4-34. Multiannual trends of common acute intestinal infections in the Republic of Azerbaijan

Adaptation measures against diseases transmitted through water and food:

- water treatment and quality improvement;
- improve and strengthen the water quality control system;
- accelerate the work on providing all settlements with drinking water;
- develop strategy for proper and efficient use of drinking water sources in the context of climate change;
- improve and strengthen the control system over the implementation of food storage standards;
- broaden sanitary-epidemiological awareness of the population in this issue;
- if necessary, organize speeches of specialists in the media on the prevention of acute intestinal infections.

CHAPTER 5. EDUCATION, TRAINING AND PUBLIC AWARENESS RAISING

5.1. Climate change-related activities

The economy of Azerbaijan is one of the most energy-intensive in the region, and it is largely due to oil and gas production, which is also the main source of greenhouse gas emissions in the country. Nevertheless, by 2012, greenhouse gas emissions were 29 percent lower than in the base year of 1990, thanks to the modernization of production and implementation of more efficient technologies.

In April 2016, Azerbaijan signed the Paris Agreement on Climate Change, its ratification is pending. Azerbaijan's preliminary commitments related to climate change (INDC) prioritize the use of alternative energy sources and the development of measures to reduce carbon emissions in the production sector and housing and communal services. The goal by 2030 is to reduce carbon dioxide emissions by 35 percent compared to the 1990 baseline year.

A state investment program is effective in the energy sector of Azerbaijan until 2030.

The country has approved several programs and goals to expand the use of renewable energy sources and established the State Agency on Alternative and Renewable Energy Sources. Renewable energy goals include increasing its share to 20 percent in electricity generation and to 9.7 percent in total energy consumption by 2020. Moreover, it is planned to put into operation power plants based on renewable energy sources with a total capacity of 2 thousand MW.

Pursuant to the 2015-2018 plan of the State Agency on Alternative and Renewable Energy, power generating plants using wind, solar and biomass energy, and hydroelectric power plants will be built by 2018 and produce a total of 735 MW of energy from alternative and renewable sources. The agency is working on a new tariff methodology for renewable and alternative energy sources and will introduce a new tariff for electricity produced by solar power plants.

Azerbaijan is developing a climate change mitigation and adaptation strategy in cooperation with international aid organizations such as the UNDP, ADB, and the German Society for International Cooperation. Agriculture and forestry, water resources, and the Caspian Sea coast, tourism, and health care are recognized as the most important sectors of the economy in terms of climate change. The tasks related to these areas must be integrated into the country's overall climate change adaptation strategy and sectoral development programs, and practical solutions must be sought.

At the initiative of the Ministry of Environment and Natural Resources, the Korean government, together with KOICA, started working on the National Strategy to Reduce Climate Change Effects.

For the purpose of climate change mitigation, infrastructure projects are implemented using clean technologies to reduce greenhouse gas emissions, use renewable energy sources, and improve energy efficiency. Discussions are ongoing with the Green Climate Fund on the Program to Support the Development of a National Climate Change Adaptation Plan which will be implemented by the United Nations Development Program.

The United Nations Development Program, the United Nations Environment Programme, the Food and Agriculture Organization, and the German Society for International Cooperation (GIZ), the Korean International Cooperation Agency (KOICA), and others are working on climate change mitigation and adaptation activities.

5.2. Climate Change Financing

International organizations such as the Global Environment Facility, the International Climate Initiative, the Asian Development Bank and UNDP assist Azerbaijan in drafting reports and introducing GHG monitoring, reporting, and control (MRV) system. UNDP and the GEF assist the low-carbon development program, while Germany assists in phasing out chlorofluorocarbons.

Azerbaijan plans to allocate $57 million for energy investments by 2030. The funds will be spent to develop a "low-carbon" development concept, modernize electricity and heat generation technologies, reconstruct distribution networks and transmission lines, and expand the use of renewable energy sources.

5.3. Climate Change Cooperation with the United Nations Development Program

Cooperation between the Ministry of Ecology and Natural Resources and the United Nations Development Program in combating climate change is mainly implemented through technical assistance and grants. UNDP acts in these projects as an implementing agency for donor organizations and is responsible for the implementation and management of project activities in line with the defined and agreed project document.

Subject to Articles 4 and 12 of the Framework Convention on Climate Change, ratified by the Republic of Azerbaijan in 1995, the country’s National Communication has to be prepared and submitted to the Secretariat of the Convention.

In this connection, the first national communication for 2000, the second national communications for 2011, and the third national communications for 2016 were submitted to the Convention Secretariat. The GHG inventory within the 1st national communication covered 1990-1994, within the 2nd national communication covered 1995-2005, and within the 3rd national communication covered 2006-2010. The complete inventory for 2011-2016 will be reflected in the fourth National Communication. The Fourth National communication is expected to be completed by the end of 2020. UNDP is a key partner under this activity. Azerbaijan's latest draft of the Fourth National Communication and the Second Biennial Report to the UN Framework Convention on Climate Change was started in 2017 and is expected to be completed this year.

Development of the Fourth National Communication and Second Biennial Report of Azerbaijan to the UN Framework Convention on Climate Change (2017-2020)

The goal of the project is to provide technical assistance to Azerbaijan for the development of the fourth national communication and biennial report to the UN Framework Convention on Climate Change. The project is funded by the Global Environment Facility.

The project consists of the following components:

–Implementing GHG inventory and strengthening the capacity for continuous data collection;

–Developing an updated report on climate change mitigation policies and measures and enhancing the ability to collect/analyze data on a regular basis for future reports;

–Studying the signs of climate change;

–Developing future regional climate scenarios;

–Assessing vulnerability to climate change (if applicable, at the regional and local levels) for priority sectors and developing plans and programs for proposed measures of adaptation;

– Accelerating the creation of a local measurement, reporting, and verification system;

–Preparing an update on the current situation in the country and other issues as required by the Convention (education, training, public awareness, and technology transfer) and summarize it in the publication of the Fourth National Communication.

EU project to support climate change (2019-2022)

The project is implemented in six countries within the framework of the Eastern Partnership program with the support of the European Union. UNDP is the implementing agency of the project. The project will facilitate the implementation of the Nationally Determined Contribution (NDC), the development of national strategies, improve interagency coordination at the political and technical level in relation to the Paris Agreement and the national commitments arising from this agreement, measurements and reporting in line with the transparency requirements of the Paris Agreement, and establish and strengthen the verification system (MRV), etc.

Project to Support the National Adaptation Plan (NAP) for Planning and Implementation of Adaptation to Climate Change in Azerbaijan" (2020-2023)

Currently, the Project to Support the National Adaptation Plan (NAP) for Planning and Implementation of Adaptation to Climate Change in Azerbaijan (2020-2023) is developed and submitted to the government for approval. This project will be implemented by UNDP with the financial support of the Green Climate Fund.

The project aims to support the implementation of commitments under the UN Framework Convention on Climate Change, as well as adaptation priorities for agriculture, water resources, and coastal areas, the Nationally Determined Contribution Document (NDC), the National Economic Prospects and agriculture of the Republic of Azerbaijan. It will promote adequate adaptation to the negative effects of climate change and plan for future development within the framework of strategic roadmaps.

National Action Plan (NAMA) to reduce carbon emissions in the fuel consumption sector in Azerbaijan (2015-2020)

Since 2015, SOCAR and the United Nations Development Program have been implementing the National Action Plan (NAMA) to reduce carbon emissions in the fuel consumption sector in Azerbaijan. The project envisages the reconstruction of the administrative building of the polyethylene production plant of the ethylene-propylene plant of SOCAR Azerikimya. In this connection, several projects were implemented to improve the energy efficiency of polyethylene production, facades, heating and cooling systems, ventilation systems, water and energy-saving operating systems, and the use of alternative energy sources and others. Special insulation materials were used on the facade of the building to save energy resources, and solar panels with a capacity of 10 kW/h were installed for interior and exterior lighting.

Moreover, as part of the project, solar panels with a capacity of 23 kWh were installed in the “Kimyachi” Palace to use alternative energy sources and improve energy efficiency, and thermal insulation materials were applied to the roof of the building on an area of 1,200 m2. Putting the building into operation will save 232 kWh of electricity, and putting the Palace into operation will save 102 kWh of electricity.

As part of the project, two administrative buildings in the Gala Eco-Park, the facade of the administration building of the Waste Management Center of the SOCAR Environmental Department, and the ceiling are insulated with stone wool, and heating panels are attached to the facade. Moreover, the windows are closed to prevent heat loss and improve energy efficiency. The taken measures taken are expected to save up to 40% of electricity.

As part of the NAMA project, 60 solar panels with a total capacity of 15.36 kW h and 4 wind generators with a total capacity of 6.9 kW/h were installed in the Waste Management Center of the SOCAR Environmental Department. In the future, it is planned to replace the existing wind generators with vertical wind generators with a total capacity of 16. 8 kW/h, and with an individual capacity of 2.8 kW/h. Also, 4 (four) new hybrid vehicles are purchased within the framework of the project to be used by SOCAR.

Raising climate change awareness (several projects)

Awareness-raising, training and skills development provide the foundation for long-term sustainable climate change programs. The purpose of public education and awareness-raising is to encourage the changes in lifestyles, attitudes, and behaviors necessary to stimulate sustainable development and prepare children, youth, women, people with disabilities, and grassroots communities for adapting to the effects of climate change.

The Azerbaijani youth are actively involved in raising awareness, participating and implementing educational programs, conserving nature, promoting the use of renewable energy sources, introducing environmentally friendly methods, and implementing various projects on climate change adaptation and mitigation at the local and national levels.

Awareness-raising is also a major way to educate future leaders in the field of climate change. It can help to build the basic skills people need to foster low-carbon, climate-resilient development. It can inspire these people to gain a deeper understanding of the causes of vulnerability to climate change and the impact of natural disasters, and how humanity can continue to develop and thrive in the face of increasing uncertainty.

Educational program "Green Network" for students and schoolchildren

This program was initiated by the Republican Child-Youth Development Center (Republican Ecological Education and Practice Center) of the Ministry of Education of the Republic of Azerbaijan in 2015.

The program is implemented by the Republican Center for the Development of Children and Youth of the Ministry of Education in general and extracurricular educational institutions of Baku and regions, within the framework of the established system of eco-clubs.

The main purpose of the establishment of "eco-clubs" is to expand the environmental movement of youth, creating a "green network", improving the environmental knowledge of schoolchildren, developing the younger generation’s special skills and competencies in the field of environmental culture and environmental protection, including climate change. The Ministry of Ecology and Natural Resources has supported the program since 2018.

Green Network of Environmentally Oriented and Energy Efficient Schools Project

Since 2016, the Republican Child and Youth Development Center of the Ministry of Education of the Republic of Azerbaijan have annually conducted the project "Green Network of Environmentally Oriented and Energy Efficient Schools" in Baku and regional general educational institutions as part of the environmental education program "Green Network". The main purpose of the project is to provide pupils with specific knowledge and skills in the field of natural resource conservation and environmental protection, sustainable use of resources, and the impact on climate change. As part of the project, educational training sessions are held for school teachers and pupils of general educational institutions. Annual reports are included in the methodological manuals developed by participating schoolchildren, based on the recordings made in schools on the efficient use of energy resources, serving the principles of careful behavior, creative solutions for recycling, water conservation, green buffet. At the end of the project, the schools participate in the final competition.

Republican contest of schoolchildren “Eco-friendly products and agrobiodiversity”

Since 2015, the Ministry of Education of the Republic of Azerbaijan, together with the Republican Children and Youth Development Center, the Ministry of Ecology and Natural Resources, the Ministry of Agriculture of the Republic of Azerbaijan, annually organizes a program of environmental education for schoolchildren on the topic organic products and agrobiodiversity in connection with environmental education for the development of organic agricultural production and the impact of agriculture on climate change. The main purpose of the program is to increase students' knowledge and skills in the development of organic agriculture and preservation of agro-biodiversity in Azerbaijan, conservation of organic local species of plants, local breeds of animals, study and the effective use of agricultural resources, and soil conservation. Schoolchildren can participate in the annual program and competition individually, collectively (schools), as a class, or as a family (farms). Over the five years of the program, more than 10,000 schoolchildren from the regions of the country have participated.

Program "Fundamentals of Ecology" for supplementary education

In 2015, a new authorial program was prepared for the members of eco-clubs. The author of the program is Firuza Sultan-zadeh, Ph.D. in Ecology, Associate Professor at the Department of Ecology and Soil Science of the Baku State University, Director of the Republican Child and Youth Development Center. This annual program is currently being piloted by teachers of extracurricular supplementary education. The new program consists of 13 environmental education modules - “fundamentals of ecology", "plant and animal ecology", "animal behavior", "human ecology, urban ecology or cities of the future", "climate change", "alternative energy", "waste management", "bionics, biotechnology and bioethics", "biodiversity conservation", "forest ecology", "bioindication and environmental monitoring", "introduction to national parks or protected areas”, and "green tourism". General educational projects and environmental mass events and activities for the eco-club network are developed along with one and two-year curricula. In 2015-2020, this program was implemented in 40 general education schools in "Eco-clubs" created in lyceums and gymnasiums of the Ministry of Education.

Environmental Education for Sustainable Development Project

The project was signed between the Ministry of Education and the United Nations Children's Fund (UNICEF Azerbaijan) in the framework of the 2016-2020 cooperation program between the Government of Azerbaijan and UNICEF and the periodic action plan for the 2018-2019 educational program.

Over two years, workshops were organized in different regions of Azerbaijan, more than 200 teachers were familiarized with the problems of climate change, and teaching methodology on the rational use of natural resources and the protection of biodiversity as part of the project “Environmental education for sustainable development”.

Healthy Environment - Healthy Future Project

The project was organized by the Ministry of Education in 2019 with the financial support of UNICEF. The purpose of the program is to raise awareness of the Sustainable Development Goals among the teaching staff and schoolchildren and to develop an environmental mindset. Training for elementary school teachers dealt with the factors directly affecting human health - climate change - and the concept of ecosystem services. Three episodes of educational animations, online games, and open lessons on the subject of “Introduction to science" will also be used as e-learning resources, and a series of intellectual games and educational seminars are planned for parents in order to ensure the implementation of Sustainable Development Goals.

Trainings for teachers

Since 2017, the Republican Child and Youth Development Center of the Ministry of Education annually conducts three-day educational training for heads of associations on ecology, tourism and local history, botany under the specialty program “the best methodological and pedagogical practices in out-of-school facilities" within the "Year of Quality in Education". Since 2018, training has been conducted by specialists from the Ministry of Ecology and Natural Resources.

In 2019, under the joint organization of the Ministries of Education, Culture, Ecology, and Natural Resources, employees of the Republican Child and Youth Development Center conducted training sessions in Baku-Absheron, Sheki-Zagatala, Guba-Khachmaz, Lankaran-Astara, Aran, and Ganja-Gazakh zones, with more than 600 teachers of general education schools and youth development centers within the framework of the Republican Creativity Festival among Schoolchildren. Training participants received detailed information on the “environmentally oriented and energy efficiency schools" that will be held within the framework of the festival. As part of the festival in the framework of the competition "Green Network of Environmentally Oriented and Energy Efficient Schools", special classes were organized with the participation of schoolchildren in 58 regional centers of the republic, they were taught special knowledge and skills in the field of energy conservation, green design, healthy eating, and waste management.

To prepare for the 2019-2020 school year, in August-September, the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan in cooperation with the Republican Child and Youth Development Center of the Ministry of Education conducted training for the heads of clubs oriented in ecology and tourism. The main objective of the 10-day training is to educate the heads of the clubs, improve their methodology for work organization, enhance their practical and theoretical skills in connection with the application of the skills learned from the training program, raise their awareness on the issues of climate change, specially protected natural areas, national parks, and state nature reserves of Azerbaijan, the flora and fauna of Azerbaijan, biodiversity, environmental education and their training on environmental protection.

Campaigns and events

Since 2015, the Ministry of Education of the Republic of Azerbaijan, together with the Republican Child and Youth Development Center and the Ministry of Ecology and Natural Resources annually organizes roundtable with schoolchildren from different regions of the country on the occasion of "April 15 - the International Day of Environmental Knowledge." The issues for discussion are climate change, tree surgery, landscaping, flora and fauna protection, environmental protection, energy, and water conservation, etc.

Since 2018, with the support of the Ministry of Ecology and Natural Resources, an ecological forum of young leaders of "Ecoclub" has been held annually in April under the motto "Green Network". The main purpose of the establishment of "eco-clubs" is to expand the environmental movement of youth, improving the knowledge of schoolchildren on environmental volunteers, developing their special skills and competencies in the field of environmental culture and environmental protection, including climate change. In five years, the number of participants of the environmental forum reached 3,000.

Since 2018, the Ministry of Education, together with the Republican Child and Youth Development Center, the Azerbaijani Representative Office of the Korea International Cooperation Agency (KOICA), the KOICA Azerbaijani Alumni Association (COAZ), and the Ministry of Ecology and Natural Resources have been holding actions and marches in connection with the Sustainable Development Goals for schoolchildren. The main objective is to provide children and youth with knowledge about climate change, special skills on the topic of environmental problems and protection, and the Sustainable Development Goals. In 2018, a special SDG module was included in the curriculum of environmental associations.

CHAPTER 6. FINANCIAL, TECHNOLOGICAL AND CAPACITY CONSTRAINTS AND REQUIREMENTS

At present, the policies to reduce GHG emissions are determined at the international level by existing market relations, i.e., economic mechanisms, including the use of international carbon mechanisms and appropriate pricing policies. Therefore, in order to integrate more closely into these relations, the Republic of Azerbaijan should establish appropriate competitive environment, effective Measurement, Reporting and Verification (MRV) system for both GHG inventory and mitigation actions, effective mitigation policies, favorable financial mechanisms for their implementation and technological, capacity building opportunities. There are still varied financial, technological, institutional and economic obstacles to achieve low-carbon, sustainable development in the Republic of Azerbaijan in different sectors, and many of them are reflected in relevant regulations and projects. At present, some of them are mentioned in the "Azerbaijan 2020: Outlook for Future" Development Concept, draft "National Strategy for Carbon Development in 2008-2015" and other documents. In this regard, the main constraints are classified by relevant sectors below.

The State Commission on Climate Change in new composition, approved by the Decree of the President of the Republic of Azerbaijan No. 1920 of March 11, 2020 can be mentioned as major institutional undertaking to implement the commitments made by the Republic of Azerbaijan in accordance with the UN Framework Convention on Climate Change which has been ratified by the Government of the Republic of Azerbaijan in recent years. On July 23, 2020, the first meeting (in video conference format) of the Commission in new composition was held under the chairmanship of Deputy Prime Minister, Chairman of the State Commission on Climate Change to discuss the action plan of the Working Group established to define the State Commission's areas of activity.[112]

6.1 Barriers of low-carbon development across sectors

6.1.1 Energy sector

Given the share of the energy sector in the overall economy and its role in the overall sustainable, inclusive development of the country, there is a need for single common regulatory legal act to cover low-carbon strategic activities in this sector. In fact, the targets set to reduce GHG emissions, energy intensity and transition to green energy provided for in the strategic documents ("Azerbaijan 2020: Outlook for Future" Development Concept, etc.), the country's commitments to the implementation of the UN SDGs, as well as strategic programs for the transition to green technologies for the development of the country's non-oil sector necessitate the creation of legal framework and regulatory platform that can provide daily monitoring of specific activities in this area.

In order to implement the "Associated Gas Reduction Plan in SOCAR and SOCAR's Joint Projects for 2017-2022" which deals with the losses in oil production and transportation and the collection of associated gases and "SOCAR's Climate Change Mitigation Strategy for 2010-2020", support from foreign donors is required along with the domestic financial resources.

In general, as directly stated in the State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015, there is a long-standing need to establish special **Carbon Fund** in the country to finance measures to reduce GHG emissions.[113].

One of the main reasons preventing the Government from expanding financial support to low-carbon development measures in the country is the socio-economic problems of about one million refugees and IDPs in Azerbaijan as the result of the occupation policy of the neighboring Armenia for almost 30

[112] https://nk.gov.az/az/article/950/
[113] https://www.economy.gov.az/article/state-program-on-the-implementation/21508

years. In fact, according to the report submitted by the "**Working Group on the assessment of losses and damages resulted from the occupation of Azerbaijani territories by Armenia**" established by the Cabinet of Ministers on February 26, 2014, based on the materials of the Ministry of Ecology and Natural Resources (MENR), 6 key areas, i.e., looting of mineral deposits, destruction of biodiversity, forests, degradation of lands, deprivation of use, environmental damages from pollution of water, reservoirs and environment, as well as moral and ecological damage to the population were estimated and the total damage to the Republic of Azerbaijan was calculated to be about 265 billion 281 million 198 thousand 203 dollars.[114]

Regarding electricity generation, It is to note that due to the obsolescence of a number of existing power plants and relevant infrastructure, there is tremendous need to replace them with new ones and expand the construction of modern plants with low GHG emissions intensity. In fact, the average life of a natural gas plant is about 25 years. In order to upgrade obsolete power plants and increase their production capacity, "**Rehabilitation Program**" was adopted in 2018. Within the framework of this Program, "Azerenergy" OJSC conducts repair and restoration works in the power plants in Baku suburbs and in regions to restore "lost" powers, enhance reliability and sustainability.[115]

Furthermore, the shortcomings such as the low last consumer prices which affect electricity consumption in the Republic of Azerbaijan, the application of discounts for some industries, the lack of tariff differentiation and volume-based tariffs at different times of the day, as well as the lack of energy efficiency certificates in buildings, transport and household appliances still exist. Taking into account the above-mentioned issues to eliminate them can create conditions for more efficient use of electricity. In general, given the use of natural gas as the main raw material for electricity generation in the country, the proper management of electricity during peak hours can ultimately reduce the emission of GHG emissions significantly.

Furthermore, gaps in legislation serve as one of the main obstacles to expand the country's transition to alternative and renewable energy sources (ARES) and attract more private investment in this area. In fact, the basic areas to prevent the release of greenhouse gases into the atmosphere are to expand the use of Alternative and Renewable Energy Sources, enhance energy efficiency, reduce losses in production, transmission and distribution, and implement other actions. As noted, currently there is no comprehensive legal framework for expanding the use of alternative and renewable energy sources. Indeed, the Ministry of Energy of the Republic of Azerbaijan has launched the development of documents to enhance the share of alternative and renewable energy sources in total electricity generation and to improve the regulatory framework which govern this sector in order to attract private investment in the renewable energy sector, and to apply preferential tariffs and other incentives, based on the amendments made to the Resolution No. 191 of December 16, 2009 by the Resolution No. 71 of the Cabinet of Ministers of the Republic of Azerbaijan dated March 2, 2018. In fact, to this end, a procurement was conducted to attract international experts and consulting companies, and the Norwegian company "DNV GL Energy Advisory GmbH", which has experience in this field, won the tender. According to the agreement signed with the company on October 5, 2018, the legislation in the field of use of renewable energy sources will be prepared shortly.

At the same time, the draft "Guidelines for determining the zones of renewable energy sources and connection capacity, holding tender for the use of zone and connection capacity, signing and implementation of the agreement on the use of zone, purchase and payment of electricity, protection of zones and infrastructure" was prepared and discussed together with relevant structural units. Furthermore, several legislative acts have been drafted in order to apply guaranteed tariffs to renewable energy projects and identify sources of financing.

[114] https://1news.az/az/news/erm-ni-i-al-n-tic-sind-az-rbaycana-d-y-n-z-r-rin-m-bl-i-a-qlan-b
[115] https://report.az/energetika/azerenerji-seki-elektrik-stansiyasinin-itirilmis-gucunu-berpa-e/

It is to note that the development of a number of government incentive mechanisms is an important condition for the development of renewable energy sources (RES):

Guidelines and contract terms for renewable energy producers;

Terms of FIT (Feed-in Tariffs), Auction/Tender, tax and customs exemption policies under support mechanisms;

Technical regulations for network connection requirements and procedures;

Guidelines on preventing technical losses when connecting ARES to the general network;

Standard commercial terms of Power Purchase Agreement (PPA).

One of the main obstacles to the development of RES in Azerbaijan is the lack of a competitive market environment. The Ministry of Energy of the Republic of Azerbaijan is currently taking certain measures to form market relations and pursue a policy of liberalization. In fact, reforms in the energy sector are being implemented with the support of an international consulting company to regulate market relations. At the same time, a draft Law on Electricity has been prepared to this end with the support of USAID. The draft law will provide free access to the market for energy producers and consumers in the conditions of free competition by electricity entities, minimizing damage to the environment and efficient use of energy resources.

In this regard, although the "Strategic Plan of the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan for 2015-2018" states that the development of tariff methodology in the field of alternative and renewable energy sources will be completed in 2016, as well as actions have been envisaged for determination of optimal tariff prices, there are still no satisfactory results in this area.[116] On the other hand, the discrepancy between the relatively low cost of electricity in the country and the high investment required in ARES, as well as the lack of financial institutions that can provide low-interest loans suitable for this sector, have significantly reduced private sector investment in this area. In this context, with the further expansion of cooperation with the European Union, the importance of projects to be developed for the establishment of CDM credits under the Kyoto Protocol will increase.

At the same time, there is a need to reinforce the network to increase the share of alternative and renewable energy in total electricity generation capacity. To this end, the "Strengthening the Network" project has been launched in cooperation with the European Bank for Reconstruction and Development.

Undoubtedly, one of the important steps taken to reduce emissions from the energy sector is the implementation of energy efficiency measures. There is no relevant legal framework for this. However, the Ministry of Energy of the Republic of Azerbaijan is taking important steps in this regard. In fact, with the support of the Energy Charter, the Ministry of Energy has developed and submitted to the Cabinet of Ministers a draft law on "Rational Use of Energy Resources and Energy Efficiency" under the "EU4Energy" Program.

As for the shortcomings in technologies, it is to note that almost all power plants are gasified, which will reduce the use of high-GWP fuels, and lead to reduction in emissions released into the atmosphere, to some extent.

Furthermore, based on the experience of developed countries, we consider it necessary to take measures to eliminate the following existing obstacles to achieve energy efficiency and to expand the use of renewable energy sources in the country:

Adopt the Law "On energy efficiency in buildings";

Implement appropriate "energy certification" of buildings;

[116] http://area.gov.az/public/uploads/AgentliyinEmr/strateji%20plan_%C6%8Fmr-21.pdf

Define normative requirements for the application of alternative and renewable energy and energy efficiency in the design of construction facilities built or overhauled at the expense of the state in the economic and social spheres;
Provide tax incentives and low-interest loans to local enterprises that organize the production of ARES equipment and facilities;
Ensure the application of guaranteed tariffs for the use of ARES, establish and apply additional coefficients to existing tariffs for the sale of energy to entrepreneurs who use domestic devices and equipment produced in the country aimed at the use of ARES;
Exempt from customs duties and value added tax of imported facilities for alternative and renewable energy and facilities used for the efficient use of such energy, as well as parts and accessories for their production;
Apply guaranteed power purchase agreement (PPA) for 10-15 years for energy produced from ARES;
Establish energy zones in the territory of the Republic and apply benefits and incentives for energy producers in those zones;
Establish appropriate trust fund of profits from natural gas and carbon emissions saved by application of ARES;
Teach the basics of ARES use in higher education institutions and research centers, conduct scientific research, strengthen human resources and establish specialized centers;
Develop regulatory framework for tenders or auctions for renewable energy sources.

In general, in order to reduce GHG emissions in this sector, it is expedient to intensify activities in the following areas:

Reduce the amount of conventional fuel used to purchase 1 kWh of electricity and align it with standards of the European Union and other international standards;
Prepare necessary draft laws in energy efficiency, alternative and renewable energy sources;
Prepare technical and regulatory documents in energy efficiency, alternative and renewable energy sources;
Apply modern technologies to reduce losses in the transmission of electricity and heat;
Enhance the use of alternative and renewable energy sources;
Apply the use of alternative and renewable energy sources in all areas of activity;
Provide central heating system for residential and other buildings with no central heating system;
Implement regular sealing of crane and interconnect equipment on gas lines to the process furnaces of the Gas Processing Plant;
Apply modern energy-saving technologies in petrochemical, oil and gas refining complexes and appropriate financial incentive mechanisms;
Modernize lighting system in public spaces such as roads, parks, etc.;
Use renewable energy sources in energy-efficient lighting system;
Apply incentives for energy saving in buildings, in workplaces, in production.

6.1.2 Transport sector

The GHG emissions reduction process in the transport sector of each country necessitates the transition to modern innovative technologies and green transport in the infrastructure and planning of this sector as whole. This, in turn, creates the need for the formation of energy efficiency standards in transport and the creation of favorable conditions for investment in relevant technologies, as well as appropriate financial mechanisms.

As it is known, in many countries the **most effective way** to reduce emissions in the transport sector is **to reduce the carbon content of the fuel used, i.e., to use compressed natural gas (CNG), liquefied petroleum gas (LPG) or biofuels instead of gasoline and diesel**. At the same time, in order to reduce emissions into the atmosphere in these countries, the practice of using fuel in accordance with EURO-4 and higher environmental standards, mixing conventional fuels with biofuels is being implemented.[117].

In order to expand the use of CNG and LPG in the transport sector in the Republic of Azerbaijan, the lack of appropriate financial incentives for the import of vehicles driven by these fuels or their production and assembly in the country is one of the main obstacles to significantly reduce GHG emissions in this sector. For example, in recent years, a number of popular taxi service companies in the country (e.g., 158, 166,189) have imported small number of CNG-powered cars. The transition to low-carbon and green vehicles by private and public sector enterprises will be significantly intensified in the country if the relevant financial institutions provide low-interest loans for low-carbon or green technologies and if the government provides the above-mentioned incentive support mechanisms.

On the other hand, technological difficulties in installing reliable and safe equipment to increase the number of CNG-powered vehicles in the country, still higher market prices of hybrid and electric vehicles than traditional cars, as well as the lack of adequate charging infrastructure are considered as the major problems. At the same time, the wholesale prices of LPG in the country are much lower than gasoline, but not so low compared to diesel. This factor and the fact that retrofitting of standard vehicles with LPG and CNG devices is not financially viable for the middle class and not completely safe technically are the factors that hinder the widespread use of these technologies in the country.

Furthermore, the poor quality of highways in some parts of the country still leads to excessive fuel consumption. Given the further improvement of road infrastructure in the regions, as well as the fact that heavy traffic jams can increase GHG emissions in large cities, the development and implementation of incentive tax mechanisms for road use, as well as financial incentives the use of public transport, including green transport (bicycles, etc.) (supplements to the salaries of those who go to work by such means of transport, etc.) can yield more effective results in this area. However, unfortunately, lack of enough infrastructure in the country to expand the use of bicycles and other green vehicles, i.e., the lack of separate safe roads, the limited availability of charging stations for electric cars and hybrid cars are among the main obstacles to further reduce GHG emissions in the transport sector. At the same time, although some positive outcomes have been achieved in recent years to improve the quality of services by suburban electric trains, these trains are still not popular enough among population in terms of economic profitability and quality of services.

Furthermore, the failure to complete the disposal of obsolete, environmentally unfriendly, non-Euro-4-compliant vehicles in the country is a major obstacle to environmental and physical safety. Whereas, Article 7.3.1 of the Action Plan for the implementation of the “State Program on Road Safety in the Republic of Azerbaijan for 2019-2023” contains provisions to take necessary measures for preparation and application of technical safety and environmental regulations in accordance with international agreements to which the Republic of Azerbaijan is a party, as well as to prevent the import, sale, use, and other forms of turnover of vehicles, their spare parts, accessories and consumables that do not meet these technical regulations. Also Article 7.3.7. **Organization of vehicle utilization** envisages the reparation and application of vehicle utilization program to ensure the removal of obsolete, technically-safe and **environmentally unfavorable vehicles** in order to improve road safety in the Republic of Azerbaijan, the environmental situation, and stimulate domestic automobile production.[118]

In general, in order to reduce emissions in this sector, it is considered expedient to intensify activities in the country in the following areas:

Establish additional charging stations for electric vehicles;

[117] Greenhouse Gas Reduction Strategies in the Transport Sector: Preliminary Report, OECD/ITF, 2008
[118] http://www.e-qanun.az/framework/41118

Adapt domestically produced motor fuels to Euro-4 and higher quality standards;

Apply tax and customs incentives (on VAT and excise tax on imports of environmentally friendly cars, customs import duty, etc.) in order to stimulate the import and local production of such vehicles, including relevant spare parts.

6.1.3. Construction and utilities sector

Due to the fact that the development of the construction and utilities sector of the Republic of Azerbaijan is correlated with the development of other related sectors of the economy, it has become necessary to increase energy efficiency and develop and implement energy saving policies in the country.

As noted in the **First Nationally Determined Contributions (NDC) of the Republic of Azerbaijan**[119], the massive use of control and measurement devices in electrical, heat energy and natural gas systems, application of energy-efficient bulbs, use of modern energy-saving technologies in heating systems, as well organization of public awareness programs on energy use will ultimately increase energy efficiency in the residential and commercial sectors and promote energy conservation and thus reduce GHG emissions.

As mentioned, the "**Strategic Roadmap for the Development of Utilities (Electricity, Heat, Water and Gas) in the Republic of Azerbaijan**" was adopted to determine the priorities and areas for the further development of the utilities sector in the Republic of Azerbaijan, and the Roadmap has defined the strategic vision for 2020, the long-term vision for 2025 and aspirational vision for post 2025.[120].

The energy efficiency of residential and non-residential buildings constructed in Baku over the past 20 years has been verified, energy audits have been conducted and violations of regulatory requirements have been identified in 95 new high-rise buildings, i.e., residential buildings. The use of Alternative and Renewable Energy Sources in the vast majority of residential buildings, unfortunately, is non-existent.

In general, in order to reduce GHG emissions in this sector, it is considered expedient to intensify activities in the following areas:

Supply of relevant equipment to individuals and legal entities that are not equipped with control and measuring devices in energy use systems;

Apply energy-saving technology in the central heating system, modernize equipment.

6.1.4. Industrial sector

According to the State Statistics Committee (SSC), oil, gas and ore mining have largest share in the mining and processing industry. In fact, about 70 percent of industrial production is formed in mining and 25 percent in processing. According to the SSC, the largest production in the mining industry is crude oil. The rest is the production of commercial gas, iron, copper, as well as precious metal ores. While in the refining industry structure, more than 33% accounts for the production of petroleum and chemical products. In fact, **the biggest damage to the environment in the country is caused by companies operating in the oil and gas sector**.

At the same time, in order to comply with European standards on harmful substances released into the atmosphere, the Technical Committee on Ecology, composed of representatives of other governmental and non-governmental organizations, has developed 53 ISO standards on environmental management, air, water and land taking into account the requirements of the "Rules for recognition and application of international (regional) and interstate standards, norms, rules and recommendations in the Republic of

[119] http://eco.gov.az/az/1142-iqlim-deyismeleri

[120] http://iqtisadiislahat.org/store//media/documents/SYX/Kommunal_xidm%C9%99tl%C9%99rin_inki%C5%9Faf%C4%B1na_dair_Strateji_Yol_X%C9%99rit%C9%99si_.pdf

Azerbaijan". To date, 11 national ISO standards on harmful substances released into the atmosphere have been developed in accordance with European standards.

It is to note that SOCAR is the only state company engaged in oil and gas refining in Azerbaijan. SOCAR, the Ministry of Emergency Situations of the Republic of Azerbaijan, the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan have received international loans to clean-up crude oil-contaminated soils and implement environmental actions. For example, in 2008, the Government of Azerbaijan and the World Bank (WB) implemented the "Clean-up of Oil Polluted Land in Absheron Peninsula" project. The World Bank has allocated $ 164 million for this project. There is need to arrange and implement new projects in this area.

Furthermore, the law requires each mining company to allocate funds from its budget for the disposal of waste released into the environment. Information on these costs is available only in SOCAR's "Sustainable Development" reports.

Unfortunately, it is difficult to get detailed information about the activities of other companies in this direction. BP-Azerbaijan and SOCAR rank first in the list of companies fined by the Ministry of Ecology and Natural Resources. But this does not mean that other companies cause less harm to the environment. In particular, onshore operating companies are subject to very small fines.

In addition, significant funds have been allocated from the state budget and international loans for waste disposal, a number of projects have been implemented, and even the "Year of Ecology" has been declared. However, as seen from the reports of both the SSC and the oil companies that the amount of waste has increased even more. In particular, the figures for 2016 are deplorable. In fact, the fire that broke out on December 4, 2015, at the deep sea platform No. 10 of the Gunashli oilfield of the State Oil Company of the Republic of Azerbaijan (SOCAR) and lasted for several months had negative impact on this indicator.

Monitoring and assessments by varied agencies and experts in areas, which are at risk of environmental impacts by oil projects, confirm that the environment is exposed to the following impacts during production:

Emissions into the atmosphere (associated gases - methane, volatile organic compounds, gas combustion, etc.);

Use of water in well equipment and compressor stations, discharge of pollutants from washing into surface and ground water, including into the Caspian Sea;

Extraction of highly mineralized formation waters with oil;

Soil contaminations by oil and oil products;

Drilling slurry and their burial;

Oil spills of accidents;

Decommissioned technical equipment, floating equipment debris and solid waste generated from repair and construction works.

6.1.5. Agricultural sector

As it is known, 85% of the developing countries in the world now focus on mitigation measures in agriculture and land use, other land use and forestry sectors to reduce GHG emissions. In addition, more than 30 countries around the world have stated in their Nationally Determined Contributions that they will achieve their commitment to reduce GHG emissions through the establishment of **Climate Smart Agriculture**. As it is known, FAO provides relevant technical, research and other support in this field, as the result of necessary funding and exchange of experience, high achievements are made, as well as the sustainable development goals are implemented. There is great need in the Republic of Azerbaijan to expand the transition to **Climate Smart Agriculture**.

As noted, the "**Strategic Roadmap for the Production and Processing of Agricultural Products in the Republic of Azerbaijan**" [121] approved by the Decree of the President of the Republic of Azerbaijan No. 1138 dated December 6, 2016, measures have been planned for 2016-2020 to reduce the negative impact of climate change and other natural factors on agriculture, reduce carbon emissions in the agricultural sector, establish forest shelterbelts and other relevant measures to develop environmentally friendly agricultural production in the country.

At the same time, Action Plan 7.2.2 of the Strategic Roadmap Action Plan (Reduction of carbon emissions in the agricultural sector) directly states that, in 2016-2020, the promotion of the methane gas collection from manure and its use as renewable energy will be considered through carbon emission reduction measures in crop farming and livestock husbandry. In recent years, a number of government agencies, including the Ministry of Ecology and Natural Resources (MENR), have launched pilot projects on the use of biogas plants, as well as awareness-raising measures to prevent the burning of agricultural waste, which resulted in relative decrease in the growth rate of emissions. For example, 1 MW biogas thermal power plant at the Gobustan landfill has already been constructed and commissioned in September 2011. However, unfortunately the significant involvement of the private sector in the utilization of methane gas in the relevant sector with the widespread use of biogas plants has not been achieved. This is reasoned by the lack of the necessary regulatory framework, which would include financial incentives for the transition to appropriate green technologies. At the same time, it is due to the weak awareness raising and promotion of relevant successful projects in this area.

Barriers to technology, which are generally considered priority in the agricultural sector, can be classified as follows:

Type of barriers	Barriers
Development of new climate change-resistant crop varieties	
Economic/financial barriers	- Limited access to available funds due to the lack of financial market formation - Poor access to foreign markets, especially by small and medium enterprises - High price of seeds - Expensiveness of feasibility studies
Political/regulatory barriers	- Lack of any special financial assistance mechanism to promote the introduction of new crop varieties
Information/capacity potential barriers	- Insufficient capacity potential of research institutes - Weak opportunities to expand agricultural production - Low level of awareness in the field of economic and environmental advantages
Social barriers	- Lack of knowledge on new technology
Application of wind protection technology	
Economic/financial barriers	- Poor access to affordable funds - Poor access to markets - Lack of financial support for research and development institutions
Political/regulatory barriers	- Lack of any special financial assistance mechanism to promote the application of wind protection technology
Information/capacity potential barriers	- Weak capacity potential of relevant sectoral research institutes - Low level of awareness about economic and environmental benefits
Social barriers	- Lack of knowledge on new technology
Development of water-saving technologies	
Economic/financial barriers	- Poor access to available funds - High investment costs
Political/regulatory barriers	- Lack of market-based pricing mechanism for the use of water from irrigation systems
Technological barriers	- Lack of technological knowledge and skills

[121] http://iqtisadiislahat.org/store//media/documents/SYX/strateji_yol_xeritesi_kend_teserrufati_mehsullarinin_istehsalina_ve_emalina_dair.pdf

Type of barriers	Barriers
Information/capacity potential barriers	- Insufficient awareness of economic and environmental benefits
Social barriers	- Lack of knowledge on new technology - Small parcels
Application of traditional cultivation technologies	
Economic/financial barriers	- Poor access to available funds - High investment costs - Expensiveness of feasibility studies
Political/regulatory barriers	- Lack of any special financial assistance mechanism to promote the use of traditional cultivation technology
Technological barriers	- Poor access to agricultural machinery
Information/capacity potential barriers	- Weak expansion of agriculture - Low level of awareness about economic and environmental benefits
Social barriers	- Lack of knowledge on new technology - Dominance of small parcels of land

Table 6-1. Priority technologies and barriers in the agricultural sector

In addition, the main barriers to the implementation of measures to reduce GHG emissions in this sector are:

1. Climate change mitigation and adaptation issues are not included in all development programs and key regulatory documents of the sector;
2. Failure of the state bodies responsible for the area (Ministry of Agriculture of the Republic of Azerbaijan) to inform the public and relevant agencies about mitigation actions and their effects in order to reduce GHG emissions and to create a single database on these actions;
3. Lack of specialized structure, highly qualified personnel responsible for climate change in the state bodies responsible for this field (Ministry of Agriculture of the Republic of Azerbaijan, including the Agrarian Science and Innovation Center[122], and other knowledge institutes subordinated to it);
4. Lack of training of specialists on climate change at the Azerbaijan State Agrarian University, the main higher education institution for training in the agricultural sector, non-inclusion of preliminary information in curricula on climate change mitigation, adaptation, GHG inventory methodologies in this area;
5. Low level of awareness on innovative farming methods to mitigate climate change impacts in agriculture, on modern technologies in the country, non-use and promotion of Climate Smart Agriculture (CSA)[123] and other green agricultural practices on climate change mitigation and adaptation methodologies;
6. Despite the large potential, many farms do not collect methane gas from manure generated in the production process and use it for energy purposes, and there is little awareness of private sector on this issue;
7. Insufficient promotion of information on the purchase and installation of appropriate equipment for the combustion of biomass and other fuel wastes, as well as the use of other alternative and renewable energy sources in agriculture, and the lack of financial and credit incentives in the country;

[122] http://aeim.gov.az/az/pages/2/4
[123] http://www.fao.org/climate-smart-agriculture/en/

8. Insufficient involvement of the private sector in climate change mitigation measures, including in the issues of creation, renewal and preservation of land protective belts, and poor awareness of the socio-economic significance of these measures, along with their climate change importance.

6.1.6. Waste sector

Although the policy documents on the waste sector, which are listed in the previous sections, contain provisions to some extent regulating the GHG emissions from the waste sector, a number of laws and regulations do not contain articles that make these provisions necessary. In this regard, the following gaps have been identified and the following are proposed to eliminate them:

1. Increase the number of separate containers for recyclable basic products such as glass, paper, plastic, metal and organic (compostable) food waste at waste collection points;
2. Increase the number of visual explanatory boards for proper waste disposal at waste collection points;
3. Avoid the mix of solid wastes in the process of sorting, separate transportation and subsequent management;
4. Ensure certain necessary individual capacity-building of human resources working in management;
5. Audit of waste collection and disposal points;
6. Organize pre-planned monitoring of waste collection, removal and disposal services;
7. Assess environmental and human health impacts of waste management improvement projects;
8. Ensure that the areas allocated for landfills meet the minimum requirements and redefine these requirements;
9. Draft periodically waste standards for landfills;
10. Ensure that waste is used and disposed of to their sources as closely as possible in environmentally sound manner;
11. Determine the rate of liquid and solid waste generation for each region and settlements of different status;
12. Dispose only those wastes at landfills that are not suitable for use or ensure their incineration at appropriate facilities;
13. Develop control mechanism on gasses emitted from wastes;
14. Prevent fires, odors, dust, wind-blown wastes at all stages of waste management.

In view of the above, the following action plan can be proposed to reduce GHG emissions from the waste sector:

No.	Areas	Actions
		i. Capacity building for solid household waste reduction
1.	Improve solid household waste management legislation and policies	1.1. Assess the impact of waste management improvement projects on the environment and human health; 1.2. Audit waste collection and disposal sites from GHG management point of view; 1.3. Arrange pre-planned monitoring of waste collection, removal and disposal services; 1.4. Draft Permissible Waste Standards for waste landfills on periodic basis and include GHGs in these standards; 1.5. Ensure that the sites allocated for landfills meet the minimum requirements and define these requirements; 1.6. Place in landfills only wastes that are not suitable for use or ensure their incineration in relevant facilities; 1.7. Determine the rate of liquid and solid waste generation for each region and settlements of different status; 1.8. Develop appropriate mechanism to control emissions from waste masses, including GHGs.
2	Enhance institutional	2.1. Increase the number of separate containers for recyclable basic products such as

	capacity for solid household waste management	glass, paper, plastic, metal and organic (compostable) food waste at the waste collection points; 2.2. Increase the number of visual explanatory boards for proper waste disposal at collection points; 2.3. Ensure separation of solid waste, separate transportation, prevention of mixing in subsequent management processes; 2.4. Use and utilize wastes as close as possible to the source of their generation by environmentally proved methods; 2.5. Prevent fires, odors, dust, wind-blown wastes at all stages of waste management
3.	Develop individual capacity for solid household waste management	3.1. Ensure that human resources working in management have certain individual capacities; 3.2. Include solid household waste management topics in curricula for the training of specialists in ecology, management, urban management, municipal work and other relevant fields
	ii. Practical activities to reduce GHG emissions from solid household waste	
1	Implement pilot projects on sorting of household wastes at their source in the districts and cities of the country	
2	Implement pilot projects on preparation of compost from household waste	
3	Ensure separate transportation of sorted wastes from households and other facilities	
4	Implement public awareness programs in waste sorting and primary processing	
5	Policy and legislation on waste management should include the use of clean technologies, in particular the reduction of greenhouse gases and waste recycling obligations	
6	Allocate special places for waste of different types (glass, metal, paper, plastic, etc.) in landfills in districts and cities of the country	
7	Clean and rehabilitate landfills that pose greatest risk to the environment	
8	Install clean technologies for recyclable waste (paper, plastic, glass)	
9	Take into account the phase of reducing GHGs emissions in the integrated waste management system	

Table 6-2.

6.1.7. Forestry sector

As it is known, 95-97% of the toxic gases emitted into the atmosphere are carbon dioxide, the main removals and decontaminants of which are sea and ocean waters, forests and greenery. According to statistics, one hectare of normally dense forest area absorbs 220-280 kg of carbon dioxide per day and purifies the atmosphere by converting about 2/3 of it into oxygen. 1 ha of forest area can filter and neutralize 70 tons of dust released into the environment in one year. It is no coincidence that the UN International Conference on Environment and Development (1992) in Rio de Janeiro also discussed the prevention of and protection against mass deforestation and identified key principles for sustainable forest management.

It is also an undeniable fact that large-scale macro-disturbances that occur daily in the forest ecosystem, i.e., illegal cut of trees, occur during forest fires and natural disasters. Such natural disasters include storms, hurricanes, floods, volcanic eruptions, mass outbreaks of insect pests, and so on. Therefore, the European Commission initiated an international conference in St. Petersburg in 2005 with the participation of environmental ministers from 44 countries in which ENPI FLEG: European Neighbourhood and Partnership Instrument- Forest Law Enforcement and Governance Program was adopted. Reflecting the current environmental problems of the forest sector, the Program aims to address complex issues such as the prevention and sustainable management of illegal cutting of forests. **The Forest Awareness component is also included as a key component in this Program, in which the Republic of Azerbaijan also participates.**

At present, Article 308 and other articles of the Criminal Code of the Republic of Azerbaijan, as well as the Forest Code of the Republic of Azerbaijan[124] (approved by the Law of the Republic of Azerbaijan "On

[124] http://www.e-qanun.az/alpidata/code/data/0/c_c_5.htm#_edn1

approval of the Forest Code of the Republic of Azerbaijan" No. N424-IQ dated December 30, 1997) against illegal logging in the Republic of Azerbaijan and other normative acts provide for specific preventive measures against illegal logging. On the other hand, the new leadership of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan has significantly strengthened control over forest areas within the framework of successful reforms in the Ministry. However, crimes and abuses in this area, unfortunately, still occur on large scale, and there is lots of materials about it in the media.[125]

If such illegal logging is not prevented in time, the country can face the threat of severe environmental disasters, the expansion of erosion process, the growth of steppe areas, floods and landslides in mountainous areas, avalanches, drying up of springs and rivers. Therefore, there is need to strengthen public control and expand awareness in key areas for solution of forest problems. It is known that logging of forests can cause torrents and floods, which are more dangerous for both vegetation and people after a certain level.

In general, the current direct negative impacts on forests and flora in the Republic of Azerbaijan occur in the following forms:

mass logging of forests;

forest fires;

logging of forests to create economic infrastructures (construction of reservoirs, processing of minerals, creation of industrial complexes, expansion of agricultural and livestock farms);

some negative impacts accompanied by the development of tourism.

Examples of indirect impacts include air and water pollution resulted from anthropogenic impacts, changes in environmental conditions by the use of mineral fertilizers and pesticides. It is no coincidence that, for example, many years of research and the historical richness of vegetation have proved that the Batabat Mountains in Nakhchivan were formerly high-bonitat forests. At that time, the Nakhchivan River had constant flow of water. At the same time, the continental climate along the Araz river was caused by logging of trees and deforestation in the surrounding areas. Seasonal floods have been known in the Kura and Araz rivers since ancient times.

Furthermore, logging of forests, even for sanitary purposes, without taking into account the main characteristics of the soil (slope, physical composition, hydrological properties, etc.) can significantly reduce the productivity of the ecosystem. Destruction of the forest floor (the forest floor protects the mineral layer of the soil from being washed away by water), soil compaction and structural damage cause erosion. Erosion loss due to logging of forests can be 15 t/ha per year, and soil erosion resulted from construction of new settlements can be 95 t/ha. In intact natural forests, this figure is 0.04 t/ha. In general, logging in a certain part of the forest causes increase in temperature and humidity in the upper layers of the soil. This accelerates the decomposition of the forest floor, wood remains and the top humus layer of the soil by microorganisms.

In fact, logging of forests has crucial negative impact on nearby agricultural lands, fisheries, groundwater levels and the microclimate. At the same time, inefficient economic activity does not allow for strong projections. Because in this case, the use of land in a particular region depends on economic benefits.

In this regard, the study of forest cover, especially mountain forests, the implementation of comprehensive system of measures to prevent, restore and increase their illegal logging, and to raise awareness of the population through the mass media are of great importance in the Republic of Azerbaijan.

In general, opinion polls through various media outlets can be an effective source of information for assessing the situation when making important decisions in the field of environment and forestry. In fact, varied meetings, discussions, written and oral proposals draw the public attention to important

[125] https://milletinsesi.info/article/az/144261

issues. Problematic issues are discussed between the parties in the form of consultations and workshops. One of the actual issues is to increase the control of civil society institutions and the population over these issues through cooperation. From this point of view, strengthening the activities of the public council and other forms of public participation under the Ministry of Environmental Protection of the Republic of Azerbaijan could be beneficial.

Furthermore, in order to reduce emissions in this sector, it is considered expedient to intensify activities in the country in the following areas:

Rehabilitation of forest openings, protection from pests;

Establishment of forest areas on degraded and unsuitable for agriculture lands;

Creation of new parks, gardens and other green areas.

6.2. Current situation on Measurement, Reporting and Verification (MRV) System in the country

The Republic of Azerbaijan signed the Paris Agreement on April 22, 2016 and ratified it on October 28, 2016. In this regard, the Republic of Azerbaijan must fulfill its obligations under the **Nationally Determined Contribution (NDC)** [126] and control the sources of harmful substances released into the atmosphere. It is also necessary to identify and implement appropriate measures to significantly reduce emissions. There are very important requirements for the development of a local MRV system in Azerbaijan to support these issues, approve emission reductions and verify the effectiveness of strategic actions. The aim is both to support national development and to ensure compliance with the Paris Agreement. In fact, the effective establishment of the MRV system plays a fundamental role in meeting the transparency requirements referred to in Article 13 of the Paris Agreement and is the starting point for Capacity-building Initiative for Transparency.

At the 21st Conference of the Parties in Paris in 2015, the Republic of Azerbaijan submitted the INDC document to the UN Framework Convention on Climate Change to support the adoption of a new Global Agreement on climate change to be applied to all Parties.

The INDC document also outlines the Measurement, Reporting and Verification (hereinafter referred to as the ‘MRV’) sectors and measures to mitigate the effects of climate change in order to reduce greenhouse gas emissions. It is to note that the Republic of Azerbaijan is a developing country and these efforts will place an additional financial burden on the country’s economy and will need support. Existing global/regional incentives to support the reduction of GHG emissions will be more accessible when a functional MRV system is operational in the country and will provide credibility for climate change mitigation measures and for the resulted emission reductions. As it is known, MRV is applied in the following areas:

MRV of Emissions - MRV of Emissions is the concept of measuring, reporting and verifying emissions at national, regional, sectoral or enterprise levels;

MRV of mitigation actions - MRV of mitigation actions is the concept of measuring, reporting and verifying the impacts of mitigation policies and actions;

MRV of financial support - the concept of the MRV of financial support can vary significantly depending on the type of support (financial flows, scientific and technology transfers, capacity building and their impacts).

[126] http://eco.gov.az/az/1142-iqlim-deyismeleri

6.2.1. Reporting on emissions and mitigation actions

The Republic of Azerbaijan has a system for monitoring and reporting on pollutants released into the atmosphere, as well as an administrative structure with specific requirements for limiting air pollution. However, there is still a need to improve this structure and its implementation, and there have been no focus on greenhouse gases in this. Emissions, including monitoring and reporting of greenhouse gas emissions, are implemented annually by the relevant enterprises themselves. The Department of Environmental Protection of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan, as well as regional offices analyze and verify the information provided by these enterprises on behalf of the Ministry. These enterprises submit annual reports on this area to the State Statistics Committee of the Republic of Azerbaijan.

Line code	Contaminants	Pollutants released into atmosphere (tons)	
		in the reporting year	in the previous year
A	B	1	2
201	Carbon dioxide (CO_2)		
202	Nitrogen oxide (N_2O)		
203	Methane (CH_4)		
204	Hydrofluorocarbons (HFC)		
205	Sulphur hexafluoride (SF_6)		
206	perfluorocarbons (PFC)		

Table 6-3. GHG Emissions section of the Statistical Report Form No. 2-TG (air-transport) compiled by entities on pollutants emitted into the atmosphere

Furthermore, in order to create accountability for mitigation actions, for the first time in the country in the process of preparing the 4th National Communications, a special table format was developed to receive detailed information from enterprises on relevant GHG emission reduction actions and modeling in the LEAP software and was submitted to relevant government agencies through the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan:

1	Name, detailed description, purpose of mitigation action, implementing agency, stages of action
2	Features of mitigation action, economic area(s) and region(s) covered in the Republic of Azerbaijan
3	Status of mitigation action (implemented, ongoing, adopted but not yet started)
4	Period covered by mitigation action (indicating start and final years in stages)
5	Volume of GHG gases (Carbon dioxide (CO2), Methane gas (CH4), Nitric oxide (N2O)) reduced by mitigation action
6	What stages of mitigation action have been implemented, what are initial results, what financial source has been used (government support or donor projects, etc.)
7	In current mitigation action status, what types of GHG emissions have been reduced and to what extent (in CO_2 equivalent)?
8	Other socio-economic effects of mitigation action

Table 6-4. Table format for collecting data on mitigation actions

6.2.2. Pilot application of MRV system

An example of the effective establishment of the MRV system in the country from the stakeholder's viewpoint is the system of measurement, reporting and verification established by SOCAR internally. The SOCAR's existing MRV system consists of 3 stages:

- SOCAR structural units prepare reports on atmospheric emissions;
- SOCAR Ecology Department holds monitoring at these structural units and prepares monitoring report in this regard;

- After that, the evaluation (audit) body contracted by SOCAR conducts independent monitoring and prepares and submits final report, which is further included in the Company's sustainable development report.

6.2.3. Legal framework and economic instruments

The "Polluter Pays" principle is applied in the Republic of Azerbaijan. In this widespread practice, those who cause pollution are expected to cover these costs in order to prevent harm to human health or the environment.

The main document regulating the economic mechanism of the "Polluter Pays" principle is the "Guidelines on the application of payments for natural resources, payments for the release of pollutants into the environment and the use of funds generated from these payments" which was approved by the Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 122. dated March 3, 1992 (the last amendment to the Resolution was made in 2008). This Resolution defines the rules for payments for natural resources, payments for the release of pollutants into the environment and the use of funds generated from these payments. The Guidelines apply to 88 different pollutants. Although major greenhouse gases are not included in the list of these pollutants, some precursor gases, such as carbon monoxide and nitrous oxide, are included in the list.

Due to the small amount of payments, many companies are not interested in emission reduction actions. For example, under normal conditions, the payment for 1 ton of sulfur dioxide is from 0.26 to 1.32 manat (depending on the location of the enterprise). If the emission is due to an accident or exceeds the permissible emission level, then the payment will be 10 times higher (for example, if the emission is sulfur dioxide, the payment will be from 2.6 to 13.2 manats).

According to the Law of the Republic of Azerbaijan "On Protection of Atmospheric Air", each enterprise with stationary sources of harmful substances (carbon dioxide is not considered as harmful substance) needs to obtain special permit for the release of harmful substances into the atmosphere from the State Expertise Office of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan. The special permit document sets emission limits measured in tons/year or grams/second for businesses. The validity period of special permit for the release of harmful substances into the atmosphere is 3 years. There are 4 types of payment for this permit: 99 manat, 189 manat, 297 manat and 396 manat. The payment amount varies depending on the amount of harmful substances and the production nature of enterprise.

The main supervisory body for environmental pollution of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan is the Department of Environmental Protection. The Department of Environmental Protection was established in 2001 by the relevant order of the Ministry of Ecology and Natural Resources. The Department is the authorized body supervising the implementation of the legislation of the Republic of Azerbaijan in the field of environmental protection in the territory of the Republic of Azerbaijan and in the enterprises of Azerbaijan and foreign countries in the waters of the Caspian Sea belonging to the Republic of Azerbaijan.

According to the Law of the Republic of Azerbaijan "On Suspension of Verifications in the Field of Entrepreneurship", all verifications, including verifications in the field of environment, were suspended from 2015 to 2021. This Law was adopted to stimulate the development of entrepreneurship. In practice, however, this highly humane law "encourages" some irresponsible entities to disregard environmental legislation, which can lead to greater costs as well as greater problems.

In accordance with the relevant legislation of the Republic of Azerbaijan, each enterprise with stationary sources of harmful substances released into the atmosphere shall submit an official statistical report on air protection to the district statistical office by January 25 of each year (after approval by the

Department of Environmental Protection and its regional offices) or submit the report electronically online (real time). The second section of the report is about greenhouse gases.

Monitoring and reporting of harmful substances released into the atmosphere, including greenhouse gases, is conducted annually by the enterprises themselves. Monitoring usually does not include actual measurements. The Department of Environmental Protection and its regional offices analyze and verify the information provided by these enterprises on behalf of the Ministry of Ecology and Natural Resources. As for the reporting part, enterprises submit relevant information to the State Statistics Committee annually.

According to Article 239 of the Code of Administrative Offenses of the Republic of Azerbaijan, officials are involved in penalization from two thousand five hundred manats to three thousand five hundred manats for failure to conduct environmental monitoring in enterprise (production) or to record and report on the impact of environmentally hazardous economic activities on the environment, while legal persons are involved in penalization from eight thousand five hundred manats to ten thousand manats.

6.2.4. Existing gaps and opportunities in MRV system

Along with contributing to global climate change mitigation initiatives, the Republic of Azerbaijan, as a developing country, is also interested in participating in varied financial mechanisms to increase its contribution to the global response to climate change.

The Republic of Azerbaijan fully understands the importance of establishing proper and reliable MRV system in the country to ensure international confidence in actions to mitigate climate change at the national level. In order to build an effective and nationally acceptable MRV system in the country, a strong institutional framework must be developed, covering the relevant institutional institutions, as well as the necessary staff, systems and processes.

Like many other countries, the Republic of Azerbaijan has little experience with relatively new international MRV systems, and therefore the country has some gaps and barriers that need to be addressed. Large-scale actions are required to raise awareness in this regard. In order to understand the field at all levels, it is necessary to pay attention to awareness by conducting trainings in enterprises and facilities and providing user-friendly instruction manuals. The reason for the private sector's lack of confidence in the UN Framework Convention on Climate Change is the pessimistic experience gained from previous experience and mistakes in the Clean Development Mechanism, as well as the Nationally Appropriate Mitigation Actions (NAMA), Nationally Determined Contributions (NDC), and Limited knowledge of Monitoring, Reporting and Verification (MRV).

In addition, with a good database available, the business opportunities of reliable MRV system can be supported by the private sector. All of this will require a great deal of training effort to change the approach and clarify the importance of business opportunities.

The analysis identified the following key gaps and barriers to the development of the MRV system:

Lack of skills capacity - limited awareness of the economic and environmental benefits of the technology, which will create difficulties in structuring the new MRV system. There is little experience with the Clean Development Mechanism, NAMA, NDC, as well as Monitoring, Reporting and Verification (MRV).

Awareness-raising gaps - lack of knowledge on new technologies will be a barrier, so preference will be given to the use of socially accepted traditional methods in energy consumption and other areas. Preference will be given to the use of socially accepted traditional methods in these areas. It is likely that many stakeholders will view the MRV system only as a control and financial instrument of the central government, while the potential benefits of the system may be ignored.

Economic and financial gap - A number of barriers exist to the introduction of the MRV system, including high investment costs, long payback periods, inadequate financial initiatives, and low energy tariffs. Given such barriers in the country, it is important to establish a cost-effective MRV system, otherwise it will not be a priority.

Technology gap - The knowledge of new technologies in the Republic of Azerbaijan, including in research institutions and suppliers is limited. This can play a limiting role in the process of structuring and building a new advanced MRV system.

6.2.5. Plans for implementation of emerging MRV system

It is planned to introduce a reliable MRV system in the Republic of Azerbaijan in the coming years. Within the framework of aligning the legislation of Azerbaijan with the legislation of the European Union (EU), EU trade scheme is proposed to be the basis of the emerging national MRV system.

The emerging MRV legislations of non-EU member states (e.g., Turkey) as well as the possibilities of market mechanisms based on the national MRV system will be taken into account, and experience in this area will be studied.

Studies show that if enterprises are prioritized, it is initially expected that up to 70 larger enterprises will operate under the MRV system. The distribution of enterprises intended to operate under the MRV system by MRV sectors is shown in the following table:

ACTIVITY TYPE	SUB-ACTIVITY TYPE	NUMBER
Fuels combustion (heat capacity> 20 megawatts)	Electricity power plant (natural gas based)	13
	Sugar production	1
	Beer production	1
	Natural gas pipeline Compressor stations	4
	Other (solid waste incineration plant)	1
Mineral oils refining	Mineral oil refining plant	1
Metal industry (heat capacity> 20 megawatts)	Iron/steel production (electric arc furnaces, hot/cold rolling, smelting, etc.)	1
	Aluminum manufacturing	1
Mining industry	Cement clinker manufacturing	3
	Glass / glass fiber manufacturing	7
	Ceramics manufacturing	1
	Bricks/tiles manufacturing	23
	Gypsum products manufacturing	6
Paper industry	Paper or cardboard manufacturing	2
Chemical industry	Production of petrochemicals and other bulk chemicals	1
Acid manufacturing	Nitric acid manufacturing	1

Table 6-5. Number of enterprises planned to operate under MRV system

6.2.6. Reliable MRV system principles

- **Completeness**. To establish MRV system, monitoring and reporting for an installation shall cover all process and combustion emissions from all emission sources and source streams.
- **Consistency**. Monitored and reported emissions shall be comparable over time, using the same monitoring methodologies and data sets.
- **Transparency**. Monitoring data, including assumptions, references, activity data, emission factors, oxidation factors and conversion factors shall be obtained, recorded, compiled, analyzed and documented in a manner that enables the reproduction of the determination of emissions by the verifier and the competent authority.

▪ **Cost effectiveness.** Monitoring and reporting of emissions shall aim for the highest achievable accuracy, unless this is technically not feasible or will lead to unreasonably high costs.

However, there is a lack of experience and information to set up and manage such an MRV system. The following shortcomings have been identified for the development and application of the MRV system in the Republic of Azerbaijan:

▪ Lack of institutional capacity in relevant ministries and Azerbaijan Accreditation Center;

▪ Lack of experience and knowledge of enterprise operators;

▪ Lack of experience and knowledge of employees to conduct verification activities;

▪ relevant gaps in the legislation (including those related to accreditation standards);

▪ Lack of templates, norms and patterns.

Based on the above information, the following steps have been identified to develop national capacity, prepare and implement legislation in conjunction with relevant programs and other donor activities in the Republic of Azerbaijan:

Step 1: Stakeholder identification and preparation level survey

It is necessary to conduct a survey to determine the list of stakeholders, including those that will provide information on greenhouse gas emissions into the atmosphere through the MRV system. A survey should be planned and conducted to identify the list of stakeholders and their contact details in order to effectively take the following capacity building steps. It is also important to conduct needs assessment surveys.

Step 2: Study the gaps in relevant legislation and development of legislation in this area

Necessary activities should be implemented to establish an appropriate national system for the application of the national MRV system at the emerging level, in accordance with the requirements of best international practices and standards. Legislative activities include comprehensive legal, technical and institutional analysis of the current national situation, the development of relevant alternatives to the system, implementation plan for these alternatives and the selected alternative, including an analysis of costs, responsibilities and timeframes, and determine the relevant legal provisions for the application of national MRV system.

Step 3: Work out norms and templates

Templates should be developed for monitoring, reporting and verification, national emission report, monitoring, reporting and verification norms, samples related to the MRV sector and templates on other technical standards so that all stakeholders can implement their work in a standardized and unhindered manner. Accreditation standards for verification bodies, as well as individuals and legal entities, should be developed to implement the accreditation process. The list of proposed norms is given below:

▪ **General guidelines for measurement and reporting**: this is an explanatory instruction addressed to the reporting entity which concern the period of compliance with norms, implementation period, duties and responsibilities, general concept and monitoring and reporting approaches, data flow and uncertainties, calculations and monitoring of greenhouse gas emissions and related reporting;

▪ **Examples of MRV calculations by sectors**: this is a comprehensive explanatory guide with step-by-step instructions on how to monitor and report greenhouse gas emissions for each sector to be involved in the MRV;

▪ **Guidelines on verification and approval of greenhouse gas reports**: this explanatory instruction is related to the independent verification bodies that will operate under the MRV system. These Guidelines will provide detailed information on the pre-contract phase of the verification process, verification preparation (strategic analysis and risk analysis and preparation of verification plan), comprehensive verification, elimination of inconsistencies and errors, final decision on the verification results, preparation and submission of independent analysis and verification report;

- **Online MRV System Guidelines**: This guide will focus on step-by-step instructions on how to use the online MRV system, including monitoring plans for enterprises and verification bodies, and how to prepare and submit annual emission, improvement, and verification reports.

The list of suggested templates is given below:

- Monitoring plan for enterprises
- Annual report on greenhouse gas emissions
- Improvement report
- Verification report
- Information exchange

Step 4: Training and capacity building activities for relevant stakeholders

It is very important to involve all participants in the monitoring, reporting and verification of atmospheric emissions. Capacity building activities should be implemented, practical training and on-the-job training should be provided, and relevant government agencies, as well as enterprises, verification bodies and other stakeholders that will monitor and report on greenhouse gas emissions, should be targeted.

The training should focus on providing practical information on how to reliably apply the MRV system at the primary level. International knowledge and best practices should also be provided to national stakeholders.

The list of proposed trainings by sectors is given below:

- MRV sector monitoring and accountability trainings:

–Electricity power sector;
–Combustion and glass sector;
–Processing sector;
–Cement sector;
–Lime and sugar sector;
–Combustion, automobile and chemical sector;
–Ceramics and gypsum sector;
–Brick (refractory), tile sector;
–Cellulose-paper sector;
–Iron, steel and casting sector.

- Training on verifying greenhouse gas emission reports
- Training on metrology and uncertainty assessment
- Training on accreditation of verification bodies

Step 5: Develop online MRV data management and reporting platform

Information on GHG emissions, as well as other pollutants that require monitoring, can be processed through an environmental information management system. Through this platform, businesses can manage their monitoring plans and reports electronically, and this system simplifies the evaluation process.

The following components of the online MRV system have been identified:

- monitoring plan: this component will allow the enterprise to develop and submit monitoring plan;
- Emission reports: this component will enable the enterprise to prepare and submit an emission report based on approved monitoring plan;
- verification component: this component will allow the verification body to receive and verify the annual emission report and prepare and submit the verification report;
- administrative component: this component will allow the competent authority to approve monitoring plans, to review and approve the verified and submitted emission reports, obtain statistical information (number of enterprises, number of verified issues, list of employees who conducted verification, etc.) and can control the increase or decrease in total emissions.

Step 6: Study on alternatives on market mechanisms

The roadmap on the application of market mechanisms should be analyzed. Reports and workshops are necessary to thoroughly review the relevant design elements to be decided when establishing market mechanisms. This study should take into account the risks and opportunities associated with different types of market mechanisms or payment mechanisms for carbon emissions.

The main components of the discussion and research were identified as follows:

- the process of accepting a payment instrument for carbon emissions;
- preparatory work;
- use of models to analyze technological and economic impacts;
- defining of volume and dynamics;
- reduction or prevention of undesirable effects;
- decision-making on the use of state revenues;
- control and observation;
- evaluation of results.

Different design alternatives for each of these elements should be discussed based on international experience.

6.2.7. Performance Period

The proposed deadline for the implementation of activities is given below. Knowledge and expertise from national, regional and international experience should be transferred for reliable and effective implementation of the activities proposed in this chapter. The country needs to obtain the necessary funding to develop and implement these activities.

Activity	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Survey to identify stakeholders and determine the level of readiness												
2. Study on gaps in legislation and development of legislation												
3. Development of norms and templates												
4. Training and capacity building activities for relevant stakeholders												
5. Development of online MRV data management and reporting platform												
6. Study on alternatives on market mechanisms												

Table 6-6.

6.3 Financial, technical and capacity requirements

During the reporting period, GIZ, with the support of the World Bank and the Asian Development Bank, conducted regional and national adaptation and mitigation training courses. Some experts were involved in training on the LEAP (Long-Range Energy Alternative Planning System) model applied by trainers at Stockholm Environment Institute (SEI) in mitigation area and SEI conducted two series of trainings on LEAP in 2019.

Furthermore, the EU's "Clima-East" project provided capacity building in the field of climate change, global climate change, and the exchange of activities on development of NAMA projects to mitigate climate change, and Nationally Determined Contributions (NDCs). The Academy of Public Administration under the President of the Republic of Azerbaijan, ADA University and the Education Center of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan held varied environmental trainings on climate change. Nevertheless, the country still needs support in mitigation actions analysis, GHG inventory, calculation of national emission ratios, and data management systems.

Climate change mitigation technologies include technologies to reduce greenhouse gas emissions across different sectors of the economy, such as energy-efficient technologies to reduce greenhouse gas emissions in residential and commercial areas, including technologies on use of renewable energy sources, technologies on efficient use of water and land, and forest and other natural resources and so on. One of the most important factors in determining actions in this area is conduct assessments on existing technologies for the implementation of actions, the need for additional technology, the amount of funds required, the source of funding (internal or external source), as well as the necessary knowledge and skills for implementation of such actions, new skills needed and the amount of external support needed.

As noted in detail in the climate change mitigation actions section of the current report, the Strategic Roadmaps adopted for Main Areas of the National Economy set medium- and long-term goals for each sector and define actions to achieve these goals. Measures to ensure sustainable development of low-carbon are among these actions, which involves the use of the latest technologies in the implementation of such measures.

For example, the country expands the use of modern, green technologies in the production and transportation of oil and gas products, cuts emissions from electricity generation, implements adaptation actions and other policies and measures. At the same time, in order to ensure the self-sufficiency of end users of alternative and renewable energy in the coming years, photoelectric power plants will be installed on the roofs of buildings which will be used to promote microelectric power generation, as the local production of this technology in the country. In the coming years, it is planned to apply the latest technologies in the construction of power plants on potential small rivers of the country. Furthermore, the production of LED lamps will be organized at enterprises located in Sumgayit Technology Park as part of the promotion of the use of efficient LED lamps in the utilities sector to obtain energy efficiency.

In order to ensure technical and environmental safety during passenger transport in the transport sector, the use of compressed natural gas (CNG) vehicles in public transport will continue in the coming years.

In the coming years, a number of actions will be taken to modernize and diversify industry, create new priority production areas, industrial parks, strengthen industrial capacity in the regions, and apply opportunities that will ensure the development of industry based on innovation and modern technologies.

In the waste sector, regional waste management centers based on modern technologies will be established in the country to achieve the goal of 100% waste collection in urban areas and 90% in rural areas by 2036.

The initiative to establish modern agro-parks in the agricultural sector will create opportunities for the proper use of resources, such as modern equipment, efficient use of information and communication technologies, cost minimization, environmental protection, efficient use of water and land resources. It is planned to apply the latest technologies for the collection and use of methane gas in these agricultural parks.

It is to note that after the accession of the Republic of Azerbaijan to the UN Framework Convention on Climate Change, a number of actions have been taken at the national level in recent years to fulfill the obligations arising from the Convention and great achievements have been made. Most of the actions taken to mitigate climate changes have been funded by the government. However, in the current economic environment and new challenges, it is necessary to take advantage of the existing financial mechanism for climate change to cover some of the billions of dollars required for the implementation of actions and for the application of the latest technologies from external funds. In this regard, cooperation with the Global Environment Facility, the Green Climate Fund, the Adaptation Fund and other financial funds will be expanded in the coming years, and the use of external financial resources will be a priority.

Under the UN Framework Convention on Climate Change, it is still important to implement a number of new actions in order to rapidly change existing mechanisms and develop more advanced measures, methods and approaches, and there is a great need to develop and update existing skills and competencies in the following areas:

Study more advance international practices in the field of climate change legislation and policy and improve them in accordance with the specific features of the country;

Establish local (in-country) system for Measurement, Reporting and Verification (MRV) and evaluation of future activities in this field;

Develop low-carbon sustainable development strategies at the national and local levels, as well as in relevant sectors;

Establish an early warning system for climate change to minimize potential losses;

Develop nationally appropriate and sectoral mitigations actions (NAMAs) to reduce GHG emissions, attract donors and implement them using varied mechanisms of the Convention;

Application of methodologies in 2006 IPCC Guidelines (at the sectoral level);

Further capacity building and awareness raising of local communities, the private sector, municipalities and other local authorities in the field of climate change.

The knowledge and skills required for the implementation of the proposed climate change mitigation actions are emerging as very important factor. In fact, the specialists of the agencies responsible for the implementation of planned activities must have necessary knowledge and skills about the new technologies applied.

There is a need to develop the knowledge and skills of specialists at the Ministry of Ecology and Natural Resources, Designated National Authority of the Republic of Azerbaijan for the United Nations Framework Convention on Climate Change (UNFCCC), as well as the Climate Change and Ozone Center under the Ministry, in order to more effectively coordinate efforts to mitigate climate change impacts. In this context, it is planned to develop the knowledge and skills of the staff in the Forest Department of the Ministry on climate change.

One of the important issues is the development of knowledge and skills of specialists working in the energy sector for efficient use of energy in various sectors of the economy and for reduction of energy consumption per unit of output. In general, in order to improve energy efficiency and energy saving in the country, it is necessary to implement actions (round tables, trainings and workshops, etc.) to develop the knowledge and skills of individual consumers, municipalities and local authorities.

Furthermore, there is an urgent need to raise awareness among the agricultural population and representatives of peasant farms about the impact of bioenergy sources, biogas plants and manure obtained on these farms on productivity.

Furthermore, it is to note that existing research institutes in the country should be actively involved in the study of technologies necessary for the implementation of climate change mitigation actions in the country. For this, their existing material and technical resources should be reinforced and the knowledge and skills of specialists working in this field should be developed.

6.3.1. Project proposals for funding

As the result of the stakeholder consultation process, project proposals for climate change mitigation and application of adaptation technologies have been identified as priority. The main criteria in selecting the most suitable project ideas were the feasibility of their implementation, compliance with the sector's development programs and sustainability of activity. At the same time, attention was paid to preventing duplication of project initiatives in the same sector. Through intensive consultations, the following project ideas on impact mitigation and adaptation technologies were selected as priority:

Projects to mitigate the impact of GHG emissions on climate change:

Project to monitor the integration of climate change issues into national policy, strategy, legislation and other guiding documents;

Project on implementation of educational and awareness-raising activities on climate change impacts;

Pilot projects for the establishment of the MRV system in enterprises and organizations that are the main sources of GHG emissions in the country and for awareness in the relevant field;

Training of experts in the Ministry of Energy and Natural Resources of the Republic of Azerbaijan on the MRV types, institutional elements of MRV, including projects on development of Central Inventory Registry, on capacity building of measurement, reporting and internal verification experts;

Project to study the options for ensuring the accreditation of external verification specialists in the country by relevant agencies for the effective operation of the MRV system and to develop their capacity;

Project to promote the use of solar energy (for hot water, etc.) at the community level in arid areas of Azerbaijan;

Project on expansion of biogas technology in rural communities of Azerbaijan;

Project to demonstrate effective practices in the application of cost-effective and efficient stoves in rural areas of Azerbaijan;

Projects to increase awareness of innovative farming methods, modern technologies to reduce the climate change impacts on the country's farms, including, for example, the use of Climate Smart Agriculture (CSA) [127] and other green agricultural practices.

Projects on adaptation to climate change impacts:

1) A project to demonstrate effective adaptation practices in the agricultural sector in arid zones of Azerbaijan;

2) Project to promote the application of conservative cultivation technology in rural areas of Azerbaijan;

[127] http://www.fao.org/climate-smart-agriculture/en/

3) Project to demonstrate the application of rainwater collection and use technology in small water basins in rural communities of Azerbaijan;

4) Project to establish and improve an early warning system to reduce the damage caused by hydrometeorological disasters related to climate change;

5) High water collection in river basins and use as an alternative water source during droughts to prevent floods and increase water use efficiency.

6.4. Barriers

The country's existing barriers to mitigating the climate change impacts have been analyzed to identify the main reasons why the private sector is not currently investing heavily, and consultations with partners have been conducted through direct interviews and surveys.

Barriers are classified into five categories:

economic/financial barriers;

structural/regulatory barriers;

technological barriers;

information/skills barriers;

social barriers.

The most important barriers are summarized and grouped as follows.

Types of barriers	Barriers
Economic/financial barriers	- Lack of a mechanism for favorable incentives (taxes, customs, etc.) for the import of necessary green technologies into the country; - High financial costs of large-scale projects; - Poor access to relevant financial sources for the import of relevant technological innovations and green technologies to reduce the climate change impacts, the reluctance of financial institutions to provide long-term and low-interest loans
Structural/regulatory barriers	- Insufficient adaptation of strategic development programs of different economic sectors to climate change problems, lack of financial and environmental assessment of climate risks in strategic roadmaps and other strategic documents, time for development of single National Climate Strategy containing all necessary mitigation and adaptation policies; - Lack of institutional elements for MRV, relevant legislation in the country; Lack of Central Inventory Registry, low quality of inventory (Tier 1), non-use of national emission ratios in inventory, lack of registry and MRV system of enterprises that are the main GHG emitters, lack of information about it; - Weak institutional, cross-sectoral relations in climate change mitigation actions, lack of MRV system for mitigation, weak material and technical base to measure actual reductions; - Lack of specialized structures for combating climate change in a number of government agencies, including enterprises that are the main GHG emitters, and the predominance of specialists with weak field knowledge; - lack of knowledge in enterprises that are main GHG emitters about participation in international carbon mechanisms; - Lack of expertise in terms of the impact of projects on different sectors of the economy on climate change; - Lack of GHG Inventory Center (electronic database) in the list of e-services for stakeholders in the country (government agencies, companies, etc.).
Technological barriers	- Challenges to implement mechanism to stimulate research, financial and technological innovations in the country to replace high-emission equipment and facilities with green technologies in the fight against climate change in relevant sectors; - Lack of effective early warning system to reduce the damage caused by hydrometeorological disasters related to climate change; - Challenges to obtain technologies for the collection and use of rainwater in small water basins in rural communities of Azerbaijan to address the problem of water shortages caused by climate change in the country;

Types of barriers	Barriers
	- Need for effective early warning system to prevent contamination of transboundary water bodies and rivers with radiological waste, deliberate contamination of these water bodies with toxic substances, etc. by neighboring Armenia; - Lack of appropriate facilities for the expansion of biogas technology in rural communities of Azerbaijan - Problems related to wastewater discharge, poor central sewerage system, lack of plans for the installation of biological water treatment plants and the use of biogas Lack of long-term plans for open storage of solid waste in the regions, solid household waste sorting and processing, as well as plastic waste recycling of
Information/skills barriers	- Low level of training of experts on climate change in stakeholders, weak potential and skills of existing research institutes, lack of awareness; - Unsatisfactory level of training of climate change specialists in higher and secondary education institutions in the country, non-compliance with labor market requirements; - Weak training of experts on MRV types in the country, weak skills of experts on measurement, reporting and internal verification
Social barriers	- About 1 million refugees and internally displaced persons in the country as the result of the occupation of 20% of Azerbaijani territories by Armenia that lasted about 30 years. It was a major social obstacle that prevented the state from expanding appropriate financial expenditures to effectively combat climate change; - Furthermore, declined financial interest of private sector in climate change mitigation actions against the background of the implementation of mechanisms to support the economic and social spheres in the country due to the global coverage of the Covid-19 pandemic in 2020

Table 6-7. Classification of the main barriers to climate change mitigation in the country

At the same time, it is to note that the new composition of the State Commission on Climate Change was approved by the Presidential Decree No. 1920 dated 11.03.2020 for the implementation of the commitments made by the Republic of Azerbaijan in accordance with the UN Framework Convention on Climate Change and the Paris Agreement. In order to ensure the activities of the State Commission, a relevant working group was established. At the first meeting of the State Commission held on 23.07.2020, the bodies represented in the Working Group adopted a decision on the preparation of the relevant Action Plan and other related issues, and the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan was identified as the coordinating body for the effective operation of the Commission.

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APPENDICES

Appendix 1. Submitted inventory tables

Table 1 (Summary). National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Inventory Year: 1990

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	53365.61145	1061.64	9.509	NA,NO,NE	377.3	NA,NO,NE	NA,NO	NA,NO	37.9754	10.7517	153.7528	0.377
1 - Energy	55933.75652	859.455	0.489	NA	NA	NA	NA	NA	37.7964	10.7517	133.3875	0.377
1.A - Fuel Combustion Activities	54748.15851	4.62422	0.489	NA	NA	NA	NA	NA	37.7964	10.7517	2.433524	0.377
1.A.1 - Energy Industries	22972.6166	0.62753	0.103						37.7964	10.7517	NE	0.377
1.A.2 - Manufacturing Industries and Construction	15374.94265	0.28907	0.032						NE	NE	NE	NE
1.A.3 - Transport	5934.115572	2.61003	0.312						NE	NE	2.433524	NE
1.A.4 - Other Sectors	10466.48369	1.09761	0.042						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	1185.598011	854.831	1E-04	NA	NA	NA	NA	NA	NE,NO	NO,NE	130.954	NO,NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	1185.598011	854.831	1E-04						NE	NE	130.954	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1122.29493	0.26041	NA,NO	NA,NO	377.3	NA	NA	NA	NE, NO	NE, NO	NE, NO	NE, NO
2.A - Mineral Industry	424.36	NA	NA	NA	NA	NA	NA	NA	NE, NO	NE, NO	NE, NO	NE, NO
2.A.1 - Cement production	411.84								NE	NE	NE	NE
2.A.2 - Lime production	3.3								NE	NE	NE	NE
2.A.3 - Glass Production	9.22								NE	NE	NE	NE
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO

2.B - Chemical Industry	187.7249296	0.25041	NO	NO	NO	NO	NO	NO	NO, NE	NO, NE	NO, NE	NO, NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	187.7249296	0.25041							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	490.76	0.01	NO	NO	377.3	NO	NO	NO	NO, NE	NO, NE	NO, NE	NO, NE
2.C.1 - Iron and Steel Production	445.2	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	45.56				377.3			NO	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	19.45387	NO	NO	NO	NO	NO	NO	NO	NA,NO NE	NO,NA NE	NE,NA, NO	NA,NE, NO
2.D.1 - Lubricant Use	19.45387								NO	NO	NE	NA
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NA	NA	NA	NA
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NE	NE	NA	NA	NE	NE	NE	NE	NE
2.F.1 - Refrigeration and Air Conditioning				NE				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE

2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NE	NE			NE	NE	NE	NE	NE
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-3690.44	165.15	9.02	NA	NA	NA	NA	NA	0.17898	NE	20.3653	NE
3.A - Livestock	NA	165.15	1.82	NA	NA	NA	NA	NA	0.17898	NE	20.3653	NE
3.A.1 - Enteric Fermentation		153.27							NE	NE	NE	NE
3.A.2 - Manure Management		11.8804	1.82						0.17898	NE	20.3653	NE
3.B - Land	-3690.44	NA	NA,NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3099.85								NE	NE	NE	NE
3.B.2 - Cropland	-590.59								NE	NE	NE	NE
3.B.3 - Grassland	NE								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	NE								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NE NA NO	NE NA	7.2	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
3.C.1 - Emissions from biomass burning		NE	NE						NE	NE	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			7.2						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		NE							NE	NE	NE	NE
3.C.8 - Other (please specify)		NE	NE						NE	NE	NE	NE
3.D - Other	NE	NE NA	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NO NE	36.777	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE

4.A - Solid Waste Disposal	NE	35.65	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NO NE	NO NE	NO NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NE	1.127	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	1284.91184	0.02864	0.035	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1049.55994	0.00734	0.029						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	235.3519	0.0213	0.006						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 1995

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	32446.652	789.50785	1.9374743	212.68	52.1	NA,NO NE	NA	NA	34.454358	66.845787	109.68739	0.2482747
1 - Energy	34688.512	592.58555	0.2874743	NA	NA	NA	NA	NA	34.329201	66.845787	94.689578	0.2482747
1.A - Fuel Combustion Activities	33823.622	2.6759021	0.2874009	NA	NA	NA	NA	NA	34.329201	66.845787	10.349578	0.2482747
1.A.1 - Energy Industries	16267.323	0.5808488	0.1118749						27.789411	4.3371873	NE	0.2482747
1.A.2 - Manufacturing Industries and Construction	7674.9978	0.149308	0.0171619						NE	NE	NE	NE
1.A.3 - Transport	2862.472	1.2845017	0.1409851						6.53979	62.5086	10.349578	NE
1.A.4 - Other Sectors	7018.829	0.6612436	0.017379						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	864.89002	589.90965	7.337E-05	NA	NA	NA	NA	NA	NO	NO	84.34	NO
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	864.89002	589.90965	7.337E-05						NE	NE	84.34	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	214.25985	0.092856	NO NA	212.68	52.1	NA NO	NA NO	NA NO	NO, NE	NO, NE	NO, NE	NO, NE
2.A - Mineral Industry	84.69	NO NA	NO NA	NA	NA	NA	NA	NA	NO, NE	NO, NE	NO, NE	NO, NE
2.A.1 - Cement production	81.49								NE	NE	NE	NE
2.A.2 - Lime production	2.25								NE	NE	NE	NE
2.A.3 - Glass Production	0.95								NE	NE	NE	NE
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	69.611048	0.092856	NO	NO	NO	NO	NO	NO	NO, NE	NO,NE	NO,NE	NO,NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO

2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	69.611048	0.092856							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	35.2	NE NA NO	NA NO	NA NO	52.1	NO,NA	NA NO	NO NE NA	NO NE	NO NE	NO NE	NO NE
2.C.1 - Iron and Steel Production	28.91	NE							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	6.29				52.1			NE	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	24.7588	NO	NO	NO	NO	NO	NO	NO	NA,NO NE	NO,NA NE	NE,NA, NO	NA,NE, NO
2.D.1 - Lubricant Use	24.7588								NO	NO	NE	NA
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NA	NA	NA	NA
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	212.68		NA	NA	NE	NE	NE	NE	NE
2.F.1 - Refrigeration and Air Conditioning				212.68				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NE	NE			NE	NE	NE	NE	NE
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-2456.12	156.54	1.65	NA	NA	NA	NA	NA	0.1251572	NE	14.997814	NE
3.A - Livestock		156.54	1.65	NA	NA	NA	NA	NA	0.1251572	NE	14.997814	NE
3.A.1 - Enteric Fermentation		145.02							NE	NE	NE	NE
3.A.2 - Manure Management		11.52	1.65						0.1251572	NE	14.997814	NE
3.B - Land	-2456.12		0	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-2268.78								NE	NE	NE	NE
3.B.2 - Cropland	-187.34								NE	NE	NE	NE
3.B.3 - Grassland	NE								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	NE								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NE NA NO	NE NA	NE NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
3.C.1 - Emissions from biomass burning		NE	NE						NE	NE	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils									NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		NE							NE	NE	NE	NE
3.C.8 - Other (please specify)		NE	NE						NE	NE	NE	NE
3.D - Other	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE NO	40.289447	NE NO	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.A - Solid Waste Disposal	NE	39.089447	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NO NE	NO NE	NO NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NE	1.2	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	314.98956	0.0030331	0.0088045	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	305.60716	0.0021371	0.0085485						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	9.3824	0.000896	0.000256						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2000

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	25630.744	713.96179	4.4503723	224.99	NA NO	NA NO	NA	NA	32.996375	34.47206	99.550642	0.2436684
1 - Energy	30276.966	476.48523	0.2483723	NA	NA	NA	NA	NA	32.822109	33.59906	81.641398	0.2436684
1.A - Fuel Combustion Activities	28747.44	1.9526008	0.2446871	NA	NA	NA	NA	NA	32.822109	33.59906	6.6923982	0.2436684
1.A.1 - Energy Industries	18708.313	0.621125	0.1153059						29.649129	4.8857603	NE	0.2436684
1.A.2 - Manufacturing Industries and Construction	2137.6501	0.0435788	0.0053494						NE	NE	NE	NE
1.A.3 - Transport	2051.196	0.7074338	0.1055725						3.17298	28.7133	6.6923982	NE
1.A.4 - Other Sectors	5850.281	0.5804633	0.0184593						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NE	NE	NE	NE
1.B - Fugitive emissions from fuels	1529.5257	474.53263	0.0036852	NA	NA	NA	NA	NA	NO NE	NO NE	74.949	NO NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	1529.5257	474.53263	0.0036852						NE	NE	74.949	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	224.23797	0.120183	NO NA NE	224.99	NO NA NE	NO NA NE	NO NA NE	NO NA NE	NO NE	NO NE	NO NE	NO NE
2.A - Mineral Industry	104.98	NA NO	NA NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.A.1 - Cement production	104.29								NE	NE	NE	NE
2.A.2 - Lime production	0.134775								NE	NE	NE	NE
2.A.3 - Glass Production	0.56								NE	NE	NE	NE
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	90.09719	0.120183	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	90.09719	0.120183							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	0.27	NE NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NE NO	NE NO	NE NO	NE NO
2.C.1 - Iron and Steel Production	0.27	NE							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	28.886	NO NA	NO NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.D.1 - Lubricant Use	28.886								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	224.99	NA	NA	NA	NE	NE	NE	NE	NE
2.F.1 - Refrigeration and Air Conditioning				224.99				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NE	NE	NE	NE	NE
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-4870.46	193.69038	4.202	NA	NA	NA	NA	NA	0.1742662	0.873	17.909244	NE
3.A - Livestock	NA	193.65238	2.08	NA	NA	NA	NA	NA	0.1502662	NE	17.909244	NE
3.A.1 - Enteric Fermentation		179.2998							NE	NE	NE	NE
3.A.2 - Manure Management		14.35258	2.08						0.1502662	NE	17.909244	NE
3.B - Land	-4870.46	NA	NA NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3286.9								NE	NE	NE	NE
3.B.2 - Cropland	-1534.86								NE	NE	NE	NE
3.B.3 - Grassland	NE								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-48.7								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0.038	2.122	NA	NA	NA	NA	NA	0.024	0.873	NE	NE
3.C.1 - Emissions from biomass burning		0.038	0.002						0.024	0.873	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			2.12						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		NE							NE	NE	NE	NE
3.C.8 - Other (please specify)		NE	NE						NE	NE	NE	NE
3.D - Other	NE	NA NE	NA NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE NO	43.666	NE NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.A - Solid Waste Disposal	NE	42.7	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NO NE	NO NE	NO NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NE	0.966	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Memo Items (5)												
International Bunkers	454.73863	0.0165825	0.0125955	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	302.52022	0.0021155	0.0084621						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	152.21841	0.014467	0.0041334						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2005

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	32159.181	490.32879	5.4288688	767.43	NA NO	NA NO	NA	NA	36.594413	65.01344	123.37547	0.2724822
1 - Energy	36411.165	210.04177	0.2986688	NA	NA	NA	NA	NA	36.406588	64.22344	101.37043	0.2724822
1.A - Fuel Combustion Activities	33782.244	2.9393019	0.2890945	NA	NA	NA	NA	NA	36.406588	64.22344	11.383435	0.2724822
1.A.1 - Energy Industries	20428.72	0.5390466	0.0862163						30.253928	9.6766399	NE	0.2724822
1.A.2 - Manufacturing Industries and Construction	1582.6867	0.0448028	0.0075219						NE	NE	NE	NE
1.A.3 - Transport	3637.4792	1.5730598	0.1728308						6.15266	54.5468	11.383435	NE
1.A.4 - Other Sectors	8133.358	0.7823926	0.0225255						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	2628.9212	207.10247	0.0095742	NA	NA	NA	NA	NA			89.987	
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	2628.9212	207.10247	0.0095742						NE	NE	89.987	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1096.9262	0.1740196		767.43					NO NE	NO NE	NO NE	NO NE
2.A - Mineral Industry	643.77	NA NO	NA NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.A.1 - Cement production	639.77								NE	NE	NE	NE
2.A.2 - Lime production	3.6822								NE	NE	NE	NE
2.A.3 - Glass Production	0.32								NE	NE	NE	NE
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	122.96	0.1640196	NA NO	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO

2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	122.96	0.1640196							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	304.3	0.01	NA	NA	NA NO	NA NO	NA NO	NA NO	NE NO	NE NO	NE NO	NE NO
2.C.1 - Iron and Steel Production	304.3	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO								NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	25.894	NO NA	NO NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.D.1 - Lubricant Use	25.894								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	767.43	NE NO NA	NA	NA	NE NO	NE NO	NE NO	NE NO	NE NO
2.F.1 - Refrigeration and Air Conditioning				767.43				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE

2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-5348.91	232.293	5.1302	NA	NA	NA	NA	NA	0.1878254	0.79	22.005039	NE
3.A - Livestock		232.29	2.51	NA	NA	NA	NA	NA	0.1858254	NE	22.005039	NE
3.A.1 - Enteric Fermentation		214.85	0						NE	NE	NE	NE
3.A.2 - Manure Management		17.44	2.51						0.1858254	NE	22.005039	NE
3.B - Land	-5348.91	NA	NA NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3318.03								NE	NE	NE	NE
3.B.2 - Cropland	-1687.85								NE	NE	NE	NE
3.B.3 - Grassland	-255.37								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-87.66								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NE NO	0.003	2.6202	NA	NA	NA	NA	NA	0.002	0.79	NE NO	NE NO
3.C.1 - Emissions from biomass burning		0.003	0.0002						0.002	0.79	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			2.62						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		NE							NE	NE	NE	NE
3.C.8 - Other (please specify)		NE	NE						NE	NE	NE	NE
3.D - Other	NE	NE NA	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NO NE	47.82	NO NE	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
4.A - Solid Waste Disposal	NE NA	46.3	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NO NE	NO NE	NO NE	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.D - Wastewater Treatment and Discharge	NE	1.52	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Memo Items (5)												
International Bunkers	1211.5794	0.0169746	0.0337949	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1114.3847	0.0077929	0.0311716						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	97.194747	0.0091817	0.0026233						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2010

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	28058.098	714.25596	6.2408108	972.87	NA NO NE	NA NO NE	NA NO NE	NA NO NE	42.199621	98.826737	160.33924	0.0896017
1 - Energy	32468.109	401.69394	0.3105108	NA	NA	NA	NA	NA	41.803226	98.701737	136.80154	0.0896017
1.A - Fuel Combustion Activities	25911.815	2.6017962	0.279972	NA	NA	NA	NA	NA	41.803226	98.701737	19.744537	0.0896017
1.A.1 - Energy Industries	11580.492	0.2269661	0.0264026						15.494035	6.7730651	NE	0.0214218
1.A.2 - Manufacturing Industries and Construction	1550.7409	0.0325104	0.0041444						2.1641159	0.6943841	0.519046	0.0681799
1.A.3 - Transport	4897.889	1.5925017	0.2286094						24.145075	91.234288	19.225491	NE
1.A.4 - Other Sectors	7882.694	0.749818	0.0208156						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	6556.2938	399.09214	0.0305388	NA	NA	NA	NA	NA	NO NE	NO NE	117.057	NO NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	6556.2938	399.09214	0.0305388						NE	NE	117.057	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1000.0386	0.1750231	NA NO	972.87	NA NO	NA NO	NA NO	NA NO	NE NO	NE NO	NE NO	NE NO
2.A - Mineral Industry	532.63	NA NO	NA NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.A.1 - Cement production	531.98								NE	NE	NE	NE
2.A.2 - Lime production	0.64905								NE	NE	NE	NE
2.A.3 - Glass Production	0								NE	NE	NE	NE
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	123.71232	0.1650231	NA NO	NA NO	NA NO	NA NO	NA NO	NA NO	NE NO	NE NO	NE NO	NE NO
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	123.71232	0.1650231							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	325.6	0.01	NA NO	NA NO	NA NO	NA NO	NA NO	NA NO	NE NO	NE NO	NE NO	NE NO
2.C.1 - Iron and Steel Production	325.6	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	18.0972	NA NO	NA NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.D.1 - Lubricant Use	18.0972								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	972.87	NA NO NE	NA	NA	NE NO	NE NO	NE NO	NE NO	NE NO
2.F.1 - Refrigeration and Air Conditioning				972.87				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-5410.05	257.385	5.9303	NO	NO	NO	NO	NO	0.3963954	0.125	23.537703	0
3.A - Livestock	0	257.38	2.75	NA	NA	NA	NA	NA	0.3933954	0	23.537703	0
3.A.1 - Enteric Fermentation	0	237.88	0						0	0	0	0
3.A.2 - Manure Management	0	19.5	2.75						0.3933954	0	23.537703	0
3.B - Land	-5410.05			NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3353.58								NE	NE	NE	NE
3.B.2 - Cropland	-1198.89								NE	NE	NE	NE
3.B.3 - Grassland	-682.26								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-175.32								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NA NE	0.005	3.1803	NA	NA	NA	NA	NA	0.003	0.125	NO NE	NO NE
3.C.1 - Emissions from biomass burning		0.005	0.0003						0.003	0.125	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			3.18						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		NE							NE	NE	NE	NE
3.C.8 - Other (please specify)		NE	NE						NE	NE	NE	NE
3.D - Other	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE NO	55.002	NE NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.A - Solid Waste Disposal	NE	51.7	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NE NO	NE NO	NE NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.D - Wastewater Treatment and Discharge	NE	3.302	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Memo Items (5)												
International Bunkers	1442.3949	0.0303813	0.040119	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1210.3878	0.0084643	0.033857						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	232.0071	0.021917	0.006262						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2011

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	30465.791	759.51412	4.8704095	1031.42	95.74	NA NO NE	NA NO NE	NA NO NE	51.959809	111.63136	157.81809	0.1798102
1 - Energy	35159.032	377.09839	0.3804095	NA	NA	NA	NA	NA	51.554288	111.62236	133.23181	0.1798102
1.A - Fuel Combustion Activities	29388.501	4.1126146	0.3548335	NA	NA	NA	NA	NA	51.554288	111.62236	21.878814	0.1798102
1.A.1 - Energy Industries	13754.911	0.2618431	0.0295041						19.615259	8.3971756	NE	0.1301662
1.A.2 - Manufacturing Industries and Construction	1900.3151	0.0400237	0.0050453						2.2771807	0.801055	0.616274	0.049644
1.A.3 - Transport	5795.8402	1.8449129	0.2830459						29.661848	102.42413	21.26254	NE
1.A.4 - Other Sectors	7937.434	1.965835	0.0372383						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	5770.5314	372.98578	0.025576	NA	NA	NA	NA	NA	NO NE	NO NE	111.353	NO NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	5770.5314	372.98578	0.025576						NE	NE	111.353	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1079.7594	0.2427264	NO NA	1031.42	95.74	NO NA NE	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.A - Mineral Industry	466.77	NO NA	NO NA	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.A.1 - Cement production	465.09								NE	NE	NE	NE
2.A.2 - Lime production	1.682025								NE	NE	NE	NE
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	174.4672	0.2327264	NA	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO

2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	174.4672	0.2327264							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	413.82	0.01	NO NA	NO NA	95.74	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.C.1 - Iron and Steel Production	402.26	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	11.56				95.74			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	24.70	NA NO	NA NO	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.D.1 - Lubricant Use	24.70								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	1031.42	NO NE NA	NA	NA	NO NE	NO NE	NO NE	NO NE	NO NE
2.F.1 - Refrigeration and Air Conditioning				1031.42				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE

2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-5773	325.97	4.49	NA	NA	NA	NA	NA	0.4055218	0.009	24.586273	NE
3.A - Livestock	NA	260.35	2.78	NA	NA	NA	NA	NA	0.4053218	NE	24.586273	NE
3.A.1 - Enteric Fermentation		240.62							NE	NE	NE	NE
3.A.2 - Manure Management		19.73	2.78						0.4053218	NE	24.586273	NE
3.B - Land	-5773	NA	NA NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3360.77								NE	NE	NE	NE
3.B.2 - Cropland	-1246.97								NE	NE	NE	NE
3.B.3 - Grassland	-902.28								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-262.98								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NE NA	65.62	1.71	NA	NA	NA	NA	NA	0.0002	0.009	NE NO	NE NO
3.C.1 - Emissions from biomass burning		NE	NE						0.0002	0.009	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			1.71						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		65.62							NE	NE	NE	NE
3.C.8 - Other (please specify)		NE	NE						NE	NE	NE	NE
3.D - Other	NE	NE NA	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE NO	56.203	NE NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.A - Solid Waste Disposal	NE	52.8	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NE NO	NE NO	NE NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.D - Wastewater Treatment and Discharge	NE	3.403	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	1556.9285	0.032371	0.0433094	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1311.3315	0.0091702	0.0366806						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	245.59704	0.0232008	0.0066288						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2012

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)					Emissions (Gg)			
Categories	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NO_x	CO	NMVOCs	SO_2
Total National Emissions and Removals	31802.113	767.19282	5.3197852	1086.1	771.58	NA NO NE	NA NO NE	NA NO NE	58.663366	121.62986	157.02549	0.2049616
1 - Energy	36469.472	382.16635	0.4097352	NA	NA	NA	NA	NA	58.249976	121.60686	132.26934	0.2049616
1.A - Fuel Combustion Activities	31017.688	4.1894114	0.3859591	NA	NA	NA	NA	NA	58.249976	121.60686	24.02934	0.2049616
1.A.1 - Energy Industries	15317.416	0.2913088	0.0327728						21.964865	9.3884368	NE	0.1563216
1.A.2 - Manufacturing Industries and Construction	2403.4704	0.0481547	0.0057334						2.796361	1.0262764	0.797665	0.04864
1.A.3 - Transport	6389.7491	1.9546574	0.3117146						33.48875	111.19214	23.231676	NE
1.A.4 - Other Sectors	6907.052	1.8952905	0.0357383						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	5451.784	377.97694	0.0237762	NA	NA	NA	NA	NA	NO NE	NO NE	108.24	NO NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	5451.784	377.97694	0.0237762						NE	NE	108.24	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO_2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1414.7011	0.2214726		1086.1	771.58				NO NE	NO NE	NO NE	NO NE
2.A - Mineral Industry	669.49	NO NA	NO NA	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.A.1 - Cement production	658.06								NE	NE	NE	NE
2.A.2 - Lime production	11.4285								NE	NE	NE	NE
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	155.5353	0.2074726	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	155.5353	0.2074726							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	564.92	0.014	NO NA	NO NA	771.58	NO NA	NO NA	NO NA NE	NO NE	NO NE	NO NE	NO NE
2.C.1 - Iron and Steel Production	471.76	0.014							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	93.16				771.58			NE	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	24.75733	NO NA	NO NA	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.D.1 - Lubricant Use	24.75733								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	1086.1	NE NO NA	NA	NA	NO NE	NO NE	NO NE	NO NE	NO NE
2.F.1 - Refrigeration and Air Conditioning				1086.1				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-6082.06	326.321	4.91005	NA	NA	NA	NA	NA	0.4133904	0.023	24.75615	0
3.A - Livestock	NA	263.64	2.81	NA	NA	NA	NA	NA	0.4123904	0	24.75615	0
3.A.1 - Enteric Fermentation		243.61	0						0	0	0	0
3.A.2 - Manure Management		20.03	2.81						0.4123904	0	24.75615	0
3.B - Land	-6082.06	NA	NA NE	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
3.B.1 - Forest land	-3369.28								NE	NE	NE	NE
3.B.2 - Cropland	-1309.66								NE	NE	NE	NE
3.B.3 - Grassland	-1061.25								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-341.87								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NA NO	62.681	2.10005	NA	NA	NA	NA	NA	0.001	0.023	NE NO	NE NO
3.C.1 - Emissions from biomass burning		0.001	0.00005						0.001	0.023	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			2.1						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		62.68							NE	NE	NE	NE
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other				NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE	58.484	NE	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
4.A - Solid Waste Disposal	NE	55	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	NE NO	NE NO	NE NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.D - Wastewater Treatment and Discharge	NE	3.484	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	1418.6614	0.0338095	0.0394148	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1145.5659	0.008011	0.0320438						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	273.09555	0.0257985	0.007371						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2013

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	32389.247	799.27121	4.3366366	1143.21	749.06	NANO NE	NA NO NE	NA NO NE	54.387938	98.648674	150.33684	0.208233
1 - Energy	37429.317	392.67747	0.4576366	NA	NA	NA	NA	NA	53.970687	98.648674	125.09259	0.208233
1.A - Fuel Combustion Activities	32002.703	4.3154792	0.4343704	NA	NA	NA	NA	NA	53.970687	98.648674	15.302588	0.208233
1.A.1 - Energy Industries	15531.997	0.3490056	0.0396156						22.232602	9.5505865	NE	0.1588833
1.A.2 - Manufacturing Industries and Construction	2420.686	0.0488937	0.0058372						2.8345168	1.040068	0.808368	0.0493497
1.A.3 - Transport	7271.6173	2.1056689	0.3542187						28.903568	88.05802	14.49422	NE
1.A.4 - Other Sectors	6778.402	1.811911	0.0346989						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	5426.6145	388.36199	0.0232662	NA	NA	NA	NA	NA	NE NO	NE NO	109.79	NE NO
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	5426.6145	388.36199	0.0232662						NE	NE	109.79	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1294.88	0.2454068		1143.21	749.06							
2.A - Mineral Industry	729.76	NO NA	NO NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.A.1 - Cement production	721.76								NE	NE	NE	NE
2.A.2 - Lime production	8.00325								NE	NE	NE	NE
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	176.4766	0.2354068	NO NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	176.4766	0.2354068							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	362.29	0.01	NO NA	NO NA	749.06	NO NA	NO NA	NO NA NE	NE NO	NE NO	NE NO	NE NO
2.C.1 - Iron and Steel Production	271.85	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	90.44				749.06			NE	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	26.35013	NO NA	NO NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.D.1 - Lubricant Use	26.35013								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	1143.21	NO NE NA	NA	NA	NO NE	NO NE	NO NE	NO NE	NO NE
2.F.1 - Refrigeration and Air Conditioning				1143.21				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-6334.95	345.07233	3.879	NA	NA	NA	NA	NA	0.4172515	NO NE	25.244255	NO NE
3.A - Livestock	NA	266.24233	2.829	NA	NA	NA	NA	NA	0.4172515	NE	25.244255	NE
3.A.1 - Enteric Fermentation		245.9723							NE	NE	NE	NE
3.A.2 - Manure Management		20.27003	2.829						0.4172515	NE	25.244255	NE
3.B - Land	-6334.95	NA	NA NE	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
3.B.1 - Forest land	-3359.62								NE	NE	NE	NE
3.B.2 - Cropland	-1785.64								NE	NE	NE	NE
3.B.3 - Grassland	-676.88								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-512.81								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NO NA	78.83	1.05	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
3.C.1 - Emissions from biomass burning		NO	NO						NO	NO	NO	NO
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			1.05						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		78.83							NE	NE	NE	NE
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE İE	61.276	NE İE	NA	NA	NA	NA	NA	NE İE	NE İE	NE İE	NE İE
4.A - Solid Waste Disposal	NE	57.7	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	İE	İE	İE	NA	NA	NA	NA	NA	İE	İE	İE	İE
4.D - Wastewater Treatment and Discharge	NE	3.576	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	1423.4095	0.0319902	0.0395684	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1171.4918	0.0081923	0.032769						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	251.91777	0.0237979	0.0067994						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2014

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	32523.735	771.97318	7.3863875	1171.93	708.22	NANO NE	NA NO NE	NA NO NE	56.159132	103.10919	150.69303	0.2572694
1 - Energy	38195.293	402.214	0.4700875	NA	NA	NA	NA	NA	55.731714	102.97819	125.32318	0.2572694
1.A - Fuel Combustion Activities	32917.428	4.3162632	0.447328	NA	NA	NA	NA	NA	55.731714	102.97819	16.078182	0.2572694
1.A.1 - Energy Industries	15531.457	0.3651092	0.0419002						22.183734	9.4687841	NE	0.2128006
1.A.2 - Manufacturing Industries and Construction	2533.5911	0.0501832	0.005851						2.9344696	1.0964956	0.857162	0.0444688
1.A.3 - Transport	7515.4747	2.1892708	0.3662257						30.613511	92.412912	15.22102	NE
1.A.4 - Other Sectors	7336.905	1.7117	0.0333512						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	5277.8654	397.89774	0.0227595	NA	NA	NA	NA	NA	NO NE	NO NE	109.245	NO NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	5277.8654	397.89774	0.0227595						NE	NE	109.245	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1372.3312	0.5935328	NA NO	1171.93	708.22	NA NO	NA NO	NA NO	NO NE	NO NE	NO NE	NO NE
2.A - Mineral Industry	601.64	NA NO	NA NO	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.A.1 - Cement production	591.08								NE	NE	NE	NE
2.A.2 - Lime production	10.560225								NE	NE	NE	NE
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	313.05168	0.5835328	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	313.05168	0.5835328							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	430.11	0.01	NO NA	NO NA	708.22	NO NA	NO NA	NO NA NE	NO NE	NO NE	NO NE	NO NE
2.C.1 - Iron and Steel Production	344.6	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	85.51				708.22			NE	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	27.52933	NO NA	NO NA	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.D.1 - Lubricant Use	27.52933								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	1171.93	NA NE	NA	NA	NO NE	NO NE	NO NE	NO NE	NO NE
2.F.1 - Refrigeration and Air Conditioning				1171.93				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-7043.89	306.55665	6.9163	NA	NA	NA	NA	NA	0.4274179	0.131	25.369844	NE
3.A - Livestock	NA	266.11065	2.826	NA	NA	NA	NA	NA	0.4234179	NE	25.369844	NE
3.A.1 - Enteric Fermentation		245.7606							NE	NE	NE	NE
3.A.2 - Manure Management		20.35005	2.826						0.4234179	NE	25.369844	NE
3.B - Land	-7043.89	NA	NA NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3368.63								NE	NE	NE	NE
3.B.2 - Cropland	-1253.65								NE	NE	NE	NE
3.B.3 - Grassland	-1806.24								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-615.37								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NO NA	40.446	4.0903	NA	NA	NA	NA	NA	0.004	0.131	NE NO	NE NO
3.C.1 - Emissions from biomass burning		0.006	0.0003						0.004	0.131	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			4.09						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		40.44							NE	NE	NE	NE
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NE	NE NA	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste		62.609		NA	NA	NA	NA	NA	NE NO IE	NE NO IE	NE NO IE	NE NO IE
4.A - Solid Waste Disposal		58.962		NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	IE	IE	IE	NA	NA	NA	NA	NA	IE	IE	IE	IE
4.D - Wastewater Treatment and Discharge	NE	3.647	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	1303.1888	0.0294901	0.0362242	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	1070.2406	0.0074842	0.0299368						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	232.94817	0.0220059	0.0062874						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2015

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	33702.895	778.85964	7.2321107	1195.95	689.92	NANO NE	NA NO NE	NA NO NE	58.656628	105.44835	147.52441	0.2517812
1 - Energy	39046.121	403.07892	0.4501007	NA	NA	NA	NA	NA	58.235415	105.44035	122.04981	0.2517812
1.A - Fuel Combustion Activities	33803.347	4.1986403	0.4274924	NA	NA	NA	NA	NA	58.235415	105.44035	16.453809	0.2517812
1.A.1 - Energy Industries	16539.399	0.4210694	0.0527834						24.370928	9.635359	NE	0.2078063
1.A.2 - Manufacturing Industries and Construction	2562.017	0.0504353	0.0058583						2.9421717	1.1001204	0.860706	0.043975
1.A.3 - Transport	6969.8849	2.0871301	0.3364498						30.922316	94.704873	15.593103	NE
1.A.4 - Other Sectors	7732.046	1.6400055	0.032401						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	5242.7738	398.88028	0.0226082	NA	NA	NA	NA	NA	NO NE	NO NE	105.596	NO NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	5242.7738	398.88028	0.0226082						NE	NE	105.596	NE
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1775.8039	0.6956598	NO NA	1195.95	689.92	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.A - Mineral Industry	997.95	NA NO	NA NO	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.A.1 - Cement production	984.93								NE	NE	NE	NE
2.A.2 - Lime production	13.020825								NE	NE	NE	NE
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	346.38856	0.6856598	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	346.38856	0.6856598							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	404.23	0.01	NO NA	NO NA	689.92	NO NA	NO NA	NO NA	NO NE	NO NE	NO NE	NO NE
2.C.1 - Iron and Steel Production	320.93	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	83.3				689.92			NE	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	27.23453	NO NA	NO NA	NA	NA	NA	NA	NA	NO NE	NO NE	NO NE	NO NE
2.D.1 - Lubricant Use	27.23453								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	1195.95	NA NE	NA	NA	NO NE	NO NE	NO NE	NO NE	NO NE
2.F.1 - Refrigeration and Air Conditioning				1195.95				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-7119.03	311.67006	6.78201	NA	NA	NA	NA	NA	0.4212122	0.008	25.474605	0
3.A - Livestock	NA	267.18006	2.832	NA	NA	NA	NA	NA	0.4210122	0	25.474605	0
3.A.1 - Enteric Fermentation		246.7566							0	0	0	0
3.A.2 - Manure Management		20.42346	2.832						0.4210122	0	25.474605	0
3.B - Land	-7119.03	NA	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3366.72								NE	NE	NE	NE
3.B.2 - Cropland	-1343.75								NE	NE	NE	NE
3.B.3 - Grassland	-1608.57								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-799.99								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NA NO	44.49	3.95001	NA	NA	NA	NA	NA	0.0002	0.008	NE NO	NE NO
3.C.1 - Emissions from biomass burning		NE	0.00001						0.0002	0.008	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			3.95						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		44.49							NE	NE	NE	NE
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NE	NA NE	NA NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NO NE IE	63.415	NO NE IE	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
4.A - Solid Waste Disposal	NE	59.56	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	IE	IE	IE	NA	NA	NA	NA	NA	IE	IE	IE	IE
4.D - Wastewater Treatment and Discharge	NE	3.855	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	976.07913	0.0206502	0.0271478	NA	NA	NA	NA	NA	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	818.03865	0.0057206	0.0228822						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	158.04048	0.0149296	0.0042656						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Inventory Year: 2016

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	34011.92	814.77275	3.9898644	1206.66	467.46	NANO NE	NA NO NE	NA NO NE	59.698163	105.82617	223.20351	0.3318808
1 - Energy	39786.222	390.8897	0.4298644	NA	NA	NA	NA	NA	59.276748	105.82417	197.67227	0.3318808
1.A - Fuel Combustion Activities	34631.344	3.6272021	0.4074118	NA	NA	NA	NA	NA	59.276748	105.82417	96.278267	0.3318808
1.A.1 - Energy Industries	16537.161	0.4310939	0.0567686						24.482809	9.2409146	NE	0.2476517
1.A.2 - Manufacturing Industries and Construction	3066.9191	0.0644158	0.0081359						3.7429689	1.311102	1.006118	0.0842291
1.A.3 - Transport	6541.6629	1.9509564	0.3161741						31.050971	95.27215	95.27215	NE
1.A.4 - Other Sectors	8485.602	1.180736	0.0263332						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	5154.8778	387.2625	0.0224526	NA	NA	NA	NA	NA			101.394	
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	5154.8778	387.2625	0.0224526								101.394	
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	1449.5875	0.6160453	NA NO	1206.66	467.46	NA NO	NA NO	NA NO	NE NO	NE NO	NE NO	NE NO
2.A - Mineral Industry	687.35	NA NO	NA NO	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.A.1 - Cement production	666.8								NE	NE	NE	NE
2.A.2 - Lime production	20.55								NE	NE	NE	NE
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	318.67412	0.6060453	NA NO	NA NO	NA NO	NA NO	NA NO	NA NO	NE NO	NE NO	NE NO	NE NO
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	318.67412	0.6060453							NE	NE	NE	NE
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	425.23	0.01	NO NA	NO NA	467.46	NO NA	NO NA	NO NA NE	NE NO	NE NO	NE NO	NE NO
2.C.1 - Iron and Steel Production	368.79	0.01							NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	56.44				467.46			NE	NE	NE	NE	NE
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	18.33333	NO NA	NO NA	NA	NA	NA	NA	NA	NE NO	NE NO	NE NO	NE NO
2.D.1 - Lubricant Use	18.33333								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE								NE	NE	NE	NE
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NO NA	NO NA	NO NA	NO NA	NO	NO NA	NO NA	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	1206.66	NA NO	NA	NA	NE NO	NE NO	NE NO	NE NO	NE NO
2.F.1 - Refrigeration and Air Conditioning				1206.66				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE	NE			NE	NE	NE	NE	NE
2.F.4 - Aerosols				NE				NE	NE	NE	NE	NE
2.F.5 - Solvents				NE	NE			NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2.G.1 - Electrical Equipment					NE	NE		NE	NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses					NE	NE		NE	NE	NE	NE	NE
2.G.3 - N2O from Product Uses			NE						NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.H - Other	NO,NE	NO,NE	NO NA	NA	NA	NA	NA	NA	NO,NE	NO,NE	NO,NE	NO,NE
2.H.1 - Pulp and Paper Industry	NE	NE							NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	NE	NE
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-7223.89	360.11	3.56	NA	NA	NA	NA	NA	0.421415	0.002	25.531245	NE
3.A - Livestock	NA	266.7	2.81	NA	NA	NA	NA	NA	0.421415	NE	25.531245	NE
3.A.1 - Enteric Fermentation		246.22							NE	NE	NE	NE
3.A.2 - Manure Management		20.48	2.81						0.421415	NE	25.531245	NE
3.B - Land	-7223.89	NA		NA	NA	NA	NA	NA	NE	NE	NE	NE
3.B.1 - Forest land	-3366.02								NE	NE	NE	NE
3.B.2 - Cropland	-1877.26								NE	NE	NE	NE
3.B.3 - Grassland	-1100.63								NE	NE	NE	NE
3.B.4 - Wetlands	NE		NE						NE	NE	NE	NE
3.B.5 - Settlements	-879.98								NE	NE	NE	NE
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NO NA	93.41	0.75	NA	NA	NA	NA	NA	NO NE	0.002	NO NE	NO NE
3.C.1 - Emissions from biomass burning		NE	NE						NE	0.002	NE	NE
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NO								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			NE						NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			0.75						NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE						NE	NE	NE	NE
3.C.7 - Rice cultivation		93.41							NE	NE	NE	NE
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NE	NE NA	NE NA	NA	NA	NA	NA	NA	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE								NE	NE	NE	NE
3.D.2 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
4 - Waste	NE NO IE	63.157	NE NO IE	NA	NA	NA	NA	NA	NE NO IE	NE NO IE	NE NO IE	NE NO IE
4.A - Solid Waste Disposal	NE	58.73	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	IE	IE	IE	NA	NA	NA	NA	NA	IE	IE	IE	IE
4.D - Wastewater Treatment and Discharge	NE	4.427	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.E - Other (please specify)	NE	NE	NE	NA	NA	NA	NA	NA	NE	NE	NE	NE
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	693.50138	0.0182042	0.0192488	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	540.83315	0.0037821	0.0151282						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	152.66823	0.0144221	0.0041206						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	C	C	C	NA	NA	NA	NA	NA	C	C	C	C

Appendix 2. Analysis of the main categories (without removals)

IPCC Category code	IPCC Category	Greenhouse gas	2016 Ex,t (Gg CO2 Eq)
1.A.1	Energy Industries - Gaseous Fuels	CARBON DIOXIDE (CO2)	12914.726
1.A.4	Other Sectors - Gaseous Fuels	CARBON DIOXIDE (CO2)	7478.5676
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO2)	5689.2627
3.A.1	Enteric Fermentation	METHANE (CH4)	5170.62
1.B.2.b	Natural Gas	METHANE (CH4)	5168.9711
1.B.2.a	Oil	CARBON DIOXIDE (CO2)	5145.3171
1.A.1	Energy Industries - Liquid Fuels	CARBON DIOXIDE (CO2)	3368.1317
1.B.2.a	Oil	METHANE (CH4)	2963.5414
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CARBON DIOXIDE (CO2)	2646.1753
3.C.7	Rice cultivation	METHANE (CH4)	1961.61
4.A	Solid Waste Disposal	METHANE (CH4)	1233.33
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	1206.66
1.A.4	Other Sectors - Liquid Fuels	CARBON DIOXIDE (CO2)	1007.0343
3.A.2	Manure Management	NITROUS OXIDE (N2O)	871.1
1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO2)	697.96155
2.A.1	Cement production	CARBON DIOXIDE (CO2)	666.796
2.C.3	Aluminum production	PFCs (PFCs)	467.456
3.A.2	Manure Management	METHANE (CH4)	430.08
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CARBON DIOXIDE (CO2)	420.74379
2.C.1	Iron and Steel Production	CARBON DIOXIDE (CO2)	367.7911
2.B.8	Petrochemical and Carbon Black Production	CARBON DIOXIDE (CO2)	318.67412
1.A.1	Energy Industries - Other Fossil Fuels	CARBON DIOXIDE (CO2)	254.30244
3.C.5	Indirect N2O Emissions from managed soils	NITROUS OXIDE (N2O)	232.5
4.D	Wastewater Treatment and Discharge	METHANE (CH4)	92.967
1.A.3.d	Water-borne Navigation - Liquid Fuels	CARBON DIOXIDE (CO2)	90.71322
1.A.3.b	Road Transportation	NITROUS OXIDE (N2O)	85.087948
2.C.3	Aluminum production	CARBON DIOXIDE (CO2)	56.44
1.A.3.c	Railways	CARBON DIOXIDE (CO2)	51.151938
1.A.3.b	Road Transportation	METHANE (CH4)	40.229727
2.A.2	Lime production	CARBON DIOXIDE (CO2)	20.55
2.D	Non-Energy Products from Fuels and Solvent Use	CARBON DIOXIDE (CO2)	18.333333
1.A.4	Other Sectors - Gaseous Fuels	METHANE (CH4)	13.997319
2.B.8	Petrochemical and Carbon Black Production	METHANE (CH4)	12.726952
1.A.3.e	Other Transportation	CARBON DIOXIDE (CO2)	12.573513
1.B.2.b	Natural Gas	CARBON DIOXIDE (CO2)	9.5607042
1.A.4	Other Sectors - Biomass	METHANE (CH4)	7.98399
1.A.1	Energy Industries - Gaseous Fuels	NITROUS OXIDE (N2O)	7.1364799
1.A.1	Energy Industries - Liquid Fuels	NITROUS OXIDE (N2O)	7.0230106
1.B.2.a	Oil	NITROUS OXIDE (N2O)	6.9328539
1.A.3.a	Civil Aviation	NITROUS OXIDE (N2O)	6.052254
1.A.3.c	Railways	NITROUS OXIDE (N2O)	5.3810445
1.A.1	Energy Industries - Gaseous Fuels	METHANE (CH4)	4.8343896
1.A.4	Other Sectors - Gaseous Fuels	NITROUS OXIDE (N2O)	4.1325418
1.A.1	Energy Industries - Other Fossil Fuels	NITROUS OXIDE (N2O)	3.438768
1.A.4	Other Sectors - Liquid Fuels	METHANE (CH4)	2.814147
1.A.1	Energy Industries - Liquid Fuels	METHANE (CH4)	2.4714656
1.A.4	Other Sectors - Liquid Fuels	NITROUS OXIDE (N2O)	2.4593106
1.A.1	Energy Industries - Other Fossil Fuels	METHANE (CH4)	1.747116
1.A.4	Other Sectors - Biomass	NITROUS OXIDE (N2O)	1.571452
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	NITROUS OXIDE (N2O)	1.4622359
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	NITROUS OXIDE (N2O)	1.0416713

1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	METHANE (CH4)	0.9905469
1.A.3.d	Water-borne Navigation - Liquid Fuels	NITROUS OXIDE (N2O)	0.759004
1.A.3.e	Other Transportation	NITROUS OXIDE (N2O)	0.7337204
1.A.3.c	Railways	METHANE (CH4)	0.384024
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	METHANE (CH4)	0.3529239
1.A.3.d	Water-borne Navigation - Liquid Fuels	METHANE (CH4)	0.1799574
1.A.3.a	Civil Aviation	METHANE (CH4)	0.1024979
1.A.3.e	Other Transportation	METHANE (CH4)	0.0738786
1.B.2.b	Natural Gas	NITROUS OXIDE (N2O)	0.0274414
1.A.2	Manufacturing Industries and Construction - Biomass	NITROUS OXIDE (N2O)	0.018228
1.A.2	Manufacturing Industries and Construction - Biomass	METHANE (CH4)	0.009261

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