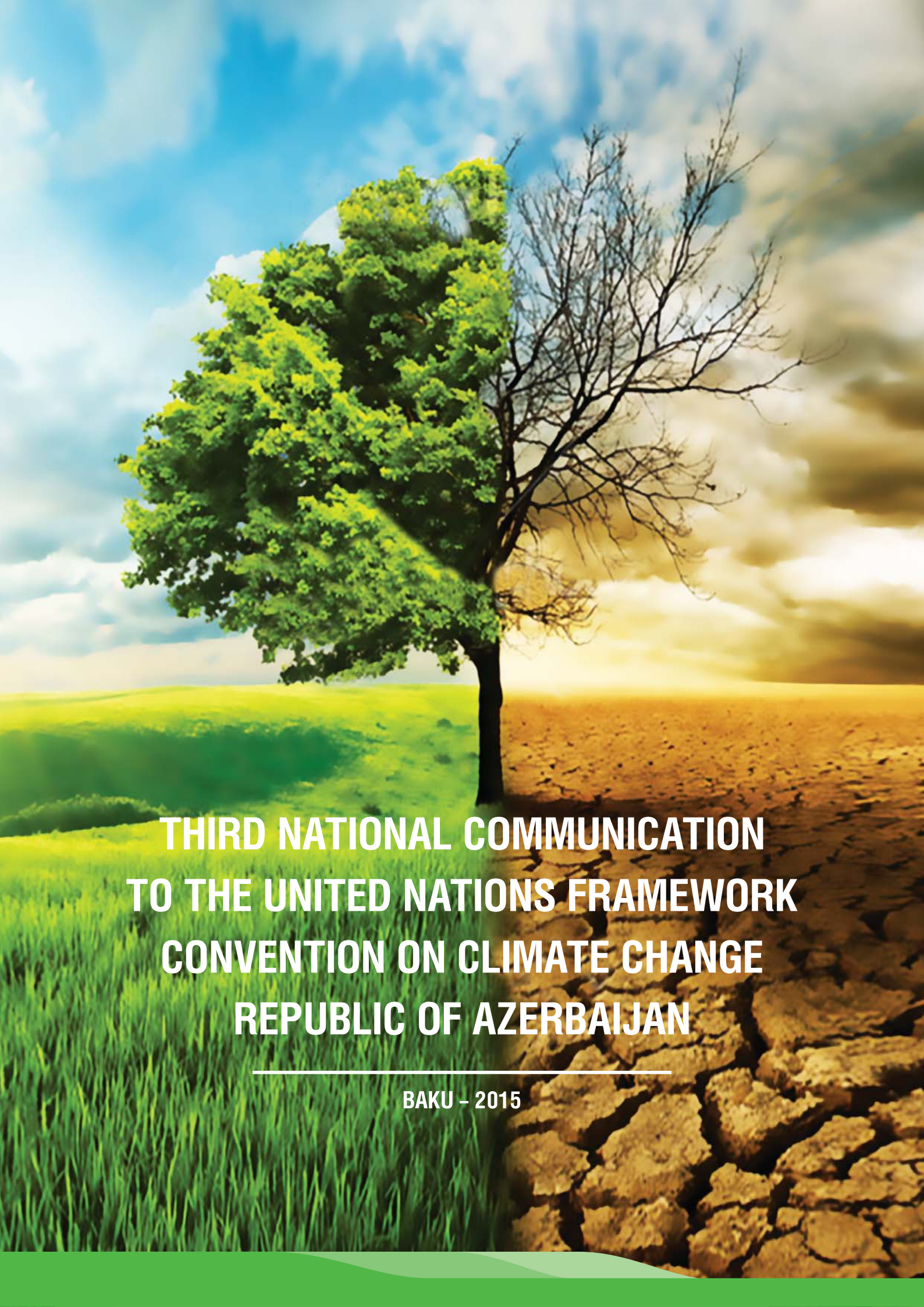

THIRD NATIONAL COMMUNICATION TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE REPUBLIC OF AZERBAIJAN

BAKU – 2015

United Nations Development Programme

UNDP is the UN's global development network, advocating for change and connecting countries to knowledge, experience and resources to help people build a better life. We are on the ground in 166 countries, working with them on their own solutions to global and national development challenges. As they develop local capacity, they draw on the people of UNDP and our wide range of partners.

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The Global Environment Facility (GEF), which was established in 1991, is an independent financial mechanism that provides grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities. GEF grants support to projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants.

Ministry of Ecology and Natural Resources
Republic of Azerbaijan

THIRD NATIONAL COMMUNICATION TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE REPUBLIC OF AZERBAIJAN

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LIST OF ACRONYMS

AFOLU	Agriculture, Forestry and Land Use
AİT	Asian Institute of Technology
AMS	Automated Meteorological Stations
BAU	Business as Usual
BUR	Biennial Updated Report
CCOC	Climate Change and Ozone Center
CDM	Clean Development Mechanism
CIA	Credit Implementing Agency
CFCs	Chlorofluorocarbon
CH4	Methane
CIS	Commomwealth of Independent States
CO2	Carbon dioxide
DNA	Designated National Authority
FSU	Former Soviet Union
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDL	Geophysical Fluid Dynamics Laboratory
GHG	Greenhouse gases
GISS	Goddard Institute for Space Studies
HPP	Hydro Power Plant
HFCs	Hydrofluorocarbons
HES	Hydro Electric Station
INDC	Intended National Determined Contribution
INC	Initial National Communication
İEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IPUM	Industrial production and use of materials
LEAP	Long-range Energy Alternatives Planning System
LULUCF	Land Use, Land Use Change and Forestry
MCDA	Multiple-criteria decision analysis
MoE	Ministry of Economy
MENR	Ministry of Ecology and Natural Resources
MES	Ministry of Emergency Situations
MIE	Ministry of Energy
MoA	Ministry of Agriculture
MoE	Ministry of Education
NAMA	Nationally Appropriate Mitigation Actions
NMVOC	Non-methane volatile organic compounds
N_2O	Nitric oxide
NGO	Non-governmental organizations

NO_x	Nitrogen oxides
ODS	Ozone Depleting Substances
OJSC	Open Joint Stock Company
PRECIS	Providing Regional Climates for Impacts Studies
PSG	Project Steeting Group
PFC	Perfluocarbon
PIN	Project Idea Notes
RETA	Asian Development Bank Regional Technical Assistance
SAARES	State Agency for Alternative and Renewable Energy Sources
SWRA	State Water Resources Agency
SFSE	State Fund for Support of Entrepreneurship
TAP	Technology Action Plan
TFS	Technology Facts Sheet
TNA	Technology Needs Assessment
TPP	Thermal Power Plant
UN	United Nations
UNEP	United Nations Environment Programme
UNDP	United National Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
URC	UNEP Riso Center
WB	World Bank
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

I. National Circumstances

Political system In accordance with the principle of separation of power three independently functioning branches exist: legislative, executive, and judicial. Executive power is vested in the President of the Republic of Azerbaijan who is elected for a five-year term. The Cabinet of Ministers is subordinate and accountable to the President. Legislative power controlled by the Parliament.

Geographic position Azerbaijan is situated in the Caucasus region of Eurasia. With its land area of 86,600 km2, Azerbaijan is the largest of the three South Caucasus countries. The territory of Azerbaijan extends 400 km from north to south and 500 km from west to east. The country is bordered by the Russian Federation to the north (border length 390 km), the Caspian Sea to the east (800 km), the Islamic Republic of Iran to the south (756 km), Turkey to the south-west (15 km), Armenia to the west (1,007 km) and Georgia to the north-west (480 km).

Demography The population of Azerbaijan is estimated to be 9477.1 thousand[1] people (as of January 1, 2013), of which 4966.2 thousand people or 53.1% are concentrated in urban areas. Annual population growth rate is 1.3%.
Climate Azerbaijan is a country with a variety of climates, although it is predominately subtropical. Recorded temperatures have reached a maximum of +46°C and minimum of -32°C. From 11 climate zones (according to V.V. Keppen) eight are found in this region.

Hydrology An extensive river network covers most of the country, hydrographically, the Republic of Azerbaijan belongs to the Caspian Sea basin. The surface of the Caspian is at 27 meters below the level of the world's oceans. Rivers form the principal part of the water systems of Azerbaijan, and are the country's main source of irrigation and hydroelectric power. There are 8359 rivers of various lengths within Azerbaijan.

Economy Currently the basis of the state economy is the oil and gas sector. Azerbaijan oil is exported to 22 countries. In 2012 oil production in the country reached 43.4 mln.t and gas production 26.8 billion m3. Electric power plays an important role in the economic development of the Republic of Azerbaijan. Electrical energy is produced by thermal-electric power generation and hydroelectric power stations. In 2012 Electrical energy production was 18,7 billion kWt/h. Agriculture is the third source of income in the country and the main source of employment. Not all territory in Azerbaijan is suitable for agricultural production, only 22.9 % is arable, due to soil erosion, salinization, swamping, chemical pollution, and so on the effects of degradation processes has become widespread. Cattle breeding, poultry farming, forestry, and fishing are the most developed industries. Animal husbandry provides foodstuffs in the form of meat, dairy, and poultry, and the agro-industrial sector with wool, fur, skins, down, and other materials.
GDP in 2012 year in Azerbaijan was $69,7 billion.

Environmental condition. The main environmental problems are: transboundary pollution of rivers; pollution of the atmosphere by industrial enterprises and transportation; land degradation; hazardous waste; biodiversity conservation. Currently the sectors with the highest emissions are transport, industry, and power engineering.
Extensive areas of Azerbaijan are being severely impacted by soil erosion and salinization. It is estimated that 3.6 million hectares (~42% of the territory of Azerbaijan) is subject to the damag-

ing effects of erosion, while 0.6 million hectares (~7% of the territory of Azerbaijan) is adversely affected by salinization.

Information Regarding the Convention. The Parliament of the Republic of Azerbaijan ratified the United Nations Framework Convention on Climate Change on January 10, 1995. As a developing Country, Azerbaijan is among the countries that are not included in Annex I group of the Convention. The Kyoto Protocol was ratified on July 18, 2000. The following activities related to the Framework Convention on Climate Change were undertaken:

- In 1998-2000 "First National Communication of the Azerbaijan Republic to the UN Framework Convention on Climate Change" was drafted;
- Since 2006 capacity building on Clean Development Mechanism (CDM) project has been carried out with the support of the Norwegian government;
- In 2006-2009 the Second National Communication was prepared with the assistance of GEF and the report was submitted in June of 2011.

II. Inventory on Greenhouse Gases

During the current inventory, emissions from 1990-2005 were analyzed and recalculated, inventory for 2006-2012 were carried out. The present inventory covers the following gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6) by sources and removals. Also inventory for carbon monoxide (CO), nitrogen oxides (NOx), and non-methane volatile organic compounds (NMVOCs) was conducted. Energy, Industrial Processes, Agriculture, Land-Use Change, and Forestry (LULUCF) and Waste sectors were covered in the present inventory. As a result of the inventory conducted, GHG emissions and carbon dioxide absorptions and net emissions from 1990 to 2012 in Azerbaijan are reported in Table 1.

Sector	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Emission										
Energy	63928	33006	39216	38642	35655	42543	37192	36596	37414	39319
Industrial processes	1447	554	1781	1986	2303	2043	1780	2108	2882	3021
Agriculture	6261	5368	6469	6689	7003	7175	7266	7244	7098	7033
Waste	1694	1837	2023	2084	2130	2182	2199	2260	2449	2478
Total emissions	**73331**	**40774**	**49490**	**49401**	**47091**	**53943**	**48437**	**48209**	**49843**	**51851**
Absorption										
Forestry	-3690	-4870	-5349	-5353	-5438	-5383	-5360	-5410	-5435	-5442
Net emissions	**69641**	**35904**	**44141**	**44048**	**41653**	**48560**	**43077**	**42799**	**44408**	**46409**

Table 1. GHG emissions and absorptions by sectors (Gg. CO_2-eq.)

III. Policy and Measures to Mitigate Climate Change

Although Azerbaijan as an oil and gas producing country is able to live at the expense of natural resources, the country prioritizes the development of low carbon-emission production. Azerbaijan has prepared a number of laws, state programs, and regulatory acts concerning the Convention, and has adopted related international documents that support climate mitigation. Furthermore, Azerbaijan prioritized the use of alternative energy and the development of low-carbon measures in the commercial and residential sectors, and set a target to reduce carbon dioxide (CO_2) emissions from 41.1 million tons to 32.7 million tons of CO_2 by 2030.

Currently 6 CDM projects as well as projects in the energy sector on the use of alternative energy and waste have been registered by the CDM Board. Two projects passed the validation process (oil and gas sector) and around 40 PINs 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.

Currently, three NAMA projects are being prepared, including NAMA on the low-carbon end-user sectors prepared by UNDP and supported by GEF; NAMA measures for the phase-out of HCFC's in the refrigerator and conditioning sectors prepared and supported by GIZ and establishment of the Samukh Agro-Energy Complex developed by the Asian Development Bank and is expected to be implemented by the State Agency on Alternative and Renewable Energy Sources.

Mitigation measures by sector

Energy

Electric power industry. At present, energy system of Azerbaijan has 13 thermal power plants (TPPs) and 8 hydro power plants (HPPs). Each year an average of 18 billion kW / h of electricity is produced out of which 90% refers to TPPs, and 10% to HPPs. 5 million tons of conventional fuel is used for energy production at TPPs. As a result of these measures in the electric power sector the amount of fuel used for electricity generation of 1 kW/h decreased from 386 gr. in 2003 to 300 gr. in 2013.

Alternative Energy Sources. The use of alternative energy sources is a priority for the country since their use will lead to the reduction in the use of organic fuel and mitigate GHG emissions into the atmosphere. In Azerbaijan, different energy sources were evaluated and the potential is 12,150 MW.

Building and construction sub-sector. The rapid development of this sector requires the increase of energy efficiency in buildings, preparation and implementation of energy saving policy. The adoption of legislative acts and their preparation in accordance with the European standards will enable to reduce the amount of emitted greenhouse gases. Some studies indicate that using energy efficient technologies in new and existing buildings could save up to 34% of the energy consumed.

Transport sub-sector. The transport sector is an important source of emissions. According to statistical data (State Statistical Committee) during 2000-2011 the sharp increase in quantity of all types of transport systems was observed. Over this period the number of passenger cars increased to 2.6 times, the number of freight traffic increased 57 times. The TNC inventory results show that amount of CO_2 emitted from the transport sector in 2012 increased to 117% compared to 1990. Mainly emissions are attributed to domestic aviation (179%) and road transport (113%).

The amount of CO_2 from the rail system was significantly reduced. This is connected with the increased use of electric vehicles.

Industry Sector

Oil and Gas Industry. Oil and gas industry are largest sources of GHG gases mainly CH_4. The inventory results show that CH_4 emissions in oil and gas sector were 429, 2 Gg in 1990, and increased up to 546 Gg. in 2012.

Other industrial sectors. According to the State Statistical Committee during the past ten years industrial production has increased 2.7 times, the production of construction materials has increased 2.5 times, electrical equipment has increased 2.1 times, metallurgical industry has increased 2.2 times, moreover, clothing production has also increased 2.5 times. In these sectors the CO_2 emissions slightly decreased from 1,183 Gg. in 1990 to 1,078 Gg. in 2010. As a result of the industrial development, CO^2 emissions increased in the cement production from 478 Gg. in 1990 up to 617, 4 Gg. in 2010. Other industrial activities such as lime and cast steel production sectors show that the CO_2 emissions decreased from 34.8 Gg. in 1990 to 0.7 Gg in 2010 and from 630 Gg. in 1990 to 460 Gg. in 2010, accordingly.

Agricultural sector. The agriculture sector is a main source of GHGs as CH_4 and N_2O. Sources of GHGs in agriculture are enteric fermentation, manure, rice planting, burning of agricultural residues. As a result of the activities in the agriculture sector CH_4 emissions increased from 129 Gg. in 1990 up to 182 Gg. in 2012. The N_2O emissions in this period slightly decreased due to the decrease in usage of fertilizers. Agricultural residues can be used in the formation of biomass. Activities on construction of biogas plants based on agricultural residues are being implemented by the ABEMDA. 1 MW biogas thermal power station was built in Gobustan polygon. Biogas plants with a total capacity of 500 kW were built in rural schools, public and in other social facilities. Small-scaled biogas plants have been commissioned by the MENR.

Waste sector. One of the main goals of the state programs is to use 80% of the solid waste until 2015. For this purposes institutional framework was improved and independent "Tamiz Shahar" JSC was established on March 12, 2009. The main GHG gases emitted by this sector are the CH_4 emission and N_2O emission. The inventory results show that the CH_4 emissions in solid waste sector increased by 20% in the period of 1990 – 2012. The CH_4 emissions from the industrial waste waters also shows a slightly increase.

IV. GHG Emissions Forecast and Related Measures

Emission scenarios. To evaluate GHG mitigation potential in Azerbaijan, a baseline scenario of energy use and emissions through 2050 was constructed.**(Asian Development Bank Regional Technical Assistance (RETA) 8119: Economics of Climate Change in Central and West Asia – Mitigation Component).**

This scenario, named "Business as Usual" (BAU), models a future in which no significant new national mitigation policies or measures are implemented and energy demand, energy supply, and non-energy GHG emissions evolve as the present historical trend. Major determinants of energy demand include: population, gross domestic product (GDP), and fuel prices; supply matches demand (plus net exports), with technology choice and utilization in the power sector based on least-cost optimization. Figures 4.1.1 -4.1.3 illustrate the scenario's assumptions concerning pop-

ulation, GDP and GDP per capita. These assumptions were developed using all official national data available.

Mitigation Measures: Abatement Potential and Costs. Table 4.3.1 below shows the cumulative GHG abatement potential and costs for the mitigation measures evaluated for Azerbaijan under ADB TA 8119: Economics of Climate Change in Central and West Asia. In both cases, the accumulation of emission reduction is projected up to 2050 (the model's end year). The costs are expressed as the average cost per ton of CO_2 abated, discounted to 2015 at a 7% real interest rate.

A Stabilization Scenario. The stabilization scenario, considers that population, total and per ca pita GDP, and fuel prices are all the same as in the BAU scenario (see Figures 4.3.1-4.3.3). Moreover, the mitigation measures will lead to a reduction in final energy demand (Figure 4.3.1), total primary energy supply, and the energy intensity of GDP (Figure 4.3.1). The carbon intensity of the total primary energy supply does not decrease relative to the BAU (Figure 4.3.2), reflecting continued reliance on natural gas and oil.

In 2030 natural gas and oil products make up 87% of final energy demand and 68% of inputs for electricity and combined heat and power generation (Figure 1). The 20% renewable power target and the individual measures for small hydro, wind, and distributed solar power do spur increased development of renewable electricity capacity in the stabilizations scenario. Thirty-two percent of domestically produced electricity comes from renewable energy sources in 2030, and 38% in 2050.

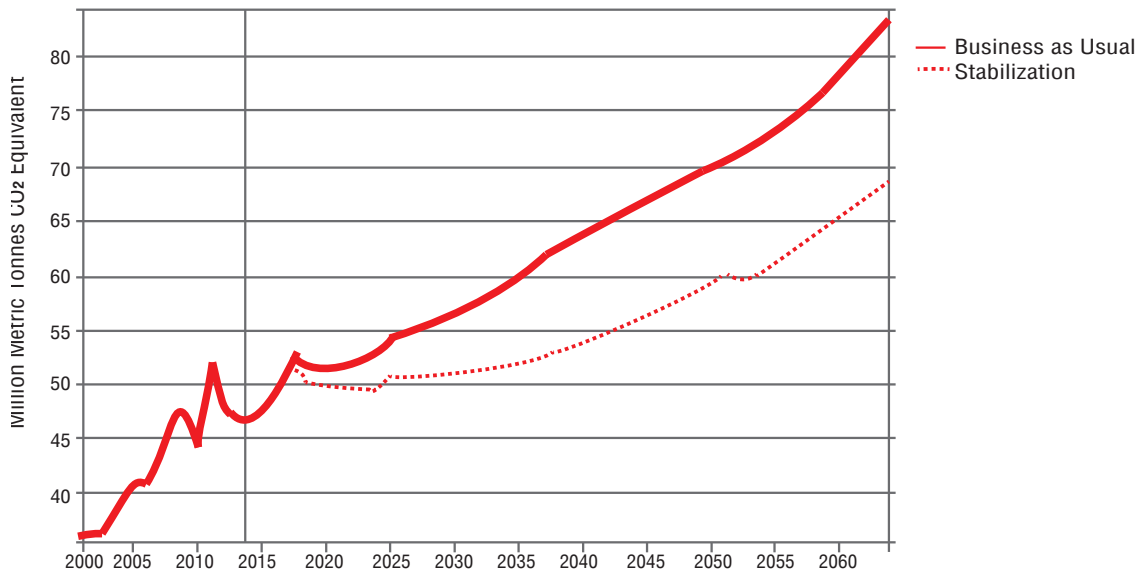


Figure 1: GHG Emissions in BAU and Stabilization Scenarios

V. Vulnerability and adaptation measures

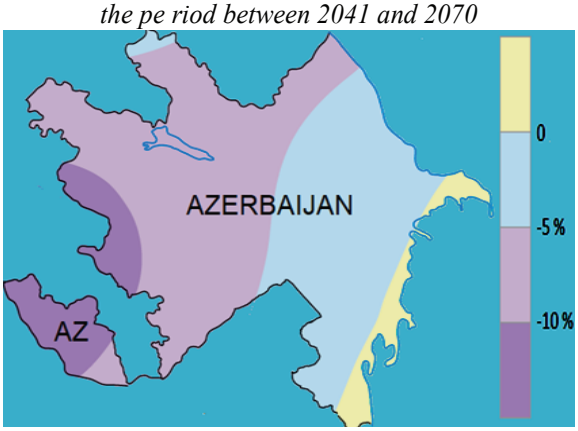
Climate of Azerbaijan Nine out of eleven climate zones are present in Azerbaijan. Temperatures vary within the country depending upon the region's proximity to sea, regional landscape and effect of artic and temperate winds. The average annual temperature varies between 14–15 °C in the Kur-

Araz Lowland, the coastal regions south to the Absheron Peninsula, and in the Lenkoran Lowland, but towards the mountains, warmth begins to lose its importance and temperature drops to an average of 4-5 °C. At its extreme, temperatures can reach a maximum of 46 °C, and in winters can get harsh at -33 °C. The maximum annual precipitation falls in Lankaran (1,600 to 1,800 mm or 63 to 71 in) and the minimum in the Absheron Peninsula (200 to 350 mm or 7.9 to 13.8 in)

Climate scenarios The HadCM3 model - A1 scenario forecasts a 1.5 ^{0}C increase of temperature in comparison with the 1961-90 average values in all the regions of Azerbaijan during the period of 2011-2040. This increase is expected to be in a range of 1.0 - 1.5 ^{0}C in Nakhichevan and in several regions of Lesser Caucasus. The HadCM3 model of A1 scenario forecasts a 10% decrease of precipitation in comparison with 1961-90 average values in Nakhichivan and Zangazur areas during 2041-2070 years.

Figure 5.1Forecasted changes in temperature for the period between 2041and 2070

Figure 5.2 Forecasted changes in precipitation for the pe riod between 2041 and 2070



Agriculture Being one of the most vulnerable sectors to the impact of the climate change agricultural sector needs implementation of adaptation measures. "HadCM3 model and A1" climate change scenario predicts increase of temperature by 1.5-2.0 ^{0}C in 2011-2040, by 2.5-3.0 ^{0}C in 2041-2070 years, by 5 ^{0}C in 2071-2100 years and decrease of precipitation by 5%. Impact of climate change on agricultural sector is expected to result in 15-20% decrease in productivity of crops. Development of adaptation measures is necessary for minimization of impacts. The adaptation measures include followings: under current climate change conditions it is required to cultivate new sorts of long vegetation, heat-loving, drought-resistant, and salt-resistant agricultural crops; in order to increase the country's food security it is necessary to continue the work of winter wheat breeding; implementation of modern irrigation techniques and technologies, the use of alternative water sources is more appropriate; continuation of the work in breeding, introduction, and implementation of drought-resistant cotton varieties with high productivity; considering the water and wind erosion processes, it is necessary to put forest shelterbelts across the areas, to register eroding and soiled lands, mapping, etc.; establishment of greenhouse farms that meet the needs of the market; establishment of artificial water reservoirs to collect precipitation and use it for irrigation; improvement of irrigation and drainage systems in order to fight against salinization, etc.; rehabilitation of vineyards in the traditional areas and increase the size of vineyards by constructing new terraces in the mountains; restoration of tea plantations in the traditional regions and construction of new gardens in other areas; soil salinization and erosion, continuation and expansion of reclamation measures against drought and white winds; in order to increase competitive production development the prepara-

tion and implementation of government assistance programs are necessary; establishment of small enterprises for perishable products in rural areas; expansion and improvement of existing storage system for agricultural products (storage, refrigerators, etc.).

Water resources Studies conducted show decrease of water flow in major rivers. The decrease mostly occurs in summer. The research results confirm the significant impact of climate change on water resources during recent 21 years. According to the "HadCM3 modeling of MAGİCC/SCENGEN" scenario in 2011-2040, 2041-2070 and 2071-2100 in the condition of increase in temperature and decrease in precipitation (especially in the Lesser Caucasus) the water resources over the country predicted to decrease by 10-15% in 2011-2040,by 15-20% in 2041-2070, by 20-25% in 2071-2100 years.

The most sensitive areas in the future will be agriculture, hydropower and domestic water supply. In order to mitigate the negative impact of climate change on water resources, the following adaptation measures have been identified: reconstruction of existing water facilities to reduce water loss; creation of additional water sources such as usage of rain water and purified seawater; use of recycled water such as underground water, and other waters coming from industries; water flow regulation and the efficient use of water during droughts and low precipitation seasons; the construction of HPPs on the mountain rivers and the establishment of new water reservoirs; construction of small HPPs on existing irrigation channels; waste water reuse; implementation of modern irrigation technology and techniques.

Forest. The total forest area in Azerbaijan is 1.2 mln. ha. In the last ten years forest area has increased from 11.4% to 11.8%. Forests in the territory occupied by Armenia, especially in the mountain forests have suffered from fatal damage. 261,000 hectares of forest areas are under occupation as a result of Armenian invasion.

Suggested Adaptation measures: Design and implementation of forest planting programs: The trees should be fast growing and drought-resistant species, preferable local species should be used; reforestation and restoration measures should be carried out in arid areas; reforestation activities in regions with high risk to flood; preventive measures should be taken to avoid forest fires; prevention of the spread of pests and diseases; prevention of illegal cutting and other forest-related measures; study the current state of forests, inventory them and draft a new forest structure; development and implementation of measures for the restoration of forests to ensure efficient use of renewable forest resources (fruits, medicinal, etc.); identification of forest areas for recreation, determine the amount of pressure, the identification and use of the potential of tourism-oriented recreation; planting of fast-growing trees on farms to reduce the shortage in forest products; design and planting of forests and gardens that meets the needs of a new agricultural system; establishment of specialized operational chemical-fire stations in order to prevent forest fires; identification of phytosanitary conditions of forests, implementation of appropriate measures on a regular basis in order to prevent various diseases and pests; establishment of forest protected areas in order to protect the agricultural land from water erosion, drought and dry winds.

Adaptation measures suggested for coastal zones are as followings:

I. Special mode boundaries of economic activities should be identified by the government for the flooded areas:

a) The first zone - covering regions that go from -29.0 m till current shoreline areas that are under water;

b) The second zone – covers the areas from modern shoreline till -26.0 m areas that are formed as a result of high winds. These are areas of short-term and permanent rising of ground water levels;

c) The third zone - covers the areas that can stay under water if the level reaches -25.0 m and groundwater level increases.

II. Two-staged approach for the solution of problems relating to the changes in the level of the

Caspian Sea should be used. The first scenario assumes that the water levels will increase till -25.0 m. Protection measures should be implemented to protect the areas from water pressing and avoid the increase of groundwater level. In the second case, if the level will pass -25.0 m height, regulation of level issue is resolved with the consent and active participation of Caspian countries. Implementation of adaptation measures are recommended to be held in the areas with a possibility of flooding:

a) The coastal zone is not allowed to carry out major construction projects, the existing economic activity areas should be restricted. The construction of complex and expensive defense systems can be justified only for available important objects.

b) The two main areas of adaptation measures in the coastal zone during the current rise in sea level are the following:

- Resettlement of industrial, recreational and other facilities to the safe areas;
- Construction of protection devices in the coastal zone. In this case, objects or the whole area should be protected. The most economically advantageous way is to establish local protection facilities for settlements.

Public health Duration and number of heats waves during recent years have been increased 5 times in comparison with 1961-90 base year in Baku. All models predict increase in summer temperatures and number of hot days which will result in direct impact of "hot weather waves" on public health. Increase in a number of people aged over 65 years who are more susceptible to heat and "urban heat island" of cities may strengthen the negative effects of heats. To maintain achievements in elimination of malaria it is significantly important to evaluate existing climate condition, and possible future impact of climate change. Duration of favorable temperature period (the dates when average daily temperature was over 16 °C) for the three day malaria disease increased to 12 days in Kura-Araz lowland in 1991-2010 years in comparison with 1961-90 base years, the long period is also observed in the mountains. Warming of climate in future predicted result in increase of favorable temperature period for malaria from the three days to 16-24 days in lowland areas, 16-31 days in foothills, 24-65 days in mountains in 2040-59 years. For mitigation of negative effects of predicted climate change on human health the following adaptation measures are recommended: improvement of medical-meteorological warning systems for heat waves; increase in the period of advanced warnings about future risks; rapid greening of cities and creation of green areas around the city; take into account the effect of "urban heat islands" during the construction of residential and public buildings, improvement of malaria control measures operating system and programs on constant surveillance, prevention, and control programs and etc.

Tourism The country has a beautiful landscape, amazing forest and very unique fauna and flora. Azerbaijan also has a good number of mineral water deposits. It should be noted that before the establishment of the MENR, National Parks did not exist in Azerbaijan. Since 2003 the Ministry of Ecology and Natural Resources established Ordubad National Park named by Hasan Aliyev, Shirvan. Aghgol National Parks, in 2004 Hirkan and Altiaghaj National Parks were established, 2005 – Absheron, 2006 – Shahdagh, 2008 – Goygol National Park. In 2008 the territory of Hirkan National Park was expanded and covered 40,358 hectares. By decree of the President of the Republic of Azerbaijan on November 25, 2009 the territory of Ordubad National Park was expanded at the expense of Shakhbuz State Nature Reserve, Julfa, Ordubad regions and covered 42,797.4 hectares. According to the order of the Cabinet of Ministers of the Republic of Azerbaijan dated July 8, 2010 the territory of Shahdagh National Park was expanded from 14,613.1 hectares to 130,508.1 hectares. By the Order of the President of the Republic of Azerbaijan dated November 5, 2012 Samur-Yalama National

Park was established. The expected climate change will increase the repetition of flood incidents in the future and will create serious difficulties for the tourism sector. Floods can cause serious damage to tourist facilities and infrastructure. The length of the Caspian Sea coastline in Azerbaijan is 850 kilometers. Ten administrative regions, including Absheron Peninsula, are located on the sea coast and the majority of the tourism infrastructure is also located here. The large areas in the Eastern coast of the Caspian Sea could be flooded due to sea level rise. The tourism sector will be under threat, because many tourist's facilities and services are located here. Climate change will also affect forests and biodiversity. If the temperature increases by an average of 1.5-2.5 0 C, 20% of animal and plant species will be in danger of extinction. As a result of the predicted increase of temperature, the number of forest fires will also increase. This will affect tourism infrastructure in the forest surrounding regions, and it will decrease the resilience of the tourism sector. Winter tourism activities depend on climate and weather conditions. This type of tourism could face serious problems because of changes on the length of the season and because of reduction in snow precipitation. In other words, the normal functioning of this type of tourism needs adequate amounts of snow. In order to be involved in winter sports the snow cover thickness should be between 20-30 centimeters. The implementation of preventive measures is essential to determine the location of tourism facilities and infrastructure, its construction should take into account risks such as floods, landslides, droughts, avalanches, forest fires, and changes in water levels, etc.). The warning systems on expected extreme hydro-meteorological events need improvement.

VI. Other Information

Activities related to Climate Change The first step the Republic of Azerbaijan has taken to meet its commitment to the Convention was to completed in May of 2000, the "First National Communication to the Conference of Parties" The First National Communication (referred as Initial National Communication -INC) of Azerbaijan Republic was prepared by the National Climate Change Center established under the State Committee on Hydrometeorology of Azerbaijan Republic and within the UNDP/GEF project of technical assistance to developing countries.

The INC presented national greenhouse gas emissions inventory for the period from 1990-1994, and also included: a vulnerability assessment; identification of mitigation options to reduce negative effects of climate change on ecosystems and different sectors of the economy.

In 2000-2001 the country received additional funds to continue the job started during the INC and implemented the II phase of the "First National Communication," the report of the activities were published as "Capacity Improvement Activities on Climate Change in Priority Sectors of Economy of Azerbaijan II Phase of First National Communication to the Conference of Parties.

The second step undertaken by Republic of Azerbaijan to meet its commitment under the Article 4 and Article 12 of the Convention was to prepare the "Second National Communication to the Conference of Parties," the report was submitted in 2006.In the framework of the "Second National Communication to the Conference of Parties" and in accordance with the regional model 'PRECIS' proposed by British Hadley Meteorological Center, the climate change sceneries were developed. In 2004-2006 by the financial support of GEF the regional project "Creation of the potential on increasing of the quality of GHG inventory for the countries of Eastern Europe and FSU Countries" was implemented. The Norwegian Government helped Azerbaijan with develop procedures concerning a CDM. In 2012 the country implemented the Technology Needs Assessment project. Currently the country is on the final phase of implementing a project called "Sustainable Land and

Forest Management in the Greater Caucasus Landscape". Currently, to show the commitment of the national government of Azerbaijan to the reduction of GHG emissions, a project called NAMAs for low- carbon, is going to be implemented by the Azerbaijani Oil Company-SOCAR.

Climate Change Research and Systematic Observation

Hydro-meteorological network and systematic observation. Complex meteorological observations are carried out at 63 stations every three hours, while limited meteorological observations are carried out at 75 stations. Observations for water level and temperature are carried out twice in the morning and in the evening and observations for water consumption are carried out once a week at 103 hydrological points (87 of them are located in the rivers, five in the lakes and nine in the water basins). Sea hydro-meteorological observations are carried out at four stations and nine points on the western shore of the Caspian Sea and its Azerbaijan water area islands four times a day. These observations have been carried out for sea level, waving regime, water temperature, salinity, color, transparency and sea flows. Agro-meteorological observations have been carried out at 14 points for agro-meteorology. The observations for atmospheric air pollution are carried out in seven cities (three times a day). Water sample taking from 30 hydrological stations is given to the laboratories to be investigated its chemical composition.

Observation network

The observation network includes the following facilities:

1. Number of meteorological stations 80
2. Number of radiological stations 4
3. Number of agro-meteorological stations 14
4. Number of meteorological posts 23
5. Number of sea posts 9
6. Number of Hydrological posts 103
7. Number of laboratories 8
8. Number of agrological stations 1
9. Number of automated meteorological stations 31
   (Only eight of them are still in operation)

Education, Training and Public Awareness on Climate Change. Climate change specialists have participated in events organized by international organizations, televised meetings, and made speeches at schools on the subject. With the help of nongovernmental organizations, climate change awareness raising campaigns were implemented in rural communities, within the framework of projects such as protection and sustainable use of agro bio-difference and struggling with desertification in arid and semi-arid zones of Southern Caucasus for adaptation to climate change. Training courses have been organized in Azerbaijan in 2011-2012 by the German Development Agency (GIZ) in order to strengthen capacity for adaptation to Climate Change. Programs for informing the general population on utilization of alternative energy are carried out with the support of NGO's Contribution Funds. The State Agency on Alternative and Renewable Energy Sources, SAARES (Azerbaijani: ABEMDA) is a governmental agency under the Ministry of Industry and Energy and mandated by the Cabinet of Ministers. It serves as the principal regulatory institution in the field of alternative and renewable energy in the Republic of Azerbaijan. SAARES and alternative energy facilities holds regular meetings with public representatives, students and youth, as well as experts from different organizations and other interested parties.

Information and Networking. Climate change news and information is regularly provided to all news websites and newsletters. Annual reports on climate change are available at: www.eco.gov.az. Information related to the Third National Communication of Azerbaijan can be found at: http://www.az.undp.org/content/azerbaijan/en/home/operations/projects/sustain_development/tnc.html.

CHAPTER 1. NATIONAL CIRCUMSTANCES

1.1. Political profile

Azerbaijan is a democratic, secular, and unitary republic. The head of state is the President of the Republic of Azerbaijan. In accordance with the principle of separation of power three independently functioning branches exist: legislative, executive, and judicial. Each of these bodies is regulated by the Constitution and legislation, and function through the use of a checks and balance model.
Executive power is vested in the President of the Republic of Azerbaijan who is elected for a five-year term. The President appoints the Prime Minister with the consent of the National Assembly. For implementation of executive powers, the President organizes the Cabinet of Ministers of the Republic of Azerbaijan. Legislative power consists of one house, which is controlled by the Parliament. The Constitutional Court, Supreme Court, Courts of Appeal, common courts, and specialized courts, exercise judicial power.
Azerbaijan pursues an active foreign policy and works on the development of relations with all countries. Continuation of war with Armenia, which has occupied up to 20% of the country over a period of 25 years, constitutes a serious obstacle for full-scale development. Therefore, the main target of the country's policy is to restore territorial integrity of the state.

1.2. Geographic position

The country stretches 400 kilometers from north to south and 500 kilometers from east to west, it is located at 38 ° 25 '- 41 ° 55' north latitude and 44 ° 50 '- 50 ° 51' east longitude and covers an area of 86.6 thousand km2.
Azerbaijan shares a border with five countries. The border length is close to 2,850 km. The capital of country is Baku, situated in the Absheron peninsula, on the shores of the gulf of the Caspian Sea. As a major international port city Baku possess a large advanced industrial area.

1.3 Demography

The population of Azerbaijan is estimated to be 9,477.1 thousand[3] people (as of January 1, 2014), of which 4,966.2 thousand people or 53.1% are concentrated in urban areas.
Annual population growth rate is 1.3%. According to official data, 2150.8 thousand people are living in the country's largest city and the capital of Baku. The average population density of the country is 108 people per square kilometer.
Women comprise 50.3% of the population. Regional and altitude zones are distributed unevenly across the population. 65.9% of total population, and 78.4% of urban population live in lowland areas. 22.2% are children and adolescents aged 0-14 years, 15-64 years old men and women make 72.1%, people ages 65 and above represent 5.7% of population. For 2012 the life expectancy at birth is 73.9 years. This figure is 71.3 years among men and 76.6 years among women.

[3] *According to The State Statistical Committee of the Republic of Azerbaijan*

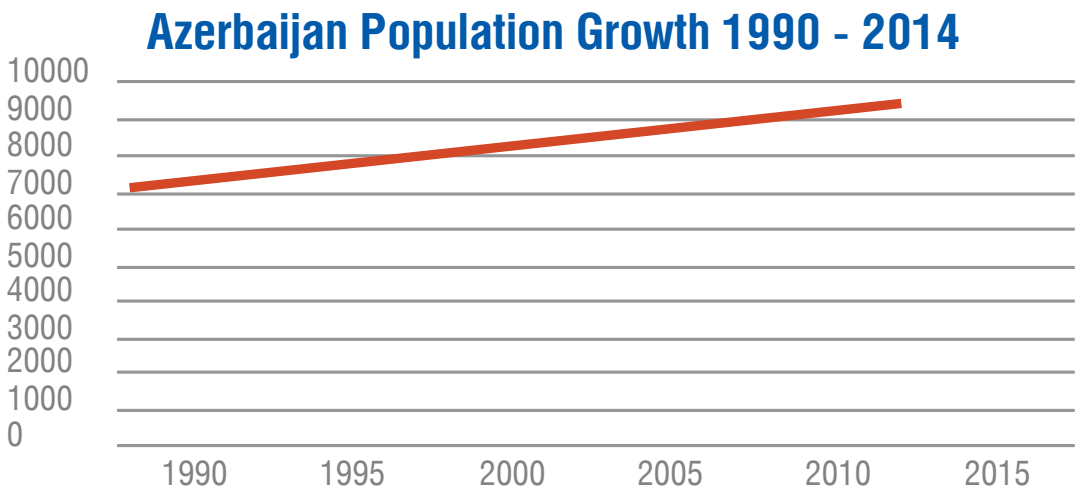


Figure 1.1: Population growth in Azerbaijan (ths)
Source: The State Statistical Committee of the Republic of Azerbaijan

1.4 Climate

Due to its geographical position there is variety of climates in Azerbaijan. From 11 climate zones (according to V.V. Keppen) eight are found in this region. Subtropical climate is predominated. On average there are 1,900-2,900 hours of sunshine annually (approximately 5-8 hours of daily sunshine). In the lowlands, summers are hot, and winters are moderate, however in the mountains, the summers are cooler, and temperatures in the mountains can reach negative figures. Recorded temperatures have reached a maximum of +46 °C, and minimum of -32°C. Humidity tends to be low, although it varies across the country. Annual rainfall in Absheron peninsular area, in the west, varies between 150-200 millimeters, whilst in the foothills of the Talysh Mountains, it averages 1,600-1,700 mm per year. Sixty five percent of the country has an average annual rainfall that is less than 400 millimeters.

1.5. Hydrology

An extensive river network covers most of the country; hydrographically the Republic of Azerbaijan belongs to the Caspian Sea basin. It has unique physical and geographical properties. The Caspian Sea is the largest enclosed body of water in the world, covering 436,000 km^2.

Rivers form the principal part of the water systems of Azerbaijan, and are the country's main source of irrigation and hydroelectric power. There are 8,359 rivers of various lengths within Azerbaijan. The Kur River is the largest river of Azerbaijan. It stretches for 1,515 kilometers,of which 906 kilometers are located in the territory of the Republic of Azerbaijan, the River covers an area of 188 thousand sq. kilometers. The second main river of Azerbaijan is the right tributary of Kur River, the Araz River. The common watershed area of Araz River is 102,000 km^2 . Samur River is the largest river (216 km) in the Northeast.

There is a large amount of other mountain rivers in Azerbaijan. Most rivers are fed by snow and rain. According to the Ministry of Ecology and Natural Resources , there are nearly 450 natural freshwater and saltwater lakes that differ in their formation conditions. Most of them are small lakes. The largest lake of republic is Sarisu lake in Kur-Araz lowland (with and area of 65, 7 km^2, the volume is 59, 1 million cubic meters). One of the most picturesque mountain lakes in the country is Goygol (Fig 1.2) This lake has been formed as a result of a strong earthquake in 1139.

Azerbaijan has several glaciers within its territory. The most important are Bazarduzu (with an area of 3.62 sq.km.), Bazaryurd (1 sq.km), Tufan (0.51 sq.km) and Shahdag (1.08 sq.km).
Azerbaijan Republic has 10.3 billion cubic meters of water reserves. These water reserves together with the waters entering Azerbaijan from neighbor countries (20.6 billion cubic meters) add up to 30.9 billion m^3.

1.6 Economy

Currently, the basis of the Azerbaijan economy is the oil and gas sector. In 2012, 43.4 million tons of oil and 26.8 billion m3 of gas were produced in the country;
İn addition of this electro power, industry and service sectors is developing in the country. As a result of development of above mentioned sectors GDP growth in Azerbaijan was quite high. Most increase in GDP growth was during 2011-2012 years (Figure 1.3).

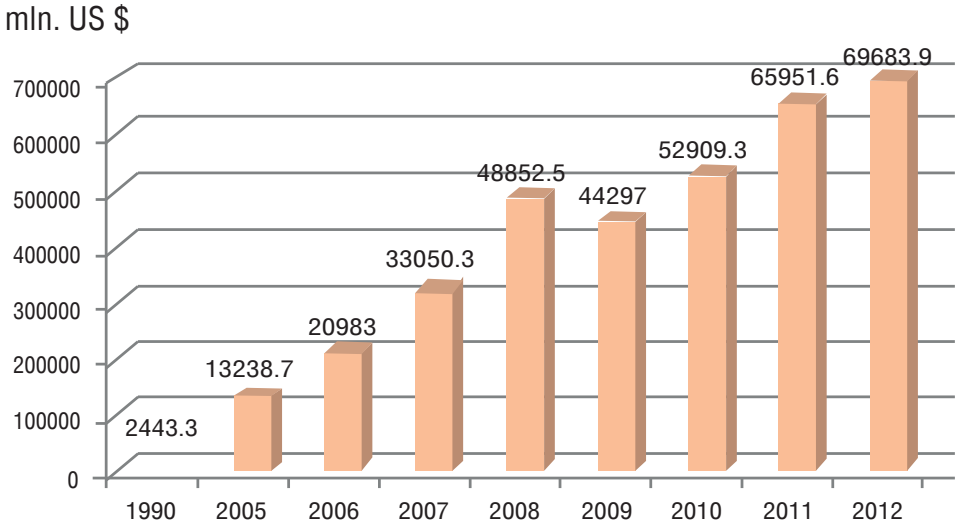


Figure 1.6.1 GDP growth dynamics in Azerbaijan

GDP per capita indicators are presented below in Figure 1.4

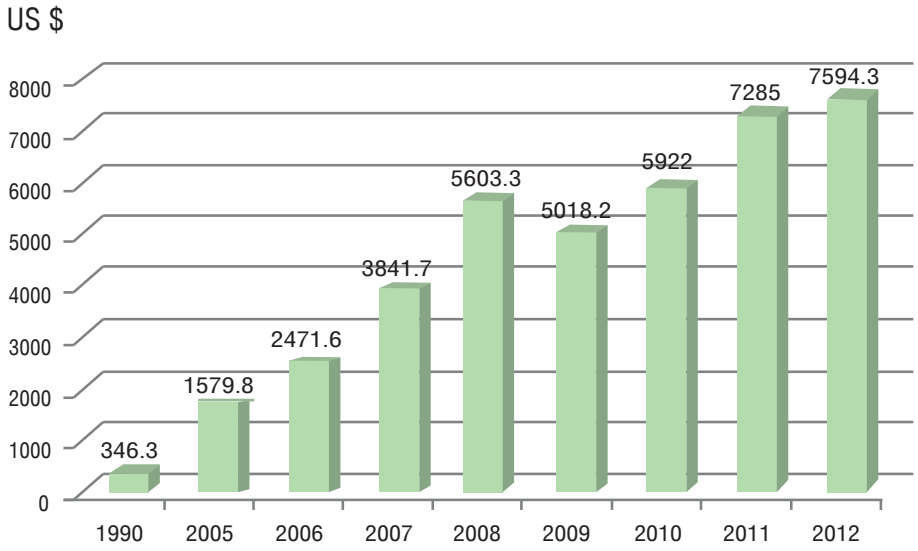


Figure 1.6.2 GDP per capita in Azerbaijan

Electricity production

Electric power plays an important role in the economic development of the Republic of Azerbaijan. These are complexes of thermal and hydroelectric power stations, includes power supply chain. Electrical energy is produced by thermal-electric power generation (TPS, SDPS) and hydroelectric power stations. TPP use fuel and combustible gas, hydroelectric power stations are generated by Kur, Araz and Tartar rivers. The hydropotential of the country is calculated to be 37 billion kWh, while available share is just 16 billion. KWh.

There are Mingechevir, Shamkir, Varvara, Yenikand, Serseng and Araz HPPs and Mingechevir, Shirvan and "North" SRES, Sumgait TPP-1 and TPP-2 thermal power stations operating in Azerbaijan.

According to 2012 records 18.7 billion KWh of electricity were produced in the country, of which 16.3 billion kWh were generated by TPP, and 2.2 billion. KWh were generated by HPPs.

Agro Industry

Agro-industrial complex plays an important role in the economic development of Azerbaijan. Azerbaijan has adopted a number of laws to encourage agricultural growth and rural development. Privatization processes and other reforms are still in progress.

The food and beverage industry forms a modest part of Azerbaijan's economy, generating 2.5% of GDP.

Agriculture

Agriculture is the third source of income in the country and the main source of employment providing approximately 39% of employment in 2013. The export of agricultural products has grown three times since 2005.

Following almost full privatization of the agricultural sector (99% of the sector is under private ownership), new policy measures have been undertaken by the Government. President of Azerbaijan president declared 2015 the Year of Agriculture in order to give a new momentum to the development of agriculture and accelerate its modernization, to ensure a systematic and comprehensive approach to solving existing problems, and to support farmers by introducing financial mechanisms and market-based services that promote local production of agricultural goods. The State Program on socio-economic development of the regions (2014-2018) has the support to the food processing industry as one of its key elements.

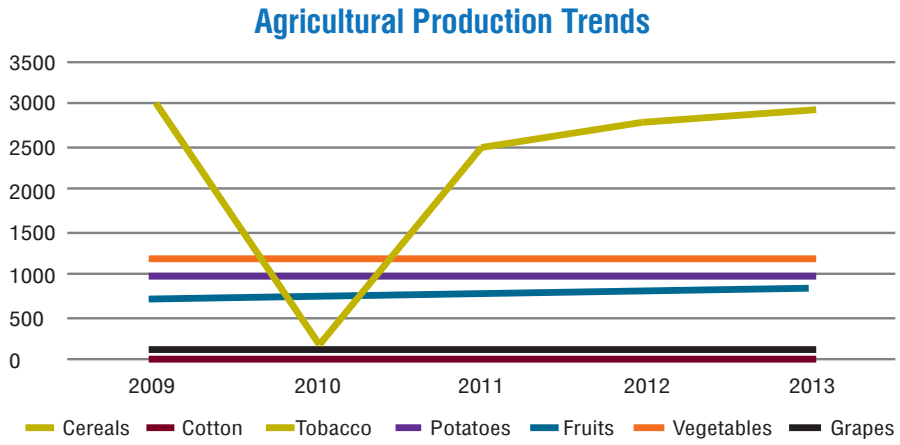


Figure 1.6.3. Agricultural production trends

Source: Business in Azerbaijan 2014

Several State programs have been adopted on development of the rural sector. During 2005-2010 the State Fund for Support of Entrepreneurship (SFSE) under the Ministry of Economic Development (MED) (now the Ministry of Economy) now provided $294 million in credits to agricultural producers and agro-processing units.[5]

Livestock production dates to ancient times. Cattle are very important for meat and milk across Azerbaijan. Livestock is fully privatized - only an insignificant number of cattle are kept on the 21 state breeding farms. More than half of the country's income from livestock accounts for cattle.

Poultry breeding is quickly growing and is considered to be one of the most profitable economic sub-sectors. Poultry meat production in Azerbaijan has increased by more than 1.5 times over the past three years and reached 97,300 tons[6]. Poultry farms produce high quality meat, eggs, feathers, etc. While poultry farming is developing very rapidly it requires investment in new technologies to increase productivity.

1.7 Environmental Situation

The rapid development of all economic sectors in the last century had a negative impact on the environment due to excessive exploitation of natural resources. Nowadays, the problems of efficient and sustainable use of natural resources and environmental protection are given great attention in Azerbaijan.

In order to achieve positive results in environmental enhancement, which forms one of the fundamentals of Republic's environmental policy, a number of important laws have been adopted and regulatory legal documents have been approved to meet the requirements of European legislation in recent years. Along with the development of international, regional, and bilateral cooperation to solve environmental problems accumulated for many years as soon as possible, the use of our own internal resources is preferred in recent years. So far, our Republic became a party to 20 international treaties in this area. At the same time due to the increase of the budget as a result of the achievements in the field of economic development of the country in recent years, allocation of funds from internal resources has been started to solve current environmental problems within the framework of the relevant programs and plans.

The main environmental problems of Azerbaijan Republic are as follows:

- Transboundary water pollution;
- Pollution of the atmosphere by industrial enterprises and transportation;
- Degradation of fertile soil (erosion, salinity, etc.);
- Solid industrial and domestic waste, including hazardous waste is not fully utilized;
- Biodiversity conservation.

Government has developed environmental policy that has the following objectives:

-Application of methodologies based on sustainable development principles to decrease environmental pollution;

-Efficient consumption of natural resources and use of alternative and renewable energy sources and pursuing energy efficiency;

-Environmental needs assessment including stronger cooperation with international organizations, and development of national capacities.

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[5]*FAO.The European Union's Neighbourhood Programme. 2014. The Republic of Azerbaijan: Assessment of the Agriculture and Rural Development Sectors in the Eastern Partnership countries.*

[6]*http://www.worldpoultry.net/Broilers/Markets--Trade/2014/2/Azerbaijan-investments-increase-poultry-meat-production-1455803W/*

Air Pollution

Up until the 1990s atmospheric pollution posed a serious threat to human health in major cities. Between 1990 and 2000 the air quality improved, due to the fact that many large industrial enterprises stopped functioning or reduced their production capacity significantly. Currently the sectors with the highest emissions are transport, industry, and power generation.

Emissions from the industrial sector has reached to 215 thousand tons, from stationary sources in 2010, from which 68.6% occurs in the country's main industrial center, Baku, 1.2% from Sumgait, 0.8% from Shirvan, 1.0% from Mingachevir. Mostly the emissions are 91% hydrocarbon, 12.6% carbon dioxide, 9.2% nitrogen oxide, and 1.0% sulfur dioxide.

Continuous growth of number of vehicles is increasing emissions. The amount emitted by the transport sector was 742 thousand tons in 2010.

Waste

For many decades of oil production using outdated technologies has led to soil contamination with oil and brine. Approximately 40% of the country's population and 70% of the industrial potential of the country is concentrated in the Absheron peninsula, where most of the ecological problems inherited from the Soviet Union period exist. One of the main problems related to the contamination of land with oil and layer waters used during oil-gas extraction and drilling works, as a consequence contaminated artificial lakes and ponds are formed due to failure to control layer waters. Another ecological problem is the situation related to the sewage waters management. In Baku city in 2008 from the produced 536 million m^3 of wastewater, 144.5 million m^3 were discharged into the Sea and internal water basins without being treated. At the same time sulphate compounds, chloride salts, superficially active substances, phenol, and other different heavy metals were also discharged into water basins. In 2009 UNDP started assisting the Government of Azerbaijan in improving the national solid waste management system. UNDP brought in the international best practices from such countries as the Czech Republic, which ten years ago had SWM problems similar to those facing Azerbaijan today and is now considered as example of excellence. With participation of the city authorities, utility services, NGOs, schools and citizens, surveys were conducted in Baku, Ismayilly, and Sheki to determine per capita waste generation capacity. The project also created a database of solid wastes across the country, with information on coordinates of dumping sites, waste accumulated in each site, their "growth speed", distance to nearby cities and settlements, etc. Inventory of the solid waste sites was prepared and laboratory analyses were conducted in 50 districts across the country. The key milestones were the setting of per capita waste generation capacity and the waste composition, which determine the appropriate policy options for reduction, recycling, and reuse (RRR) strategy.

1.8 Information on activities related to UNFCCC

The Parliament of the Republic of Azerbaijan ratified the United Nations Framework Convention on Climate Change on January 10, 1995. As a developing Country, Azerbaijan is among the countries that are not included in Annex I group of the Convention. The Kyoto Protocol was ratified on July 18, 2000.

The following activities related to the Framework Convention on Climate Change were undertaken:

- In 1997, State Commission on Climate Change was established. The Commission included certain ministries, committees, and other relevant organizations;

- In 1998-2000, “First National Communication of the Azerbaijan Republic to the UN Framework Convention on Climate Change” was drafted;
- In 2000, the project “Actions on Capacity Building in the Priority Areas of the Azerbaijani Economy on Climate Change” was carried out as the second phase of the Initial National Communication;
- In 2002-2005, projects leading to GHG reduction were implemented within the program of Caspian Basin in Azerbaijan, realized with the Canadian International Development Agency;
- In 2003-2006, Azerbaijan participated in the regional project on the quality improvement in GHG inventory process;
- In 2004-2005, the project of the assessment of the capacity for the preparation of National Communication in Azerbaijan;
- In 2004-2006, Azerbaijan took part in the project of “Technical Support to Caucasian countries and Moldova regarding the Global Climate Change obligations” within the TACIS program;
- Since 2006, capacity building on Clean Development Mechanism (CDM) project has been carried out with the support of the Norwegian government;
- In 2006-2009, the Second National Communication was prepared with the assistance of GEF and the report was submitted in June of 2011;

CHAPTER 2. NATIONAL INVENTORY OF GREENHOUSE GASES

2.1 INTRODUCTION

Azerbaijan began the preparation of the first Greenhouse Gas Inventory of emissions and sinks in 1998, The inventory took place from 1998-2000 within the project of "Initial National Communication of the Azerbaijan Republic to the UN Framework Convention on Climate Change" prepared with the financial assistance of Global Environment Facility (GEF) and the technical support of the United Nations Development Program (UNDP).

The first GHG inventory process covered emissions for the years 1990-1994.

In 2003-2006, a regional project directed at improving the quality of GHG inventory of the CIS countries was carried out with the assistance of UNDP and GEF. The overall objective of this project was to strengthen the capacity of participating countries to improve the quality of their national greenhouse gas inventories (GHG) in the context of their commitments as Parties to the United Nations Framework Convention on Climate Change.

The project inventory covered the following years: 1990-2003 for the sectors: LULUCF, Energy (transport, and fugitive), agricultural (enteric fermentation and manure management), and waste (solid waste). Emissions for the years of 1990-1994 were compared with the emissions reported in the Initial National Communications for the same years.

The form of "data on the quantity of GHG released into the atmosphere from the activity of enterprises" was developed, and it was proposed to include these data in the reports of the State Statistics Committee for further specification of the quantity, and documentation of GHG emissions in the industrial sector. Currently, these data are printed in the report document of the State Statistics Committee.

In 2006-2007, within the process of preparing the Second National Communication Report recalculation of GHG for the years of 1990-1994, and calculation for the years 1995-2005, was conducted. The current inventory covers the years 2006-2012. All sectors were analyzed, and emissions and uncertainties were calculated within the process.

Data for the present national GHG inventory was obtained from national and international statistical reports and from relevant organizations.

During the current inventory, emissions from 1990-2005 were analyzed and recalculated, inventory, calculations for 2006-2012 were carried out. According to the agreement, the results of calculations for 2006-2010 will be reflected in "The first Biennial Updated Report on Azerbaijan (BUR)" document. The base year for this inventory is 2010.

The present inventory covers the following gases: carbon dioxide (CO^2), methane (CH_4), and nitrous oxide (N2O) by sources and removals by sinks and also emissions by sources of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and also carbon monoxide (CO), nitrogen oxides (NOx), and non-methane volatile organic compounds (NMVOCs).

Energy, Industrial Processes, Agriculture, Land-Use, Land-Use Change and Forestry (LULUCF) and Waste sectors were covered in the present inventory.

As a result of the inventory conducted, GHG emissions released into the atmosphere and carbon dioxide absorptions in Azerbaijan and net emissions of Azerbaijan from 1990 to 2012 are reported in table 2.1-1.

Sector	1990		2000	2005	2006	2007	2008	2009	2010	2011	2012
Emission											
Energy	63928		33006	39216	38642	35655	42543	37192	36596	37414	39319
Industrial processes	1447		554	1781	1986	2303	2043	1780	2108	2882	3021
Agriculture	6261		5368	6469	6689	7003	7175	7266	7244	7098	7033
Waste	1694		1837	2023	2084	2130	2182	2199	2260	2449	2478
Total	**73331**		**40774**	**49490**	**49401**	**47091**	**53943**	**48437**	**48209**	**49843**	**51851**
Absorption											
Forestry	-3690		-4870	-5349	-5353	-5438	-5383	-5360	-5410	-5435	-5442
Net emissions	**69641**		**35904**	**44141**	**44048**	**41653**	**48560**	**43077**	**42799**	**44408**	**46409**

Table 2.1.1 GHG emissions and absorptions by sectors (In Gg. CO^2-eq.)

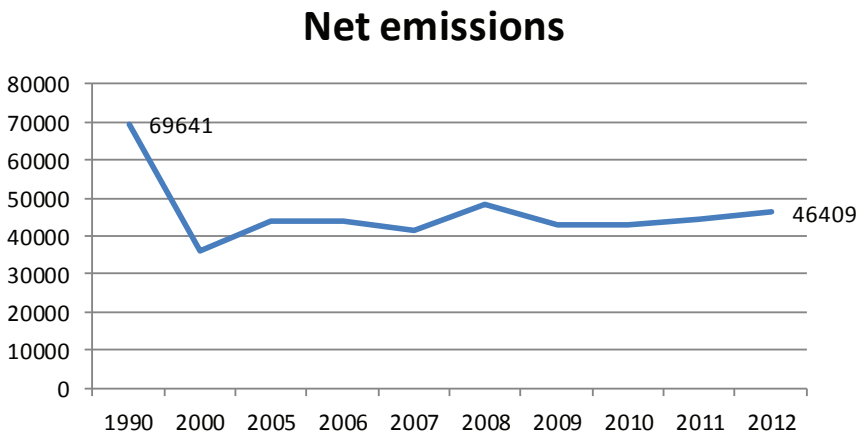


Figure 2.1-2.Total emissions 1990-2012 (In Gg CO_2 eq.)

GHG	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Emissions										
CO_2	55934	29011	35473	34310	29284	32283	26893	26411	28798	30186
CH_4	13456	8858	10407	11387	13805	17629	17269	17485	17081	17594
N_2O	3681	2473	3005	3028	3230	3178	3343	3288	3088	3131
F-gases	260	431	604	676	771	853	932	1025	876	940
Total	**73331**	**40774**	**49490**	**49401**	**47091**	**53943**	**48437**	**48209**	**49843**	**51851**
Absorption										
Forestry	-3690	-4870	-5349	-5353	-5438	-5383	-5360	-5410	-5435	-5442
Net emissions	**69 641**	**35 904**	**44141**	**44048**	**41653**	**48560**	**43077**	**42799**	**44408**	**46409**

Table 2.1-3. GHG Emissions and Absorptions by Gases (In Gg. CO_2-eqv.)

As can be seen from the table 2.1-2, above, the 2012 net emissions accounts for 79.2% of the 1990. The figure below shows the emissions by gas, CO_2 emissions have decreased. CH_4 emissions showed a reduction between 1990 and 2000, however, from 2000-2012 the emissions are increasing.

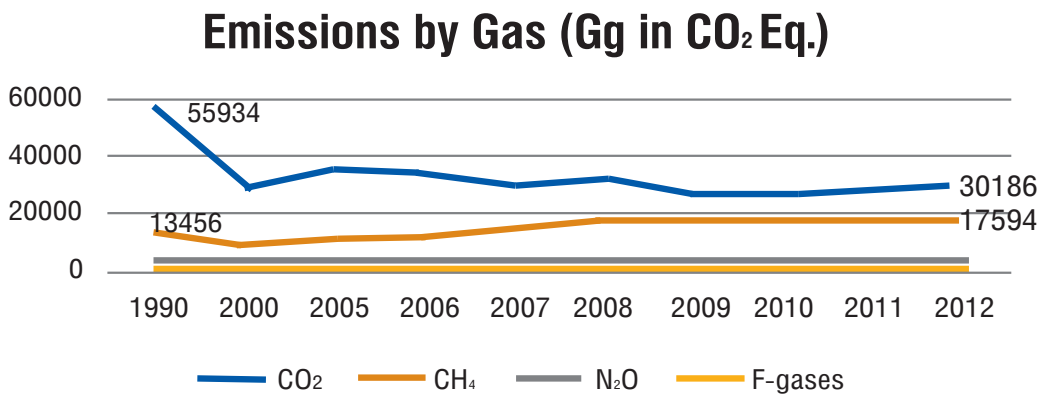


Figure 2.1-4 Emissions by gas 1990-2012

As per the figure below shows, the per capita emissions have decreased during the period of 1990-2012. Currently, the 2012 per capita emission has decreased 1.7 times in comparison to the base year (1990).

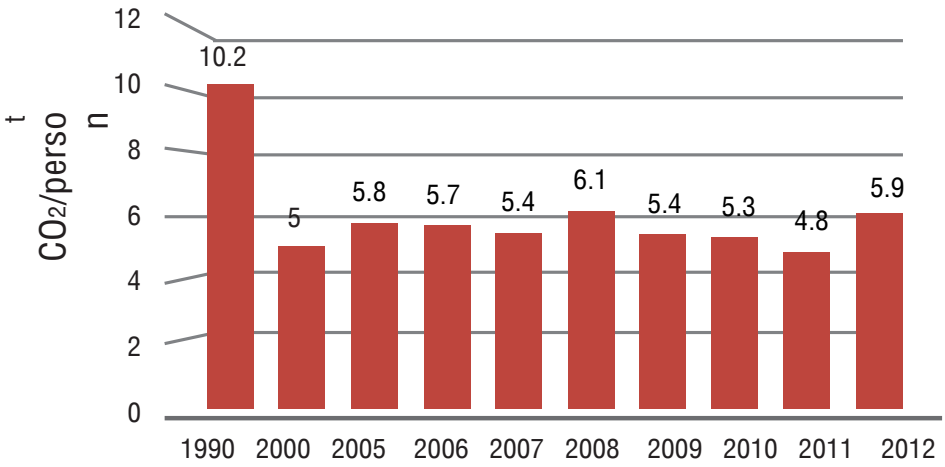


Figure 2.1-5. GHG emission per capita

Methodology

The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories were used for the preparation of the GHG Inventory.
Tier 1 methods from the 1996 IPCC Guidelines with country specific data and both default and country-specific parameters data were used.
To estimate and report the emissions, for the sectors Industrial Process, Agriculture, Land Use Change and Forestry and Waste, the UNFCCC non-Annex I Inventory Software version 1.3.2 (Excel-based) was used. For the Energy sector the NAIIS Web Application, and upgraded version of the previous Excel based software were used.
The base year for this inventory is the year 2010 and Tier 2 methodology was used.

Institutional Arrangements

The Ministry of Ecology and Natural Resources (MENR) is the key governing body in charge of climate change, emission accounting and regulation on natural resources use, it also serves as the Designated National Authority (DNA) for CDM and NAMAs in Azerbaijan.

The Climate Change and Ozone Center (CCOC) of the National Hydrometeorological Department of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan is in charge of all activities of the National Communications process and also in charge of activities to prepare Azerbaijan's GHG inventories, National Communication Report and other analysis on national/sectorial GHG abatement potential and costs.

2.2 Energy sector

GHG emissions from the energy sector were mainly produced during the use and processing of fuel, and during fossil fuel extraction, processing, transportation, storage, and use. Emissions included in the energy sector come from the following sources:

- Fuel burning
- Emissions of volatile fuel
- CO_2 transportation and storage

GHG emissions from fuel combustion are divided into two parts:

- Fuel burning from stationary sources;
- Fuel burning from mobile sources.

In stationary sources the following processes are included: fuel burning processes such as in oil and gas industry exploration and production, storage, processing, transportation and distribution, various technological processes connected with the use of fuel in industrial spheres, commercial, public sector and other categories. Emissions from mobile sources occur during the use of mobile technology such as transport, agriculture, and other specific areas.

CO_2 generated during use of fuel is discussed in a separate section, because it is possible to calculate it precisely. CO_2 depends on the amount of carbon in the fuel. The evaluation of CO_2 emissions in the energy sector with slight amendments can be made on the basis of information on the use of energy. CH_4, N_2O, NOx, CO and NMVOC emissions calculation require more information than the one for CO_2. This is due to close linkage factors of these gases, including burning conditions, technology, and fuel characteristics.

Energy sector emissions also include the burning of biomass, however, the CO_2 reported here is not included and is reported separately.

This report analyzed the information that was documented and archived in the First National Communication for the years 1990-1994. The re-calculation for the mentioned years has been carried out again, and emission factors approved in the country have been used.

As Azerbaijan is an oil and gas country, the most common types of fuel used are oil, oil products, and natural gas.

The data collected during the inventory process and its analysis shows that the change in the dynamics of usage of petroleum products and natural gas depends on the production quantity of oil and gas. Oil and gas productions in 1990 and 2012 are shown in Figure 2.2-1.

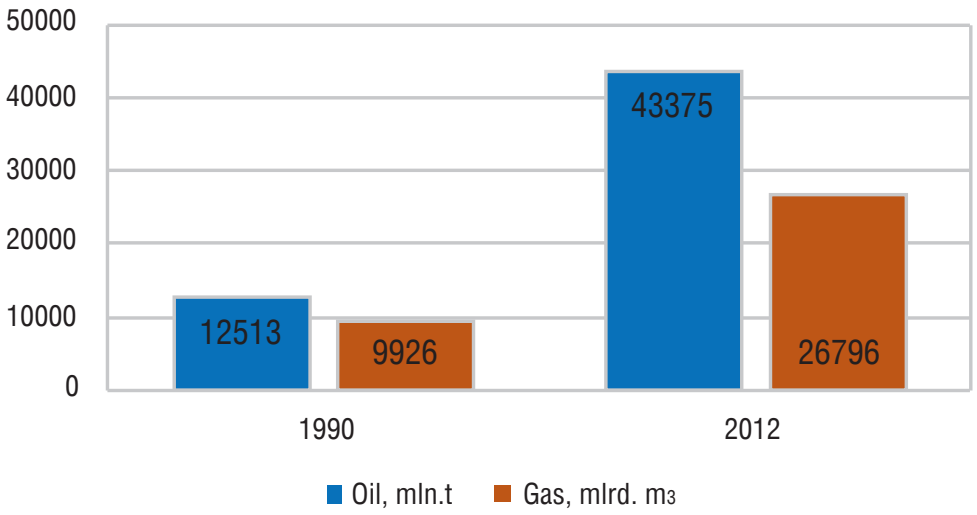


Figure 2.2-1. Oil and gas production in 1990 and 2012

2.2.1 Fuel burning

Activities related to the fuel burning cover almost all sectors of human activity. This category was divided into five sub-categories according to Intergovernmental Panel on Climate Change (IPCC) methodology and was coded and reported as follows:

- Energy industries;
- Manufacturing industries and construction;
- Transport;
- Other sections (commercial, population, agriculture, forestry, fishing);
- Others (not specified)

All above mentioned subcategories were reported and are included in the inventory.

The energy sector category analyzes the fuel and other sources for the production of electric and thermal energy, oil, and gas production and processing. The waste from energy usage in these enterprises is considered in the industrial process sector. Aviation, road transport, rail, and navigation sources are reviewed in the transport sector also. According to the IPCC methodology aviation and navigation are divided into two parts: domestic and international aviation, national, and international navigation.

GHG emissions from international aviation and international navigation were calculated, however as per the guidelines they are not included in the National inventory report and are reported as Memo Items.

Other Sectors, include the following subcategories Commercial/Institutional, Residential, and Agriculture/Forestry/Fishing. Other sources that are not included in the previous subcategories were reported as “other”.

2.2.1.1. Stationary sources emissions

Sub categories such as energy industries, manufacturing industries, and construction industries and other sectors relate to stationary sources.

- Energy sector

During 165 years, Azerbaijan as an oil and gas country has been producing oil and gas using industrial methods. Oil and gas reservoirs are found both in water and on land.

Currently there are two oil and one gas processing plants in the country. Processing capacity of the oil refineries is about 20 million tons. Currently, the majority of the oil is exported. Three pipelines are available for this process (Baku-Novorossiysk, Baku-Supsa and Baku-Tbilisi-Jeyhan). In 2007 Baku-Tbilisi-Erzurum gas pipeline was built for gas exportation. The construction of new pipelines is planned.
The largest sources of emissions in the energy sector are thermal power plants in the country. The energy system of the country includes two different regimes, namely power stations working in condensation and heating regimes.
In order to get the electric and thermal energy, number of different type stations were built in the country. It should be noted that, reconstruction and renovation works were made in many stations and as a result, the emissions have decreased.

- Manufacturing Industry and Construction

The main sources in this sub-categories are the enterprises for the production of mineral materials, metallurgy, and chemical industry. Cement production, steel, and iron pipe production are the main sources of mineral material. In 1995 the volume of production volume in the industry and construction sub sectors decreased by 70% compared to the base year.
For the inventories of these sub-sectors, national and IPCC ratios were used depending on the type of fuel. Some types of fuel (naphtha, bitumen) are used as raw material.
Currently it is not possible to control the process and calculate the amount of CO_2 emissions from separate areas of industrial spheres and construction due to the lack of data.

- Other sectors

Commercial, residential, agriculture, forestry, and fishing sectors are included in this sub-category. These sources mainly use diesel fuel, kerosene, fuel oil, and natural gas. The amount of fuel used has changed between 1990 and 2012. In the period of shortages of liquid fuel and natural gas (1991-1994) firewood has been mostly used. Sub categories such as energy industries, manufacturing industries, construction industries, and other sectors relate to stationary sources emissions from wood burning (biomass) are included only as informational items because, for this sector, it is assumed that the consumption of biomass is similar to the volume that is regenerated.
The sources that were not included in any of the previous sub-categories, such as fuel types burned in military forces and other sub-sectors are reported here.
CO_2 emissions from stationary sources are shown in Table 2.2-1.

Source	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Energy industry	22383	16527	17410	17778	15431	14953	12047	10706	11296	12544
Industry and construction	17709	2711	2099	2021	456	2157	1237	1092	1878	2385
Commercial	-	795	34	58	325	396	338	303	298	377
Residential	4679	3774	6741	6259	5993	7295	6522	6778	6497	5355
Agriculture, forestry and fishing	3843	295	780	144	610	777	1017	1057	1090	1120
Other	743	2668	3075	2016	1210	831	720	537	431	849
Total	**49357**	**26770**	**30139**	**28275**	**24024**	**26407**	**21880**	**20472**	**21490**	**22630**

Table 2.2.1.1-1 CO_2 emissions from stationary sources of energy sector, Gg

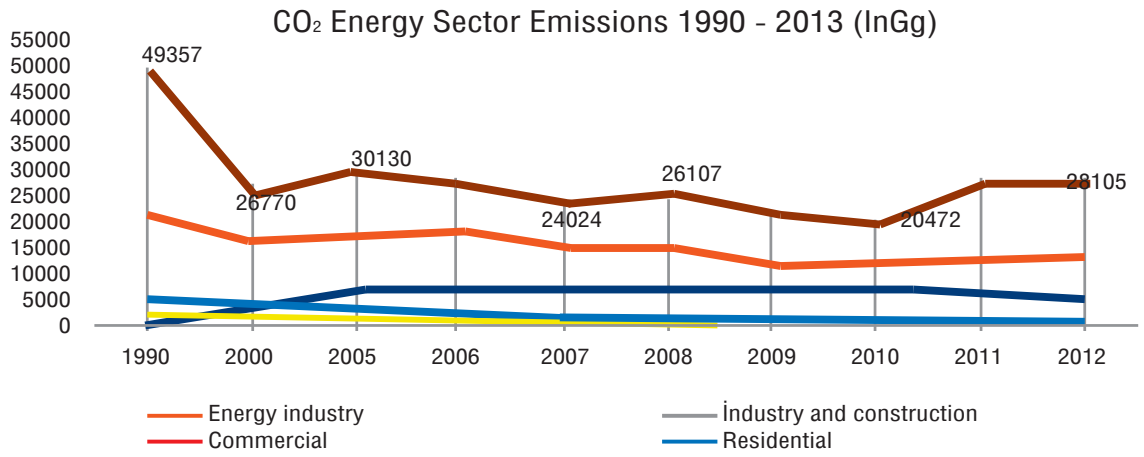


Figure 2.2.1.1-2 CO_2 Emissions from Energy sector 1990-2012 (in Gg)

-Emissions from burning of biomass

Energy sector also includes the burning of biomass section, but the emissions calculated from biomass burning are not included in National Greenhouse Gases Emissions. Results of calculations of emissions from biomass burning are given below.

Years	2006	2007	2008	2009	2010	2011	2012
Emissions	NA	NA	357,08	306,13	376,37	403,43	410,76

Table 2.2.1.1-3 Emissions from biomass burning (in Gg)

The amount of CH_4 emitted from the burning process (Figure 2.2-3) is negligible compared to CO_2 gas and is not accepted as a priority source. However, it is possible to achieve the reduction with the implementation of new technologies.

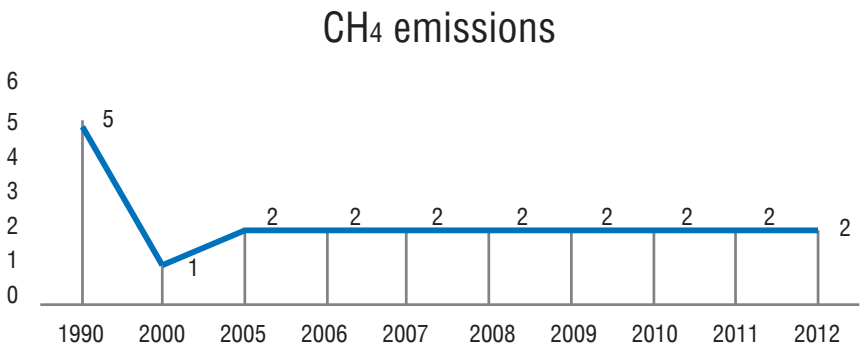


Figure 2.2.1.1-4. CH_4 emissions from the burning processes, (in Gg)

N_2O emissions in Azerbaijan were identified in three sectors out of six, as indicated in IPCC methodology. These sectors are energy, agriculture, and waste. The potential source out of all above falls under the agricultural sector. In energy sector these emissions are produced mostly in energy industry (thermal power stations, heating centers) and transport. N_2O emissions in agriculture sector is associated with manure management and provision of land with mineral fertilizers. In the waste sector N_2O is separated from the "industrial and domestic wastes" category source.

Emissions from N_2O are illustrated in the figure below.

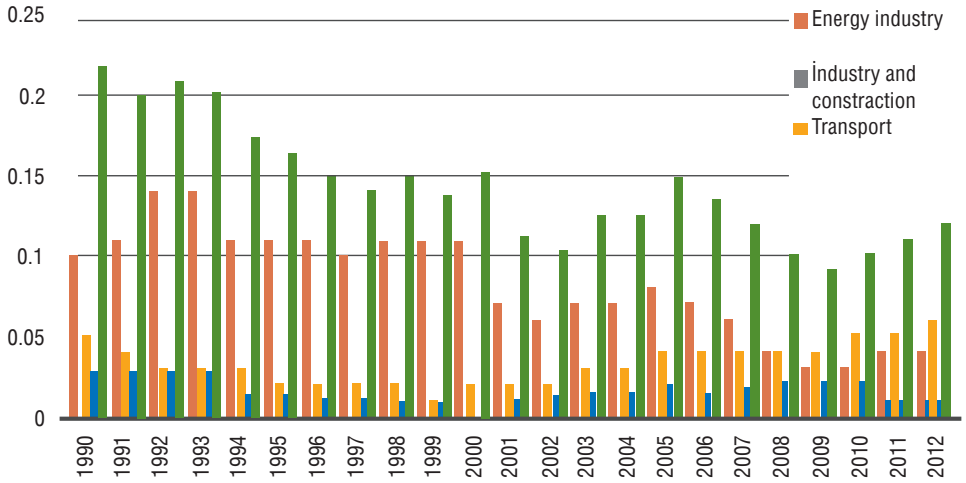


Figure 2.2.1.1-5. N_2O emissions from the burning processes, (In Gg.)

2.2.1.2 Mobile sources emissions

Aviation, road transport, rail, and shipping categories are included in this sector sources. CO_2, CH_4 and N_2O are emitted into the atmosphere directly from mobile combustion, NOx and CO indirectly. In addition, depending on the type of fuel SO_2 gas is emitted into the atmosphere in smaller amounts.

The highest emissions come from road transport subsector, this sub-sector is one of the priority sources of GHG emissions in the country and the emission are rapidly increasing. CO_2 amounts emitted from the transport sub sector are shown in Table 2.2-3.

Source	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Domestic aviation	186	52	196	220	208	176	190	275	316	333
Road transport	5188	2041	3897	4472	3467	4361	3865	4477	4624	4767
Rail	15	20	49	27	53	45	45	23	9	9
Shipping	5	7	16	9	0	104	64	86	108	114
Total	**5394**	**2119**	**4158**	**4727**	**3729**	**4686**	**4165**	**4861**	**5057**	**5223**

Table 2.2.1.2-1. CO_2 emissions from transport sector (Gg.)

As can be seen from the table above, the amount of CO_2 emitted from the transport sector in 2012 increased up to 117% compared to the base year, 1990. Most emissions come from domestic aviation (179%) and road transport (113%). The amount of CO_2 in the rail system was significantly reduced. This is connected with the increasing use of electric vehicles.

Emissions from CH_4, N_2O, NOx, CO, and SO_2 gases for 2006-2012 have been calculated. The annual amount of CH_4, N_2O emitted by the transport sector is 1 or less than 1 Gg, so these emissions are not considered a priority.

2.2.2 Fugitive emissions

Fugitive emissions in the energy sector are formed from natural gas production, processing, storage, transportation, burning flares, and leaks. GHGs (CO_2, CH_4, N_2O, hydrocarbons, etc.) are in-

cluded into the volatile emissions and should pass the inventory. These gases can be reduced as a result of the implementation of certain projects. Fugitive emissions occur in big amounts in coal, oil and gas industry, therefore the inventory is done in these areas. In general, this category is divided into the following subcategories:

- Solid fuel types;
- Oil and natural gas production;
- Production of other energy.

The coal is considered as a solid fuel type and is not produced in Azerbaijan. In the past, the coal for consumption was imported to Azerbaijan from Russia, Kazakhstan, and other countries. Since 1991 the country has stopped importing coal. Only recently there was the use of coal in certain areas and the emissions are still very low.

Fugitive emissions are released during the production of oil and gas in Azerbaijan. CO_2, CH_4, and other hydrocarbons are the priority. These gases are formed during oil and gas exploration, production, storage, processing, transportation, burning flares, and leaks. Gas methane (CH_4) is the priority among the volatile (fugitive) emissions from oil and gas deposits. This gas is emitted into the atmosphere in a form of associated gas with oil during the processing.

Activity	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Oil production	1,4	1,6	2,5	3,7	4,9	5,1	5,8	5,8	5,2	4,9
Oil processing	0,5	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3
Natural gas production	7,0	4,0	4,0	4,7	7,6	11,4	11,4	11,7	11,4	11,9
Natural gas production / processing	176,8	100,8	102,1	118,6	193,3	291,3	291,3	297,2	290,6	302,7
Natural gas transportation / distribution	87,6	50,0	50,6	58,8	95,8	144,4	144,4	147,3	142,5	153,6
Natural gas leaks (non-residential sector)	144,5	26,3	53,7	62,9	57,3	71,8	59,0	54,8	52,1	56,7
Natural gas leaks (residential sector)	11,4	9,2	16,3	15,2	13,5	16,8	15,2	15,6	15,4	15,9
Total	**429,2**	**192,0**	**229,5**	**264,1**	**372,6**	**541,0**	**527,2**	**532,7**	**517,5**	**546**

Table 2.2.2-1.CH_4 Fugitive Emissions from oil and gas industry (In Gg)

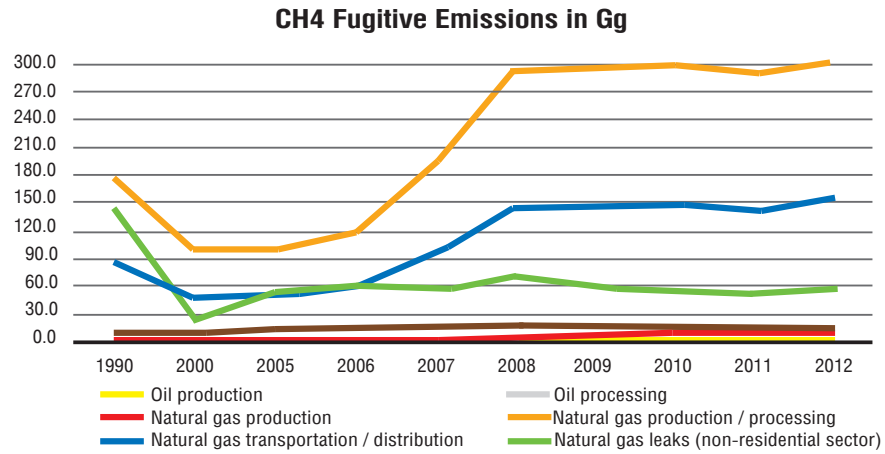


Figure 2.2.2-2 CH_4 Fugitive Emissions in Gg

2.3 Industrial processes sector

Many industrial processes emit CO_2 through fossil fuel combustion. Several processes also produce CO_2 emissions through chemical reactions that do not involve combustion, for example, the production and consumption of mineral products such as cement, the production of metals such as iron and steel, and the production of chemicals. Note that many industrial processes also use electricity and therefore indirectly cause the emissions from the electricity production. For this inventory the following types of production are considered in the industrial processes sector:

- Mineral products manufacturing: Cement production; Production of lime; Glass production.
- Chemical industry: Production of ethylene-propylene; Consumption of GHG alternatives.
- Metallurgy industry: Steel and iron products production; Cast iron production.
- Others: Food and beverage industry

The inventory for the industrial sector held in the frame of initial and second national communication project in 1990-1994 and 1995-2005 was revised. During the inventory the existing data for those years were used. Additionally, more precise emission factors were developed (emission factors used for calculation in cement production were provided by cement producer), data from several sources was used, and further refinements were made during the discussions. As a result of this re-calculation, a number of uncertainties have been found.

- Mineral products manufacturing

Mineral products manufacturing in Azerbaijan are mainly the ones used for construction sites. Emissions in this subsector are generated from cement, lime, and glass production.

One of the main sources of the category: mineral products manufacturing category is cement production. Until 1990, there were two large cement production plants in the country. Currently, only one plant (Qaradagh cement plant) is functioning. Its production capacity is 1.2 million ton / year. In 1990, Azerbaijan, produced 990,000 tons of cement. Its production was subsequently reduced by the end of 1990 and has begun to increase since 1999 due to the increasing construction work, the import of cement and clinker has also expanded. The production rate of other construction materials is relatively low.

Currently 1.5 million tons of cement is produced in Azerbaijan. During the cement production, carbon dioxide and SO_2 are generated and emitted. The calculation of the amount of CO_2 emissions from cement production was made using national emission factors.

The lime plant activities are temporarily suspended. Currently there are only small lime factories functioning in the country.

There were three glass factories in the country engaged in the production of glass: Sumgait glass factory, Baku glassware factory, and Baku lamp factory. Only Sumgait glass factory works with a capacity of 50-60%. The production volume of Baku glassware factory is 10-15%, Baku lamp factory has stopped its activity completely.

- Chemical industry

Until 1990, a large chemical complex was operated in the country. Currently only competitive ethylene-propylene production is functioning. An Industrial park will be opened in the future. Many other industries are expected to be opened in this area.

- Metallurgy industry

Many of the old factories almost do not operate or produce only small quantity of products. Many new factories are formed, cast iron and steel industry is developing. There are three large facto-

ries for the production of steel and cast iron: Baku Steel Fusing Plant, Baku Steel Company, and Sumgait Tube OJSC.

- Use of ozone-depleting substances (ODS) substitutes

After joining Vienna Convention for the Protection of the Ozone Layer and Montreal Protocol on Substances that Deplete the Ozone Layer, Azerbaijan implemented a number of actions for the reduction of use of ozone-depleting substances and their completely withdraw. Until today, the use of group A and B substances has stopped, project proposals on the stopping of the use of group C substances have been prepared. They are as follows:

• UNUDO-GEF project to stop the use of C-group substances;

• Implementation of the use of alternative substances for the GHG replacement included to the ODS (Ozone Depleting Substances) as alternative.

- Others

This section includes alcoholic beverages, bread, other flour products, etc. Non-methane volatile organic compounds (NMVOC) are separated from alcoholic beverages, baked goods, and other food products.

Emissions from Industrial Process sector

CO^2 emissions from the production of cement and lime, production of iron and steel were calculated for 2006-2012 years and are shown in table 2.4-1.

Industry processes	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Cement	477,97	121,04	742,50	783,10	816,51	770,84	621,03	617,40	688,09	949,09
Lime	34,76	0,14	3,88	21,52	12,12	0,00	0,59	0,68	0,68	12,01
Metal Production	630,00	0,06	429,15	502,95	702,00	417,50	225,48	459,75	848,10	1033,65
Total	**1142,73**	**121,24**	**1175,53**	**1307,57**	**1530,63**	**1188,34**	**847,10**	**1077,83**	**1536,87**	**1994,75**

Table 2.3-1.CO_2 emissions from Industrial processes (in Gg)

CH_4 and N_2O emissions from the sector are very low. NO_x are emitted during the production of iron, steel, and aluminum production in the industry sector. The activities in these areas were stopped after 1995, therefore the GHG emissions are very low (Table 2.4-2).

Name of product	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Cast steel	0,02	0	0,01	0,01	0,02	0,01	0,01	0,01	4,72	4
Aluminum	0,06	0	0	0	0	0	0	0	0	0
Total	**0,08**	**0**	**0,01**	**0,01**	**0,02**	**0,01**	**0,01**	**0,01**	**4,72**	**4**

Table 2.3-2 NO_x emissions in the steel and non-ferrous metals production (In Gg)

CO emissions in the sector are generated during aluminum production. Emissions were calculated from 1990, the base year, until 1996. As the aluminum production has stopped since then, the reduction of emissions has dropped to zero.

Non-methane volatile organic compounds (NMVOC) are emitted during technology processes the industrial sector. Processes such as extracting oil bitumen, road asphalt covering, glass, iron and

steel production, and also production of various chemicals, alcoholic beverages, bread and other food products are included in these technology processes.
The results of the NMVOC emissions from Industrial Processes are shown in the following table.

Name of product	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Natural asphalt and bitumen	318,27	41,18	106,75	115,62	222,05	278,08	522,24	361,95	368,00	522,24
Oil bitumen	0	0	0,01	0,02	0,02	0,02	0,02	0,02	0,01	0,02
Ethylene	0,12	0,06	0,08	0,1	0	0	0	0,08	0,08	0
Propylene	0,06	0,03	0,04	0,05	0,04	0,05	0,03	0,04	0,04	0,04
Polyethylene	0,32	0,21	0,34	0,45	0,3	0,42	0,27	0,34	0,34	0,3
Cast steel	0,01	0	0,01	0,01	0,01	0,01	0	0,01	0,01	0,01
Whiskey, cognac, brandy	0,63	0,05	0,01	0,01	0,04	0,02	0,01	0,03	0,01	0,04
Vodka	2,7	0,68	0,73	0,8	1,84	1,12	1,29	1,33	0,73	1,84
Champagne	0,09	0,01	0	0	0,01	0,01	0,01	0,01	0	0,01
Malt beer	0,02	0	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Meat	0,07	0,03	0,04	0,04	0,04	0,05	0,07	0,07	0,04	0,04
Fresh bread	4,66	5,4	5,52	5,66	5,88	5,95	5,93	5,84	5,52	5,88
Confectionery	0,11	0,02	0,04	0,04	0,05	0,04	0,04	0,04	0,04	0,05
Sugar	0	0,01	0,04	2,16	3,06	2,72	3,16	3,36	0,04	3,06
Oils	0,23	0,13	0,32	0,22	0,3	0,29	0,36	0,02	0,32	0,3
Total	**327,29**	**47,81**	**113,94**	**125,19**	**233,65**	**288,79**	**533,44**	**373,15**	**375,19**	**533,84**

Table 2.3-3 NMVOC in the Industrial Processes and material use sector, (in Gg.)

2.4 Agriculture

Azerbaijan's main sources of emissions in the agriculture sector come from enteric fermentation, manure management, rice cultivation, and land fertilizing.
There are also other sources, however, they do not have priority in the terms of GHG. Please note that the lack of information for these and difficulties in the choice of the coefficients has not allowed us to include them in the current inventory.

2.4.1 Information on sector sources

Until 1990 the agricultural sector in Azerbaijan contributed up to 25% of gross domestic product and the sector took the second place in GDP. Although the agricultural activities benefited economically the country they had a negative impact in the environment.
The emissions in the agricultural sector comes from three sources:

- Separation of CH_4 during the keeping of domestic animals;
- Separation of CH_4 as a result of rice-cultivation;
- Separation of N_2O from agricultural lands.

The separation of CH_4 during the breeding of domestic animals such as livestock, is divided into two categories:

- Internal fermentation of agricultural animals;
- Manure management.

Other activities such as rice cultivation increase methane emissions, due to the anaerobic decomposition of organic material in flooded rice fields, which escapes to the atmosphere primarily by diffusive transport through the rice plants during the growing season. The amount of methane emitted, depends on the type of rice crops, amount and duration of harvesting, soil type and temperature, as well as the use of fertilizers and irrigation methods.

Methane is primarily separated from animal fermentation (85%). The rest (15%) refers to manure. As the rice cultivation areas cover a very small part of the country, methane emissions are very low, and not representative. In addition to this, rice production in the country has virtually stopped during recent years.

N_2O separation process occurs in agricultural lands and mainly depends on microbial processes, nitrification and de-nitrification of soils. Increase in the amount of nitrogen in the soil causes more separation of N_2O. Increase in the amount of nitrogen in the soil may occur in the following cases:

– Precipitation;
– Fertilizers obtained by commercial sources;
– Manure and agricultural wastes;
–Biological fixation of nitrogen;
– Mineralization of organic substances in the soil.

2.4.2 Sectoral emissions

It should be noted that, due to the increase in the number of livestock in recent years has played a crucial role in the growth of methane (CH_4) emissions. CH_4 emission has increased around 45% in the reporting year comparing to the base year. In 2012 in the manure area it has increased by 19.5 % compared to the 1990 values.

CH_4 emissions from rice production in 2012 were only 0.16 Gg. The burning of agricultural residues is also decreasing.

The table below illustrates the evolution of the emissions in this sector.

Source	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Enteric fermentation	115,66	129,12	153,68	162,95	167,39	176,58	173,99	175,4	170,6	166,05
Manure management	12,1	14,59	17,69	18,12	18,68	20,57	19,52	19,74	20,01	19,37
Rice cultivation	0,05	0,45	0,23	0,12	0,11	0,13	0,17	0,16	0,16	0,16
Field burning of agricultural residues	1,34	0,3	0,66	0,49	0,42	0,32	0,25	0,25	0,21	0,22
Total	**129,15**	**144,46**	**172,26**	**181,68**	**186,6**	**197,6**	**193,93**	**195,55**	**190,98**	**185,80**

Table 2.4.2-1.CH_4 emissions from agriculture sector (in Gg.)

As the table shows, in general, the amount of methane emissions in this sector has increased compared to 1990 values. Reduction is only observed in the category of burning of agricultural residues.

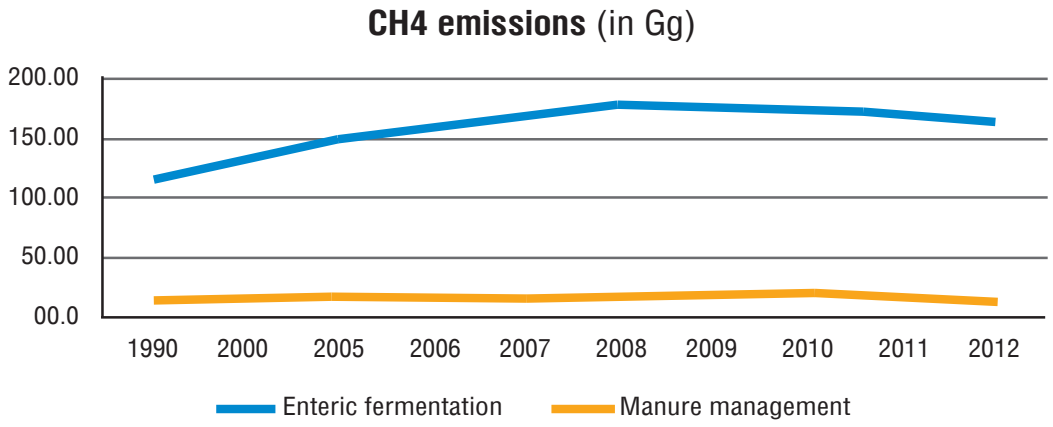


Figure 2.4.2-2 CH_4 Fugitive Emissions (in Gg)

For 2012 N_2O emissions in the agriculture sector have decreased by 11.8 % compared with the 1990 values N^2O emissions in manure management have increased by 55% compared to 1990, and N_2O emissions in agricultural soils have also decreased by 20% because of the decrease in the use of fertilizers.

Source	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Manure	1,28	1,95	2,15	2,17	2,21	2,23	2,24	2,25	2,21	1,98
Agriculture soils	10,14	5,6	7,04	7,09	7,73	7,52	8,06	7,86	7,74	8,11
Others	0,03	0,01	0,01	0,01	0,01	0,01	0	0,01	0,01	0,01
Total	**11,45**	**7,56**	**9,2**	**9,27**	**9,95**	**9,76**	**10,3**	**10,12**	**9,96**	**10,1**

Table 2.4.2-3 N_2O emissions of the sector, Gg

2.5 Land Use, Land Use Change and Forestry

The total forested area in Azerbaijan is 1,021.0 hectares and covers approximately 11.8% of the country's territory. 95% of forests are situated in the mountains areas, 5% in the low-lying areas. 49% of forest reserves are located in the Greater Caucasus, 34% in the Lesser Caucasus, 15% in the Talish, and 2% in the Aran zones.

Currently 261,000 hectares of forest area have been occupied by Armenia. Forests in Azerbaijan are state-owned. They are responsible for protecting and belong to the first group of forests, the forest–forming species are very particular and they are forests consists with broad leaves.

One of the main challenges we have faced during the preparation of the inventory for the sector are:

- Uncertainties about the data on the forests; and

Absence of an inventory of forests. The last time the forest inventory was conducted was in 1988.

2.5.1 Sectoral removals

Forests in Azerbaijan are included in the "non-tropical", natural forests type. The types of trees in the forests are mostly mixed, are shown in the figure below.

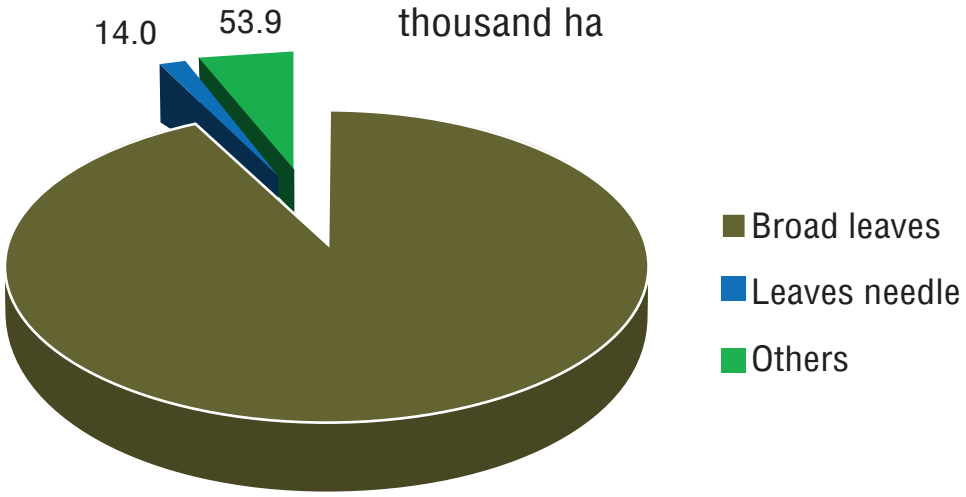


Figure 2.5.1-1. Forest areas by types

The report on gas emissions (except CO_2) during the burning of biomass as a fuel has been prepared in the "Energy" sector. However, the amount of GHG emitted into the atmosphere during the burning of forest areas, lawns, pastures are reported in this sector. Previously, forests and other natural burnings was rare. Though land and forests fires recently occurred in the territories occupied by Armenia. As a result of deliberate burning of these areas by Armenians, the amount of emissions in this sector has increased. Unfortunately, on the Azerbaijani side we cannot calculate the amount of carbon dioxide that were emitted during these fires.

Forests and other vegetation absorb carbon dioxide during photosynthesis. Resulting in the reduction of GHG emissions into the atmosphere. However, deforestation and burning, the use of their land for other purposes leads to emission of carbon dioxide into the atmosphere again. The flow of CO_2 is also formed as a result of agricultural waste burning and decomposition of organic substances in the soil.

CO_2 absorbed from the atmosphere during the decommissioning of forest areas and soil. The inventory results of net absorption of CO_2 from these areas are shown in Figure 2.6-2.

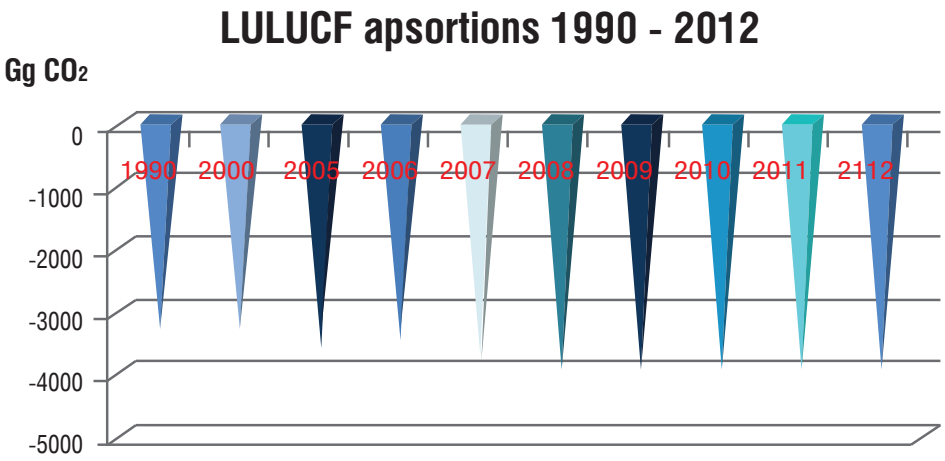


Figure 2.5.1-2 LULUCF CO_2 Net absorptions (In Gg)

2.6 Waste sector

The inventory of CH_4 gases emissions from solid waste landfill and wastewater cleaning and N_2O gases emissions from the activities of human activities were calculated in this sector.
Outdated technologies used in industrial entities and solid industrial wastes are still the main sources of emissions for the sector. The main problem for the industry is accumulated wastes.
Assessments provided by MENR show that storage of wastes in most entities does not meet the standards. In most cases, wastes are not isolated from the environment and just buried. Lack of specialized polygons and landfills in the country leads to contamination of the lands and negatively impacts the health of local population.
The processing of solid-waste by industry and urban population leads to GHG emissions. Solid waste can be eliminated through recycling, incineration, or the conversion to energy (waste is used directly as fuel). Wastewater can go through many treatment processes to remove impurities.
Methane gas is the most important gas emitted in this category. There are two main sources of methane in this sector: landfills and waste water cleaning. Methane formation may occur during the anaerobic processing of wastewater.
Waste management is key sector to reducing carbon emissions, not only in Azerbaijan. The decomposition of solid waste in landfills results in the release of methane. Burning of wastes and the transportation of waste to disposal sites also produces carbon dioxide emissions.

2.6.1 Information on sector sources

All emission's categories mentioned for the waste sector are present in Azerbaijan. The sources are the following:

- Solid waste landfills (CH_4)
- Wastewater cleaning (CH_4 and N_2O)
- Wastewater as a result of human activities (N_2O)

The main sources of emissions mentioned in this sector are solid waste landfills and wastewater handling, reduction activities in these sources are possible.

- Solid waste

The main source of emissions come from the following solid waste landfills sites:

- Waste landfills in the Balakhani, Azizbayov, and Qaradagh districts of Baku;
- Sumgayit landfill;
- Ganja landfill.

Solid waste management was a serious problem for Azerbaijan until 2012. Landfills of the Greater Baku were managed ignoring environmental requirements for a long time, creating problems for the Boyuk Shor Lake adjacent to the landfill and the neighboring areas including some residential areas of Baku. The Balakhany landfill as well as other informal landfills created serious health hazards for the population, additionally the rapid increase of the Absheron population deepened the solid waste problem. As a result of various initiatives some projects were implemented.. For instance the new waste burning plant that is now operating in the Balakhani landfill. The new solid waste management system established in Baku includes an incineration and recycling plant, and is the first of its kind in the entire country.
Waste water treatment plants were also installed in the following regions:

1. Biological treatment plan at the Hovsani aeration station;
2. Biological treatment plant located in the Sahil district;
3. Zikh mechanical treatment plan;
4. Haji Hassan mechanical treatment plan;
5. Mardakan-Shuvelanmechanical treatment plan.

As a result the above mentioned initiatives the emissions from this sector is expected to decrease.

2.6.2. Sector emissions

Methane emissions for waste waters are shown in the table below.

Year	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012
Waste	1629	1753	1915	1972	2019	2065	2078	2139	2161	2184

Table 2.6.2-1 Methane emissions 1990-2012 in Gg CO_2-eq

CH_4 emissions from municipal solid waste during 1990-2012 are shown in the figure below.

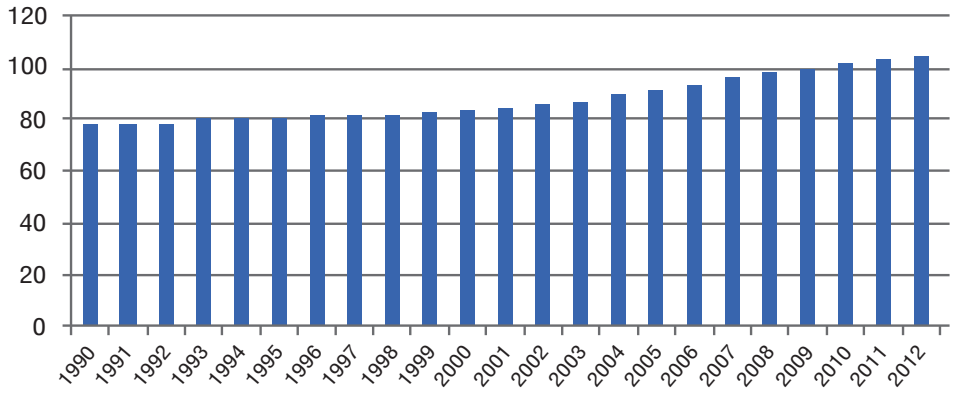


Figure 2.6.2-2. CH_4 emissions from municipal solid waste

The separation of methane from waste water in the industry spheres mainly occurs during the production of iron and steel, non-ferrous metal, fertilizer, food and drinks, petrochemical, and rubber. After the base year 1990, the activities in the industry sectors decreased, and only some of these processes are increasing in the last years. The dynamics of change of CH_4 gas emissions from industrial waste water is shown in figure 2.7-2.

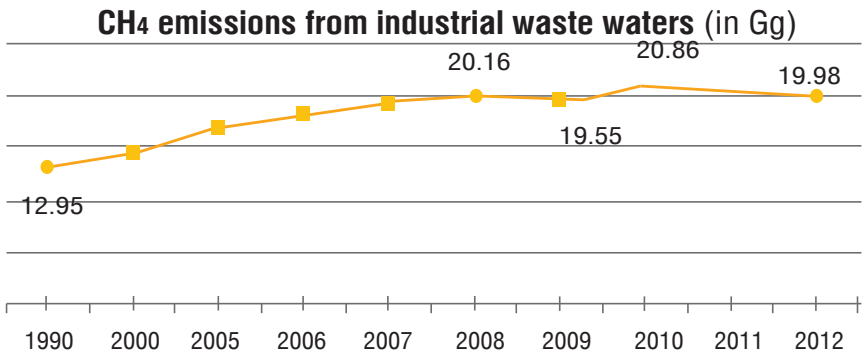


Figure 2.6.2-3. CH_4 emissions from industrial waste waters

The information on N_2O emissions from waste waters from domestic activities is presented in Figure 2.7-3.

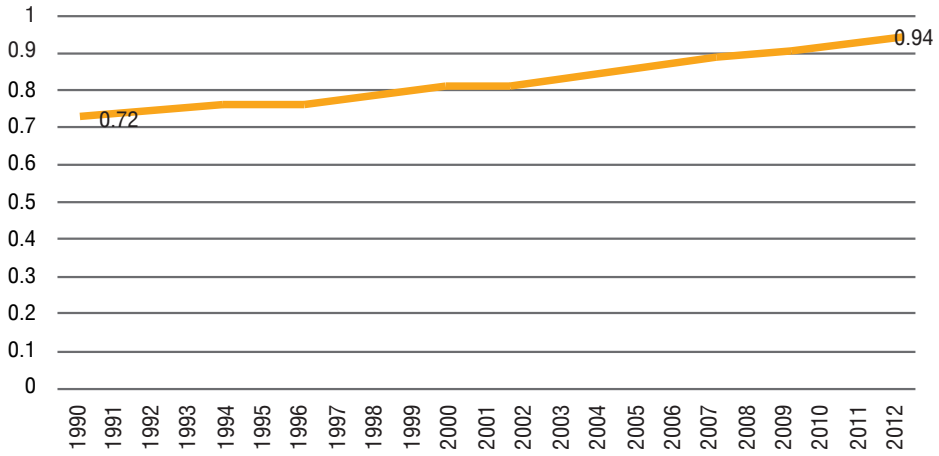


Figure 2.6.2-4 N_2O emissions from domestic activities (In Gg)

As the figure shows, N_2O emissions continue to grow. In general, it is advisable to implement mitigation measures considering the increasing emissions in this sector.

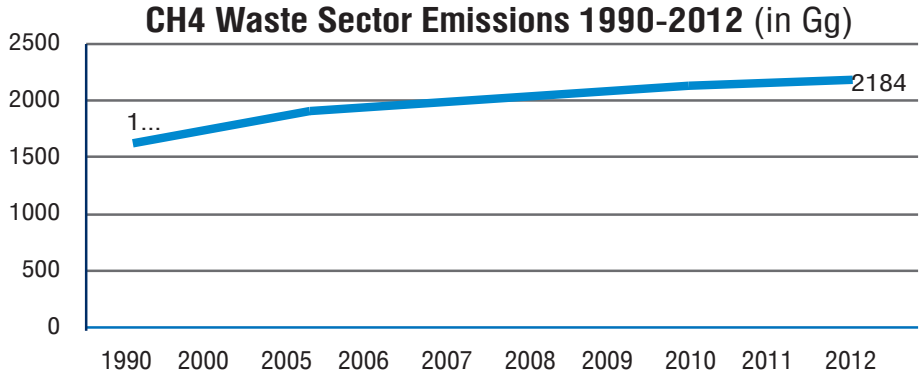


Figure 2.6.2-5 Waste sector CH_4 emissions

2.7 Key Category Analyses:

A key Category Source analysis was carried out using the Level Assessment, and the results are shown on table 2.8-1. The level assessment identifies categories that contribute to at least 95% of national emissions in the current GHG inventory.

The key category analysis allows the GHG national team to estimate which category has the most significant influence on a country's emissions and the analysis will help to prioritize national mitigation measures.

The energy sector is a key category and main efforts should be put in undertaking this analysis since provides information regarding priorities for National GHG Inventory preparation and improvement. A key category is very important because it allows the country to prioritize the sources emissions/sinks within the national inventory system.

As far as possible, key categories should receive special consideration in terms of:

Identification of key categories in national inventories, this will enable to prioritize limited resources available for preparing inventories.
Enables the country to focus on the available resources for the improvement in data and methods onto categories identified as key.
To improve the national greenhouse gas inventory, it may be necessary to consider applying more accurate or higher tier methodologies, collect more detailed activity data, or develop country-specific emission factors. Each greenhouse gas emitted from each category was considered separately.
All of these activities require additional resources, and it is not possible to make improvements for every one of them. The inventory category list resulting from this analysis can provide a quantitative framework for the national greenhouse gas inventory team to develop an inventory improvement plan. The key category analysis also provides more complete and transparent information to be included in the National Communication Report.
The results of the analysis are shown in the table below.

#	Sector	*Category*	GHG	Emission Gg CO_2-eq.	%	Cumulative%
1	Energy	Oil and Natural gas	CH4	11185.86	23.72	23.72
2	Energy	Energy Industries	CO2	10705.6	22.70	46.41
3	Energy	Residential	CO_2	6777.76	14.37	60.78
4	Energy	Transport	CO_2	4861.14	10.31	71.09
5	Agriculture	Enteric fermentation	CH4	3683.4	7.81	78.90
6	Agriculture	Agricultural soils	N2O	2436.6	5.17	84.07
7	Waste	Solid waste disposal on land	CH4	1701	3.61	87.67
8	Energy	Manufacturing industries and construction	CO_2	1092.01	2.32	89.99
9	Energy	Agriculture/Forest/Fishing	CO_2	1056.56	2.24	92.23
10	Agriculture	Manure management	N2O	697.5	1.48	93.71
11	Industrial processes	Mineral products	CO_2	618.08	1.31	95.02
12	Energy	Other	CO_2	536.95	1.14	96.16
13	Industrial processes	Metal production	CO_2	459.75	0.97	97.13
14	Waste	Waste-water handling	CH4	438.06	0.93	98.06
15	Agriculture	Manure management	CH4	414.54	0.88	98.94
16	Energy	Commercial	CO_2	303.3	0.64	99.58
17	Waste	Waste-water handling	N2O	120.9	0.26	99.84
18	Energy	Transport	CH4	26.88	0.06	99.90
19	Energy	Transport	N2O	15.5	0.03	99.93
20	Energy	Energy Industries	N2O	9.3	0.02	99.95
21	Energy	Chemical industry	CH4	5.46	0.01	99.96
22	Agriculture	Prescribed burning of savannahs	CH4	5.25	0.01	99.97
23	Energy	Energy Industries	CH4	4.62	0.01	99.98
24	Agriculture	Rice cultivation	CH4	3.36	0.01	99.99
25	Agriculture	Other	N2O	3.1	0.01	99.99
26	Energy	Manufacturing industries and construction	CH4	1.89	0.00	100.00
27	Energy	Commercial	CH4	0.42	0.00	100.00
28	Industrial processes	Metal production	CH4	0.21	0.00	100.00
				47165.00	**100.00**	

Table 2.7-1 Key Category Analysis-Results

2.8 Quality assurance and quality control

As mentioned in the IPCC Good Practice Guidance (GPG), one of the main elements to be undertaken during the inventory process is the Quality Assurance, Quality Control (QA/QC)
Higher level QA/QC procedures were used for the main sources of emission as this is strongly recommended in the good practice guidance, and methodological selection and recalculation operations were conducted as described in the chapter 7. These procedures covered the following years 1990, 2000, and 2006-2012 covering the following sectors: energy, agriculture and waste.
The present inventory used the Tier 2 analysis for some of the sectors, the inventory indices were compared with the results of emission factors calculated with the use of coefficients applied in the IPCC methodology, and also with the reports of IEA.
QA/QC procedures in the current inventory were carried out for the categories of key sectors such as energy and agriculture which are priority sectors for the country.

Completeness

One of the best practices in the inventory process is to determine whether a double calculation was made, and whether all GHG emissions are included in each one of the sectors included in the inventory.
Accordingly, if these emissions are not included in one section, then it is necessary to include them in another section. For example, unless industrial processes are thoroughly taken into account, then those emissions are needed to be included in another appropriate section. The inventory group took all these distinctions into consideration, and sources set in the country were included in their respective categories.
There were certainly some difficulties in the assurance of entirety. In this regard, lack of complete and accurate data on the new GHG, and banning of many such substances, e.g., ozone-depleting substances, and use of their alternatives since 2005 along with other reasons, led to the lack of information on those gases in the inventory process. Nonetheless, some information on F-gases emissions was included in the report. The results of inventory on the HCFC gases (2000-2012) were included in the current inventory report by the GIZ German Society for International Cooperation.

Uncertainties

IPCC 2006 Guidelines did not indicate that the diapasons of the rate of uncertainties were very large of all emissions except CO_2 during stationary fuel combustion. Regardless of the accepted level, quantity determination of uncertainties associated with the results of examination is considered a good practice. There are two main types of uncertainties in the inventory:

- Uncertainties in the emission coefficients;
- Uncertainties on the actions in the data.

As there were no specific figures for the calculation of uncertainties in the country, the coefficients given in the IPCC Guidelines were used, and the figures accepted from the diapasons were based on expert opinions. Report for each sector was carried out.

Documentation and archiving

Transparency of given emission coefficients are based on the data sources for the control over all phases of report. Inclusion of a short description of the methodology used in the inventory is considered a good practice.

Currently used IPCC report format (spreadsheets, statistical tables) provides a balance between the potential achieved by the inventory developers and exigency on the transparency.
A good practice considers the imposition of additional effort established for full realization of the demand for transparency. In particular, when the level 2 (or more detailed approach) is used, additional tables reflecting the data on the action regarding the coefficients of direct emissions should be prepared.
The spreadsheets generated by the IPCC software, the data acquired for the present inventory and the document archiving will be done in an electronic and print format, and submitted to the Climate Change and Ozone Center of the Ministry of Ecology and Natural Resources (MENR).

CHAPTER 3. POLICY AND MEASURES TO MITIGATE CLIMATE CHANGE

3.1 Background Information

3.1.1. Introduction

Azerbaijan does not have a dedicated climate change strategy yet, but it has undertaken measures to support climate change efforts, such as the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Azerbaijan has prepared a number of laws, state programs and regulatory acts concerning the Convention, and has adopted related international documents that support climate mitigation. Azerbaijan prioritized the use of alternative energy and the development of low-carbon measures in the commercial and residential sectors, and set a target to reduce GHG emissions up to 35 % by 2030, relatively 1990.
GHG emission trend for the period 1990-2012 is shown in the following table;

GHG emission trend in Azerbaijan (1990–2000-2010) **GHG Source and Sink Categories**	**Emission base year – 1990, (Gg CO2 eq.)**	**2000 Emissions (Gg CO2 eq.)**	**2012Emissions (Gg CO2 eq.)**	**Change from 1990 to 2012**
Energy	63.928	33.006	39.319	-38%
Industry	1.447	554	3.021	+109%
Agriculture	6.261	5.368	7.033	+12%
Waste	1.694	1.837	2.278	+46%
Total Emission	**73.331**	**40.774**	**51.851**	-41%
LULULUCF	-3690	-4.870	-5442	+47%
Net emission	**69.641**	**35.904**	**46.409**	-33%

The net emissions decreased from 69641 in 1990 up to 46409 Gg CO_2 eq. in 2012. The rapid decline of GHG emissions was observed in the period of 1990-2000s and was about 35904 Gg CO_2. This decline in GHG emissions was related to a decline in industrial activities during the first period and also due to the implementation of mitigation measures after the year 2000. But the economic boom and the growth of population is leading to an increase of CO_2 emissions, which is evidenced by the inventory results.

3.1.2 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 devolping 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 and Ozone in MENR and Designed National Autority 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 registed projects are given in the following table:

Projects	Date of Registration
”Yeni Yashma Wind Park” №4822/	23.05.2011
”AZDRES Energy Efficiency” №5574	20.08.2012
”Baku – From waste to energy” №7658	10.10.2012
“Balakhani dump” №8181	12.11.2012
”United Periodic Energy Station - South” №4884	23.12.2012
”Sumgayit Periodic Energy Station” №3836	16.02.2013

3.1.3 Preparation of NAMA projects

Currently the following three projects are being prepared:
1) National Appropriate Mitigation Action (NAMA) on the low-carbon end-user sectors prepared by UNDP and supported by GEF; Sub-component: (a) Energy production (fuel passage): wind energy plant connected to the network through the SOCAR pilot investment for 1.5 MW wind project; (b) the use of energy in buildings/heat production (energy saving/fuel passage): retro-adaptation of solar water heating and energy efficiency in public and residential buildings. This project is expected to be financed by the Global Environment Facility (GEF).
2) NAMA measures for the replacement of chlorofluorocarbons (CFCs) in the refrigerators prepared and supported by GIZ.
3) Establishment of the Samukh Agro-Energy Complex. This project was developed by the Asian Development Bank and is expected to be implemented by the State Agency on Alternative and Renewable Energy Sources. The project plans to use 12 MW of renewable energy sources. Solar energy plant, solar thermal energy plant, and a biogas plants are included in this complex. The project is in its final stage of preparation.
Azerbaijan has regularly attended all the meetings and conferences on climate change. Currently, Azerbaijan continues the preparation activities with other partners at the level of working groups within the framework of the European Union ClimaEast project.

3.1.4. Legal basis for Adopting Measures directed to the mitigation of GHG emissions

Although Azerbaijan, as an oil and gas producing country is able to live at the expense of natural resources, the country’s administration prioritizes the development of low carbon-emission production (Climate Action Network). In recent years, the government adopted a low carbon sustainable development path and several policies such as the following were approved:

State programs/strategies	Actions
"Azerbaijan 2020: Look into the future" Development Concept	- Reach the level of the Organization for Cooperation and Economic Development countries for energy intensity and the carbon dioxide emissions per unit of GDP; -
State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015	- A 20% reduction by amount of the fuel consumed for the production of 1 Kw / h of energy by 2015; - By the end of 2015, forest areas will reach 12.5% of the entire territory; - By the end of 2015, protected areas will reach 12%; - Provision of full cleaning of wastewater by the end of 2015 - Utilization of 80% of municipal solid waste by the end of 2015; - Preparation of an action plan in order to reduce the amount of greenhouse gases emitted into the atmosphere from fuel and energy heating systems; - Capacity building for alternative and renewable energy sources; - Mitigation of environmental impact as a result of gas energy sector activities; - Adoption of legal and regulatory framework governing the protection of the environment according to international norms, standards and requirements of international partner agreements; - Establishment of Carbon Fund to finance actions on mitigation of greenhouse gases - Assessment on the effects of climate change, mitigation of negative impacts on the economy and ecosystems; - Installation of gas sampling devices in high traffic areas of Baku and other major urban cities for the prevention of air pollution by vehicles - Assessment on the impact of climate change; - Modernization of surveillance and early warning systems for reducing the impact of disasters that may occur as a result of the climate change; - Creation of a database on waste.
Comprehensive Action Plan to improve environmental situation in the Republic of Azerbaijan in 2006 – 2010	-Prevention of atmospheric air pollution by toxic gases emitted by motor vehicles through control over the technical condition of vehicles, adaptation of technical norms for atmospheric emission to European standards, creation of environmental monitoring and measuring stations, organization of utilization of out of service vehicles, avoiding traffic jams using modern facilities for road traffic regulation; - To ensure the operation of fuel, power and heat supply systems and other industrial facilities polluting the environment in Baku, Nakhchivan, Ganja, Sumgait, Shirvan, Baku and other cities in compliance with environmental requirements; - Development of Early Warning System in order to reduce the damage caused by the hydrometeorological incidents associated with climate change; - Reduction of anthropogenic pressure on the forest fund, - Identification of prospective areas for new forest plantations based on the country's climate, soil conditions and organic agriculture.
State Program on social-economic development of Baku city and its settlements in 2011-2013	- Construction of new power stations, infrastructure changes in the energy sector; - Reconstruction and modernization of existing heating centers; - Development of road transport complexes.
State program on social-economic development of the regions of the Republic of Azerbaijan for 2009-2013	- Implementation of actions on mitigation of emissions from waste of industry sector; - Reconstruction of oil and gas production systems, transportation, and processing infrastructure; - Expanding the use of alternative energy sources; -Reconstruction and construction of power stations; - Upgrade the distribution and transmission lines and sub-stations; - Organization of activities for the prevention of emissions into the atmosphere from the transport sector.
National Program on Environmentally Sustainable Socio-economic Development for 2003-2010	- Implementation of high efficiency technology in thermal power stations (TPS); - Implementation of modern energy-saving technologies (production and consumption); - Improve the use of renewable energy sources in rural areas.
State Program for Development of Fuel and Energy Sector in 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; - - 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 expansionof 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 ofAzerbaijan in 2015-2020	- Preparation of proposals on the promotion of efficient and environmentally friendly energy technologies. - Expansion of the production of alternative energy installations and equipments; - 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 Mingacevir 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.

3.2. Mitigation measures by sectors

3.2.1 Energy

3.2.1.1 Electric power industry

At present, energy system of Azerbaijan has 13 thermal power plants (TPPs) and 8 hydro power plants (HPPs). Each year an average of 18 billion kW / h of electricity is produced, out of which 90% refers to TPPs and 10% to HPPs. 5 million tons of conventional fuel is used for energy production at TPPs.

The Measures performed during the last period in the sphere of electric power industry have stimulated the emergence of low-waste production and are shown below:

- Restoration of old power plants;
- Construction of highly energy-efficient new power plants;
- Reconstruction of distribution and transmission networks;
- Increase of energy efficiency in the domestic sector;
- Construction of power plants based on renewable energy sources;
- Improvement of tariff policy.

As a result of these measures in the electric power sector, the amount of fuel used for electricity generation of 1 kW/h decreased from 386 gr. in 2003 to 300 gr. in 2013. This ultimately saves energy and reduces emissions of greenhouse gases (GHG) into the atmosphere.

The inventory data shows that CO_2 emissions from stationary sources was equal to 22383 Gg. in 1990 and decreased to 17410 in 2005, and 12544 in 2012 for the electricity sector. In industry and construction, the analogical data were 17709, 2099, and 2385. In the commercial sector the emissions increased from 34 Gg.in 2005 up to 377 Gg. in 2012, in the residential sector emissions increased from 4679 Gg. in 1990 up to 5355 Gg. in 2012, in agriculture, forestry and fishery sectors emissions were 3843 Gg. in 1990 and decreased to 1120 Gg. in 2012. The total CO_2 emissions from the stationary sources decreased from 49357 Gg. in 1990 to 28105 Gg. in 2012. CH_4 emissions from this sector fell 5 Gg. in 1990 down to 2 Gg. in 2005 and then remained stable until 2012.

3.2.1.2. Alternative Energy Sources

The use of alternative energy sources is a priority for the country, since their use will lead to the reduction in the use of organic fuel and mitigate GHG emissions into the atmosphere. In Azerbaijan, different energy sources were evaluated and the potential is shown below:

Source	Potential
Solar energy,	more than 5,000 MW
Wind energy	more than 4,500 MW
Bioenergy	more than 1,500 MW
Geothermal energy	more than 800 MW,
Small hydro power plants	more than 350 MW.

Institutional structure is established for the development of this sector, internal and external resources were funded for promoting alternative energy sources:forty million manats in 2010, 14.4 million manats in 2011, 28 million manats in 2012,and during the first nine months of 2013 twenty million manats were allocated from the state budget and 15 million Euros were allocated from the European Commission to achieve this objective.

The forecast share of renewable energy sources for 2020 is presented in the figure below:

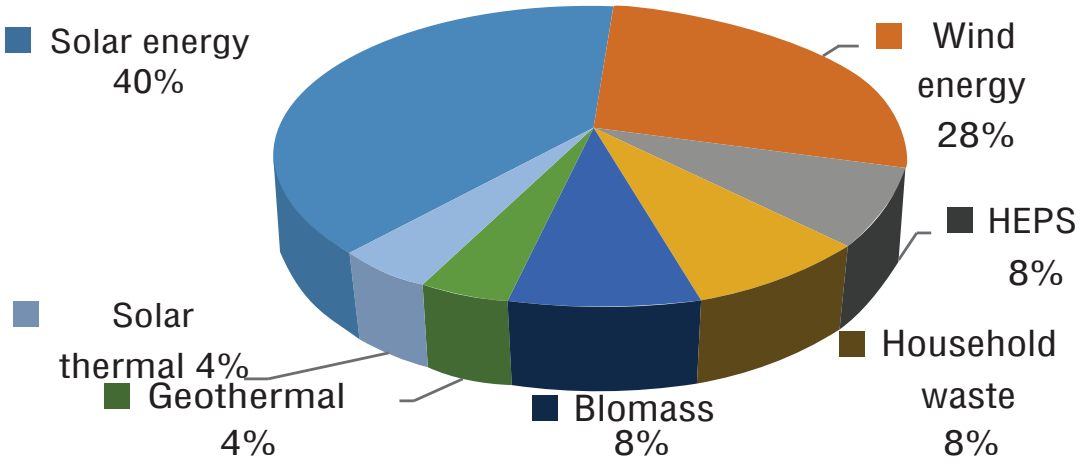


Figure 3.2.1.Share of renewable energy sources in 2020
(Source: State Agency on Alternative and renewable sources)

3.2.1.3. Tariff policy

According to the order No. 11 of the Cabinet of Ministers of the Republic of Azerbaijan dated on January 31, 2005 on the "List of goods exempt from value added tax imported into the territory of the Republic of Azerbaijan" and order No. 187 dated on October 15, 2005 on "Making amendments and additions to some decisions of the Cabinet of Ministers" wind-electric systems and their parts are exempt from customs duties and value added tax when imported. The systems that produce energy from other renewable sources are not exempt from customs duties and value added tax.

3.3.1. Building and construction sub-sector

The rapid development of this sector requires the increase of energy efficiency in buildings, preparation and implementation of energy saving policy. The adoption of legislative acts and their preparation in accordance with the European standards will enable to reduce the amount of emitted greenhouse gases.
Some studies indicate that using energy efficient technologies in new and existing buildings could save up to 34% of the energy consumed.

3.3.2 Transport sub-sector

The Transport sector is an important source of emissions. According to statistical data (State Statistical Committee) during 2000-2011, the sharp increase in quantity of all types of transport systems was observed. Over this period the number of passenger cars increased to 2.6 times, the number of freight traffic increased 57 times. As a result, the volume of harmful emissions into the atmosphere from road transport increased 2.4 times and according to the information in 2012, the total volume of harmful emissions waste (NO_x, SO_2, CO and solid particle's) (excluding carbon dioxide) from the transport was 78%.
The TNC inventory results show that amount of CO_2 emitted from the transport sector in 2012 increased to 117% compared to 1990. Mainly emissions are attributed to domestic aviation (179%) and road transport (113%). The amount of CO_2 from the rail system was significantly reduced. This is connected with the increased use of electric vehicles.

3.3.2.1. Measures in the transport sector directed to the mitigation of GHG emissions

In order to reduce the emissions from the transport sector, a number of mitigation measures should be introduced. Ministry of Transport prepared the measures for GHG emissions reductions. These measures include the following:

- Development of intelligent management system of vehicles;
- Creation of new communication lines;
- Expand the use of high energy-efficiency vehicles;
- Gradual reduction of old vehicles;
- Adaptation of fuel used in transport vehicles to euro standards;
- Upgrade the tariff system;
- Expansion of the use of electric vehicles (metro transport, electric trains and trams).
- Development of intelligent management system of vehicles; Implementation of new buses

in accordance with EURO-4 and higher standards in order to remove the passenger buses that do not meet the environmental and safety requirements and to modernize the bus park;
- Reconstruction of Baku-Sumgait existing railway line and organization of speed passenger transportation with electric trains;
- Renewal of electric cars, improvement of railway signaling and communications infrastructure in order to increase the quality of services provided by the suburban electric trains;
- Expansion of the scope of Intelligent Transport Management Center;
- Road network development and reconstruction of roads;
- Electrification of railway lines and changing the current system;
- Implementation of "Metrobus" system in passenger transport organization, preparation of proposals for the introduction of tram, Monorail (LRT) and other modern transportation systems.

3.4 Industry Sector

3.4.1 Oil and Gas Industry

Oil and gas industry are largest sources of GHG gases mainly CH_4. The inventory results show that CH_4 emissions in oil and gas sector were 429,2 Gg in1990,and increased up to 546 Gg in 2012. The dynamics of CH_4 emissions in various activities shows that CH_4 emissions from oil production increased from 1.4 Gg. in 1990 up to 4.9 Gg. in 2012, CH_4 emissions from natural gas production from 7 Gg. 1990 up to 11.9 Gg. 2012, CH_4 emissions from natural gas production/processing in-1990was about 176.8 Gg. and increased up to 302.7 Gg. in 2012, CH_4 emissions from natural gas transportation/distribution increased from 87.6 Gg. in 1990 up to 153.6 Gg. in 2012. CH_4 emissions from natural gas leaks (residential sector) increased from 11.4 in Gg. in 1990 up to 15.9 Gg. in 2012. A decrease of CH_4 emissions is observed in oil processing and natural gas leakage (in non-residential sector).

In cooperation with the German Institute for Economic Research the document under the title "SOCAR strategy to reduce the impact on climate change" was prepared. As a result the national oil company SOCAR has adopted the implementation of GHG emissions reductions internally along with implementing other initiative to promote more efficient and low carbon initiatives.

The national oil and gas company, SOCAR, has been at the forefront of national climate change mitigation actions. Apart from adopting bold targets and implementing GHG emission reduction measures internally, the company is implementing several initiatives to promote more efficient and cleaner oil and gas end-use technologies and practices among its customers and employees.

SOCAR's demand-side management program for natural gas users supports installation of meters and smart-cards for individual and industrial oil and gas end-users. The company has set up an ecological park to popularize zero-carbon technologies, such as wind, solar and energy efficient buildings. SOCAR also announced the plans to act as a RES-project developer and has already started with supplying RES-based energy for its own needs from pilot 40kW wind and 20kW solar projects. The company is designing a 1.5 MW wind park on Jilov Island, which will provide clean energy to the island's population of 2,000 and SOCAR's premises and production facilities located there. The company's Climate Change Strategy envisages development of new wind parks to provide electricity for its offshore oil and gas fields, as well as other renewable energy projects for electricity and heating of SOCAR's own buildings and industrial premises in Baku and other cities (Source: SOCAR NAMA project).

According to Associated Gases Reduction Plan(SOCAR) the value of associated gases will be decreased from 450360,2 thous.m_3 in 2010 up to 7415,7 thous.m_3 in 2015.

3.4.2 Projects to be implemented

- The implementation of projects on collection of low-pressure associated gas in Gunashli, NeftDashlari and PalchiqPilpilesi fields will continue.
- The biggest project is: Utilization of associated gas in Gunashli field (Result: reduction of CH_4 emissions)
- Replacement of old kompressors with new kompressors.
- "Utilization of associated gas" a project preparedby SOCAR at "NeftDashlari" Oil and Gas Operations Department (an equivalent of 200,000 tons of CO_2 will be avoided during the life of the project).

3.4.3. Measures in the oil and gas sector directed to the mitigation of GHG emissions, prepared by SOCAR

- Preparation of a document containing Technical Operational Rules and Measurement for the installation of control devices that will measure the volume of associated gas from oil and gas wells that are stationary sources of oil and gas production
- Calculation of specific emission factors for each oil and gas field
- Reduction of losses in gas transmission and gas distribution systems
- Implementation of measures directed towards the reduction of emissions from associated gases
- Increase of renewable and alternative energy sources, including the use of alternative fuel in transportation
- Implementation of energy-efficient lighting system in administrative buildings which are under the supervision of the SOCAR
- Implementation of alternative fuel in systems of SOCAR
- Preparation of an action plan for energy efficiency for the purchase of ISO 50001 certificate on energy management
- Implementation of Projects financed by the Global Environmental Fund (GEF) and United Nations Development Programme such as "Nationally Appropriate Mitigation Actions (NAMAs) for Low-Carbon End-Use Sectors in Azerbaijan: UNDP Project Document";
- Assessment of GHG emission reduction at the plants under the new oil, gas processing and petrochemical Complex according to the Decree No. 492 of the President of the Republic dated September 23, 2009;
- Calculation of specific emission factors for measuring the amount of leakages in gas transportation and distribution systems;
- Reconstruction of the oil and gas industry. As a result, the rate of oil refining should reach 91%, production of gasoline and diesel fuel must comply with Euro 5 standards, gas processing regulation should reach the international standards level and petrochemical products should be adapted to the requirements of foreign markets.

3.4.4. Other industrial sectors

Accordintg to the State Statistical Committee during the past ten years, industrial production has increased 2.7 times, the production of construction materials has increased 2.5 times,electrical equipment has increased 2.1 times, metallurgical industry has increased 2.2 times,moreover, clothing production has also increased 2.5 times.

In these sectors the CO_2 emissions slightly decreased from 1183 Gg. in 1990 to 1078 Gg. in 2010. As a result of the industrial development, CO_2 emissions increased in the cement production from 478 Gg. in 1990 up to 617, 4 Gg. in 2010. Other industrial activities such as lime and cast steel production sectors, show that the CO_2 emissions decreased from 34.8 Gg. in 1990 to 0.7 Gg. in 2010 and from 630 Gg. in 1990 to 460 Gg. in 2010, accordingly. Other gases (CO, NO_x and non-methane hydrocarbons) were emitted especially in cast steel and aluminum production but in small scale.

3.5. Agricultural Sector

The agriculture sector is a main source of GHG gases as CH_4 and N_2O. Sources of GHG gases in agriculture are enteric fermentation, manure, rice planting, burning of agricultural residues. As a result of the activities in the agriculture sector, CH_4 emissions increased from 129 Gg. in 1990 up to 182 Gg. in 2012. The N_2O emissions in this period slightly decreased, due to the decrease in usage of fertilizers.

Agricultural residues can be used in the formation of biomass. Activities on construction of biogas plants based on agricultural residues are being implemented by the State Agency for Renewable & Alternative Energy Sources (ABEMDA). 1 MW biogas thermal power station was built in Gobustan polygon. Biogas plants with a total capacity of 500 kW were built in rural schools, public and in other social facilities. Small-scaled biogas plants have been commissioned by the Minister of Ecology and Natural Resources of the Republic of Azerbaijan.

3.6. Waste Sector

One of the main goals of the state programs is to use 80% of the solid waste until 2015. For this purposes institutional framework was improved and independent “TamizShahar” JSC was established on March 12, 2009. The main GHG gases emitted by this sector are the CH_4 emission and N_2O emission. The inventory results show that the CH_4 emissions in solid waste sector increased by 20% in the period of 1990 – 2012. The CH_4 emissions from the industrial waste waters also shows a slightly increase.

3.6.1. Baku Solid Waste Incineration Plant

The construction and design of this plant reached 346 million Euros. The plant was built in Balakhanı settlement in an area of 20 hectares with an annual capacity of 500 thousand tons. The plant is planned to be operated by “French Constructions Industrielles de la Mediterranee S.A.” (“CNIM” S.A.) for a period of 20 years. Balakhani Solid Waste Incineration Plant consists of two lines each of 250 thousand tons and a turbine that produces electricity. As a result of the incineration processes, 231.5 million kW/ h of electricity is expected to be received during the year. On December 19, 2012 the plant was given for exploitation. This plant is considered to be the largest of its kind in Eastern Europe and the CIS according to the production capacity.

3.6.2. Solid Waste Sorting Plant

A Solid Waste Sorting Plant with an annual capacity of 200 thousand tons was built based on advanced German technology. The plant sorts and separates: paper, glass, plastics, non-ferrous metal, iron, and other raw materials suitable for recycling. This reduces the total volume of waste, forms the recycled low-cost raw materials in the market, lays the foundation for the establishment of recycling, saves energy and most importantly reduces the negative environmental impact of waste.
In addition, by sorting such hazardous waste like batteries and electronic waste from the pulp, the plant sends it to the appropriate places for proper utilization.
The main benefits of the project are:

- Reducing negative impacts on the environment and human health;
- Saving natural resources and energy;
- Recyclable and cheap raw materials market;
- Promoting the recycling industry;
- Reducing the amount of waste;
- New employment opportunities.

As result of these activities the amount of waste will decrease leading to a reduction of GHG emissions.

CHAPTER 4. GHG EMISSIONS FORECAST SCENARIOS AND RELATED MEASURES

4.1.Emission scenarios

To evaluate GHG mitigation potential in Azerbaijan, a baseline scenario of energy use and emissions through 2050 was constructed.(Asian Development Bank Regional Technical Assistance (RETA) 8119: Economics of Climate Change in Central and West Asia – Mitigation Component).
This scenario, named "Business as Usual" (BAU), models a future in which no significant new national mitigation policies or measures are implemented and energy demand, energy supply, and non-energy GHG emissions evolve as the present historical trend. Major determinants of energy demand include: population, gross domestic product (GDP), and fuel prices; supply matches demand (plus net exports), with technology choice and utilization in the power sector based on least-cost optimization. Figures 4.1.1 -4.1.3.illustrate the scenario's assumptions concerning population, GDP and GDP per capita. These assumptions were developed using all official national data available.

Figure 4.1.1: Population in BAU Scenario

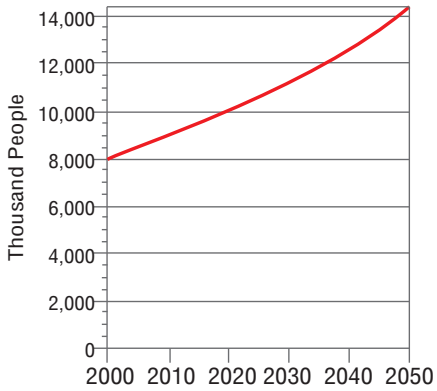


Figure 4.1.2: GDP in BAU Scenario

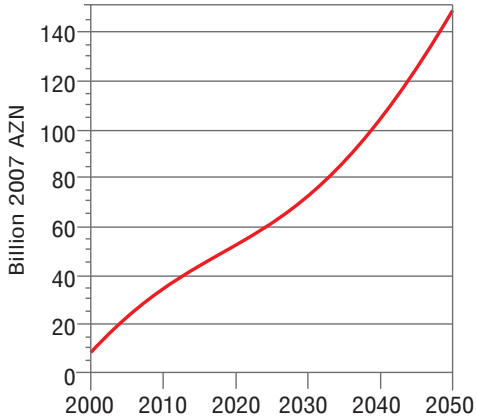
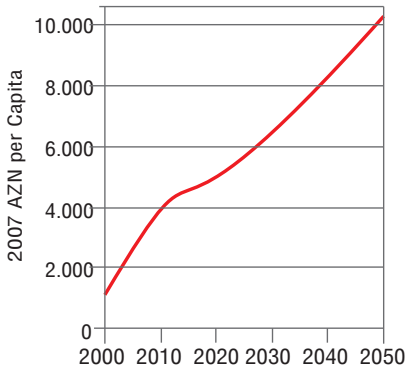


Figure 4.1.3: GDP per Capita in BAU Scenario



As shown in the above figures, population, GDP, and GDP per capita are all projected to increase substantially through 2050. Although the overall energy intensity of GDP decreases (abetted by rising real fuel prices), this factor is outweighed by the growth in population and economic activity. The final result is a significant increase in energy demand: final energy demand rises 90% between 2010 and 2050, while total primary energy supply climbs 64%. Because the carbon intensity of en-

ergy does not change materially during this period, the increase use of energy leads to higher GHG emissions. Non-energy emissions also grow in sectors linked to population or economic activity (industrial processes, agriculture, and waste).

4.2.Mitigation Measures: Abatement Potential and Costs

Table 4.2.1 below shows the cumulative GHG abatement potential and costs for the mitigation measures evaluated for Azerbaijan under ADB TA 8119: Economics of Climate Change in Central and West Asia. In both cases, the accumulation of emission reduction is projected up to 2050 (the model's end year). The costs are expressed as the average cost per ton of CO_2 abated, discounted to 2015 at a 7% real interest rate. Table 4.2.1 separates the physical and price-based measures because they are not directly comparable.

The costs listed in Table 4.2.1 include direct capital, operating and maintenance (O&M), and fuel costs associated with the mitigation measures. The costs include social costs, meaning that they are calculated from the perspective of society as a whole. The costs faced by particular actors in society may be different.

The following mitigation measures result in negative costs and/or offer substantial reductions in exchange of modest positive costs:. Each one of the proposed mitigation measures are explained in table 4.2.1.

- SOCAR Eco-driving
- Electricity Network Upgrade
- Residential CFL Lighting
- Commercial CFL Lighting
- Forests 20% of Total Land Area
- Small Hydro
- Improved Insulation
- Sustainable Land Management
- Onshore Wind

Other measures with higher-costs are not as immediately attractive on grounds of GHG mitigation potential, but they may be compelling when other social objectives are considered. The main advantage from the price-based measures is that there is likely significant reasonable-cost mitigation potential in Azerbaijan, particularly on the demand side of the energy system.

Proposed Mitigation Measures		Cumulative GHG Emission Reductions (Million Metric Tons CO_2eq)	Cumulative Discounted Reduction Cost (2007 AZN per Tons CO_2eq)
SOCAR Eco-driving	Implementation of an eco-driving program for SOCAR's vehicle fleet. The program is assumed to start in 2015.	1.93	-43.24
Electricity Network Upgrade	Electricity transmission and distribution (T&D) losses are reduced to 10% by 2050. The improvement affects both existing and newly constructed T&D lines	25.54	-9.31
Residential CFL Lighting	By 2030, all light bulbs in both urban and rural households are high-efficiency compact fluorescent bulbs (using 75% less energy than incandescent bulbs).	66.64	-6.73

Commercial CFL Lighting	By 2030, all light bulbs in commercial establishments are high-efficiency compact fluorescent bulbs (using 75% less energy than incandescent bulbs).	43.51	-5.74
Forests 20% of Total Land Area	Forested area increases to 20% of total land area by 2050. (based on Ministry of Ecology and Natural Resources (2013) sources).	54.17	0.60
Small Hydro	164 new small hydroelectricity plants averaging 2 MW apiece are constructed by 2030.	31.39	0.77
Improved Insulation	Insulation upgrades in 20% of urban residential buildings by 2050. Heat losses in upgraded buildings are about half those in existing urban residential buildings	70.36	1.15
Sustainable Land Management	Pilot projects to improve management of and rehabilitation of forests and pasture land. Covering approximately 47,000 hectares. (	12.05	2.22
Onshore wind stations	Build-out of onshore wind mills with a power capacity of 800 MW by 2050.	15.23	5.88
3 MW Small Solar	Construction of an additional 3 MW of distributed solar electricity capacity by 2030.	0.09	27.42
25% Municipal Solid Waste to Energy	New waste-to-energy (WtE) capacity is deployed to maintain the diversion of 25% of municipal solid waste to WtE plants through 2050 (currently, about 25% of municipal solid waste is diverted to the Baku WtE plant).	4.84	54.74
Euro-4 Vehicle Standards	Implementation of Euro-4 standards for all new light and medium duty passenger vehicles, beginning in 2014.	0.26	63.00
Biogas	Installation of biogas digesters in rural areas not supplied with natural gas. Assumes that 10% of rural households have biogas by 2030, and that the energy supplied is used for heating and cooking.	1.86	131.13
AC Rail Conversion	Conversion to alternating current (AC) electrified rail of all electrified rail existing in the BAU scenario, which is assumed to be entirely direct current. Full implementation is anticipated by 2050.	0.49	335.24
Solar Hot Water	Installation of solar hot water systems in rural households to reduce demand for conventional fuels. Assumes that 25% of rural households have such systems by 2050	1.42	382.86
Efficient Stoves	Efficient liquefied petroleum gas and wood cook stoves are installed in rural households not supplied with natural gas. Assumes that 10% of rural households have such stoves by 2030.	0.20	773.86
Rail Electrification	Electrification (using AC) of railways that are not electrified in the BAU scenario. Full implementation is expected by 2050.	0.13	868.92
Price-Based Measures			
Fossil Subsidy Removal	Price subsidies for fossil fuels and derived secondary fuels are phased out by 2030.	588.56	4.90
OECD Fuel Prices	Prices for major fuels equalize with current (2013) OECD averages by 2030.	1,118.39	5.10

Table 4.2.1: Cumulative GHG Abatement Potential and Costs for Mitigation Measures

4.3. A Stabilization Scenario

The stabilization scenario includes the following mitigation measures from Table 4.2.1.

1) All physical mitigation measures in Table 4.2.1. cumulative cost of which per ton is less than 50 AZN (2007)will be implemented.

2) The AC Rail Conversion and Rail Electrification measures described in table 3.7.3.1.are being implemented in accordance with Ministry of Transport (2015).

3) Two other national goals that have mitigation implications are the following:

i. adoption of Euro-4 vehicle standards, and

ii. generating 20% of electricity from renewable sources by 2020

The stabilization scenario, considers that population, total and per capita GDP, and fuel prices are all the same as in the BAU scenario. Moreover, the mitigation measures will lead to a reduction in final energy demand, total primary energy supply, and the energy intensity of GDP. Interestingly, the carbon intensity of the total primary energy supply does not decrease relative to the BAU, reflecting continued reliance on natural gas and oil. In 2030, for example, natural gas and oil products make up 87% of final energy demand and 68% of inputs for electricity and combined heat and power generation.

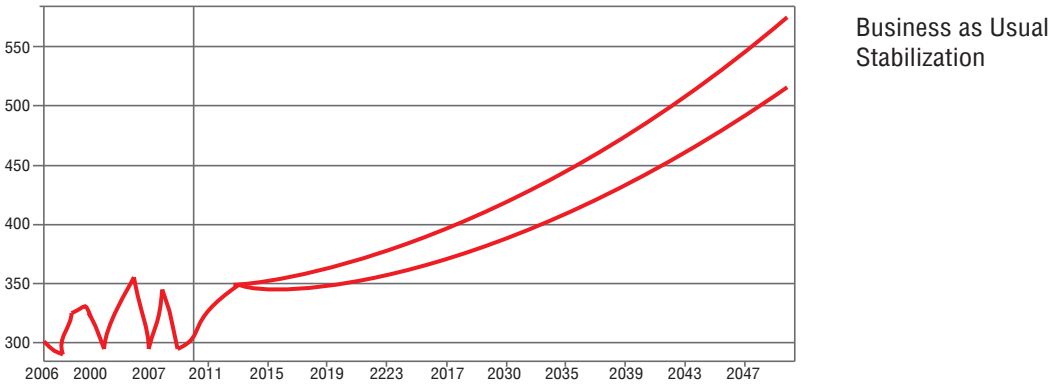


Figure 4.3.1: Energy Demand in BAU and Stabilization Scenarios

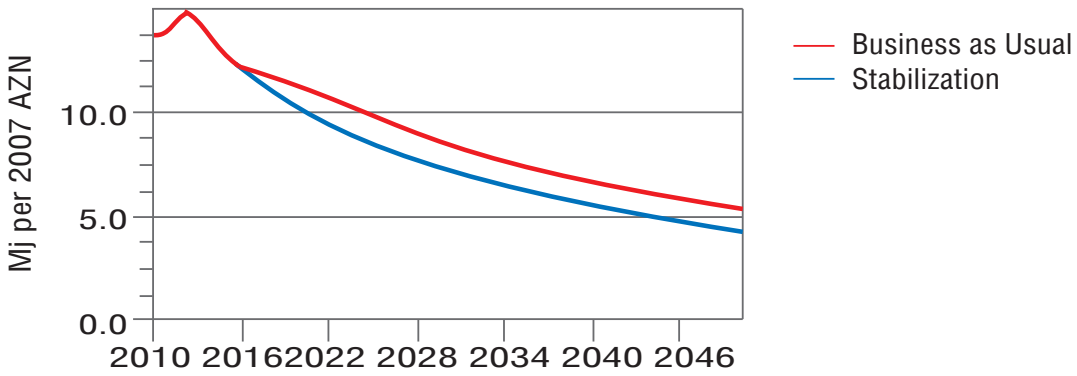


Figure 4.3.2: Energy Intensity of GDP in BAU and Stabilization Scenarios

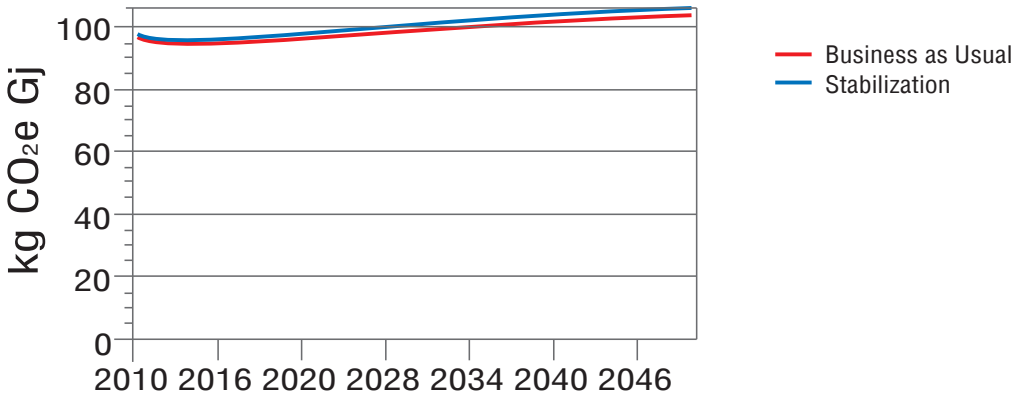


Figure 4.3.3.Carbon Intensity of Energy in BAU and Stabilization Scenarios

Renewable Electricity Capacity in BAU and Stabilization Scenarios (MW)					
Scenario	**2010**	**2020**	**2030**	**2040**	**2050**
Stabilization Scenario	787	1432	1249	1399	1672
BAU	787	1124	899	711	771

Table 4.3.1. Renewable Electricity Capacity in the BAU and Stabilization Scenarios

The 20% renewable power target and the individual measures for small hydro, wind, and distributed solar power do spur increased development of renewable electricity capacity in the stabilizations scenario, as illustrated in Table 4.3.1. Thirty-two percent of domestically produced electricity comes from renewable energy sources in 2030, and 38% in 2050.

As expected, the net result of the implemented mitigation measures is a reduction of GHG emissions. Table 4.3.2 depicts total emissions for the BAU and stabilization scenarios as a percentage of the measured national emissions in 1990.

National GHG emissions for the stabilization scenario remain below 80% of 1990 emissions until 2033, whereas under BAU conditions by 2020 the levels have exceeded the 80%. Cumulative emission reductions by 2050 are 321.8 million tons of CO_2e for the stabilization scenario, and the overall average discounted cost per ton is -1.45 2007 AZN.

The stabilization scenario (Figure 4.3.4) shows what could be attained under a moderately ambitious, cost-effective program of GHG abatement. The emphasis is on low-cost measures, and meaningful emission reductions relative to 1990 and the BAU.

Emissions in percent for the BAU and Stabilization Scenarios in relation to the 1990 GHG emissions					
Scenario	2010	2020	2030	2040	2050
Stabilization Scenario	68.99	74.29	77.85	88.27	100.68
BAU	68.99	80.16	91.79	103.49	121.99

Table 4.3.2:Percentage in relation to the 1990 GHG Emissions

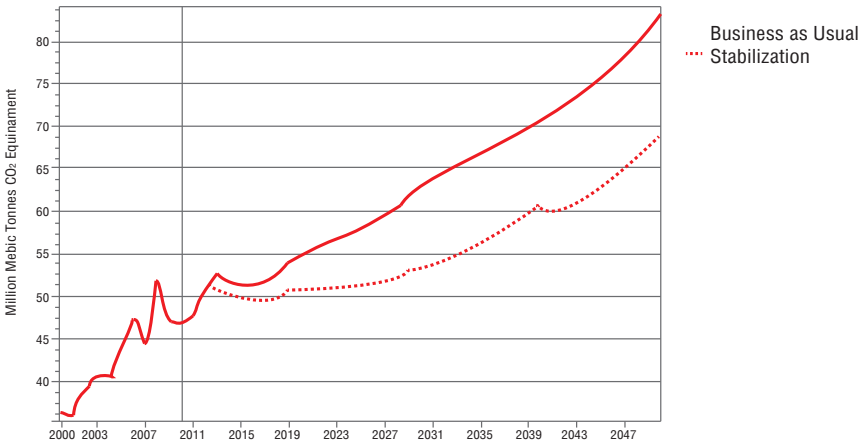


Figure 4.3.4: GHG Emissions in BAU and Stabilization Scenarios

4.4. Needs and barriers for the implementation of mitigation actions

The conducted analysis shows that there are three options for mitigation of greenhouse emissions:

- Improvement of energy efficiency in energy sector (generation, distribution, consumption of electricity and heat energy)
- Development of alternative energy sector sources for electricity and heat energy generation
- Development of forestry sector

Legal bases aspect

- Lack of special laws on climate change, energy efficiency, and alternative energy sources
- Need for energy efficiency standards on building and heating sectors
- Develop a tax discount and financial incentive programs to increase the interest of private and residential sectors for increasing energy efficiency

Institutional aspect

- No acting fund on energy efficiency
- Weak participation of private sector in fuel and energy sectors
- Program for effective management of electricity distribution
- Capacity building on development of new mechanisms for mitigation measures as NAMAs
- Capacity building on mitigation analysis and programs applications such as LEAP for assessing Azerbaijan's GHG emissions calculation and reduction assessment
- Improvement of statistical data quality on relevant parameters important for GHG emissions and mitigation analysis and for application of LEAP software
- Improvement of intersectional and international cooperation in GHG mitigation

CHAPTER 5. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

5.1. Climate of Azerbaijan

Climate types

According to the temperature and distribution and regime of precipitation, as well as humidity conditions, eight from eleven global climate zones (Köppen climate classification[2]) are presented in Azerbaijan.

1. Semi-desert and dry steppes climate-lowland districts: Mainly covers the Central Aran regions, Caspian zone from Samur River to Qizilagaj gulf, the Araz plains of Nakhchivan AR, Talish Mountain. 15-50% of the annual precipitation is lost thru evaporation. Winter is mostly warm (cold along Araz River plains and in the valleys of the Talish Mountains). Summers are extremely hot, temperature can reach 40°C.

2. Warm-temperate climate with dry winters: Spreads over the low mountainous areas of the Southern slopes of the Greater Caucasus, Ganikh-Ayrichay, Northern and Eastern slopes of the Lesser Caucasus. 50-100% of the precipitation received is lost by evaporation. Winters are mild, slightly rainy, summers are warm and mild.

3. Warm-temperate climate with dry summers: Mostly covers the Lankaran-Astara zone. 50-100% of the precipitation received is lost by evaporation. Winters are mild, summers are hot, dry and mild, and autumn is rainy. From May to mid-August it rains less and drought periods occur very often, irrigation methods are used for agriculture.

4. Cold climate with dry winters: Occurs in the Southeast hills of the Greater Caucasus (1,000-2,700 meters) and also in the medium and high mountains of the Lesser Caucasus (1,400-2,700 meters). Annual precipitation accounts for 75-to 100% of possible evaporation. Summers are warm, winters are mild.

5. Cold climate with dry summers: Covers the middle and high mountain zone of Nakhchivan AR (1,000-3,000 m). Annual precipitation accounts for 50 to 100% of possible evaporation. Summers are cool, and winter is cold enough to allow the formation of snow.

6. Temperate climate with an equal distribution of precipitation: Covers forested zones in the south (600-1,500 meters) and northeast hills (200-500 meters) of the Greater Caucasus. The annual precipitation in the south slope is 75-100%, in the north-east slope it is 50-100%. Winter is mild, summers are hot.

7. Cold climate with all seasons' rains: Typical of the south slopes (1,500-2,700 meters) of the Greater Caucasus. It covers high forest, subalpine and alpine zones. Annual precipitation accounts for more than 150-200% of possible evaporation. Winters are quite cold, summers are cool.

8. Tundra climate: Covers the areas of the Greater and Lesser Caucasus above 2,700 meters, and above 3,200 meters in the Nakhchivan AR. Annual precipitation accounts for more than 100-200% of the possible evaporation. Winters and summers are cold. In some places snow remains on the ground from one year to another.

Main climate elements

Temperature: The temperature regime and its areal distribution is relevant and depends on air masses' characteristics, terrain of the area and proximity of the region to the Caspian Sea. Caspian Sea

reduces the temperature in the coastal areas in summer and increases the temperature in winter.
The average annual temperature in the Kur-Araz lowland, coastal zone in the south of Absheron Peninsula, including the Lankaran lowland is around 14-15C. Towards the mountains temperature decreases by 4-5° C.
The average monthly temperature of the coldest month (January) does not fall below 0° C in the plains and foothills. The temperature in the coldest month is 3-4° C in the coastal areas and islands located in the south of the Absheron Peninsula. The temperature decreases in the direction of highlands and is -5-6° C (-7° C in the Nakhchivan AR) at the height of 2,000 meters above sea level, and -12-13° C at the height 3,000 meters. The average temperature in the hottest month of the year (July) is 26-27° C in the Kur-Araz lowland, it does not fall below 24 ° C in the plains and foothills.
The average monthly temperature in the mountains at an altitude of 2,000 meters is approximately 14-16° C, at 3,000 meters it is not lower than 8-10° C. The absolute maximum (+ 46° C) and minimum (-32 ° C) temperature values in the country have been observed at the Araz plains in the Nakhchivan AR which is characterized by extreme continental climate.
Atmosphere precipitation: The atmosphere precipitation in Azerbaijan is connected with the entry of air masses on the territory. The amount of precipitation, seasonal and annual is determined by the interaction of air masses with the landscape and the Caspian Sea. The minimum average annual precipitation (150-200 millimeters) occurs on the Southern shore of the Absheron Peninsula and Southeast of Gobustan.
The annual precipitation amount in the central and Eastern Kur-Araz lowlands, In the Southeastern lowlands of Samur-Davachi, Araz plain of Nakhchivan AR, main parts of Gobustan and Absheron Peninsula precipitation is less than 300 millimeters. This amount gradually increases from the Caspian Sea coast to the West and from plains to mountains.
Precipitation in the mountains increases up to a certain height (2,600-2,800 meters in the Greater and Lesser Caucasus, 2,600-3,000 meters in the Nakhchivan AR, 200-600 meters in Talish), then decreases gradually. The maximum amount of annual precipitation in this area is 1,400-1,600 millimeters in the Southern slope of the Greater Caucasus, 800 millimeters in the Northeastern slope, 800-900 millimeters in the Lesser Caucasus and Nakhchivan AR, and 1,700-1,800 millimeters in the Talish Mountains.
Unlike other mountain regions in the country, the amount of precipitation in the Talish Mountains decreases at higher altitudes (over 2,000 meters) and is less than 250-300 millimeters in intermountain valleys. Although the majority of the precipitation coincides with the warm period (April-October) summer months are mostly dry and even the annual precipitation rate in the Lankaran-Astara, a region with abundant precipitation, diminishes by 5-15%.
The average annual number of rainy days in the Kur-Araz lowland and Araz plains in the Nakhchivan AR is less than 60-70 days. This number reaches 170 days in the central part of Southern slope of the Greater Caucasus. The highest daily maximum of precipitation was recorded in the Southern slope of the Greater Caucasus (148 millimeters, Alibek) and Talish Mountains (334 millimeters, Beleser). The intensity of rainfall reaches 1-2 millimeters or even 3 millimeters per minute. In lowland areas 4/5 of the total precipitation falls as a rain while in mountainous areas this figure constitutes 1/3 of total precipitation.
Snowfalls are very sporadic and do not accumulate on the plains, and snow is not observed every year. The Southern slope of the Greater Caucasus is the snowiest region of the country. The average number of snow-covered days in the middle mountains is 80-120 days, in the high mountains

250 days. Snow cover remains constant on the Greater Caucasus mountain peaks.
Air humidity: The average annual values of absolute air humidity is 11-12 gr. in the Kur-Araz lowland, and 14-15 gr on the coast of the Caspian Sea. The values decline with altitude in the mountains. The annual average at altitudes of 1000 meters is approximately 9 gr.; at 2,000 meters it is 6-7 gr. Absolute humidity is much lower in the Nakhchivan AR and on some heights it is 1-1.5 gr or less compared to other regions of Azerbaijan.
The highest values of absolute humidity are reached in the summer (July-August) in coastal areas for example at Ganikh-Ayrichay valley the values are between 20-24 gr, and 8-10 gr. at heights of 3,000 m. The value in the lowland areas in January is 6 gr, at altitudes above 1500 m is approximately 3 gr. The lowest quantity of humidity occurs in the Nakhchivan AR and even less in the mountains.
The highest average annual values of relative humidity occur on coastal areas (75-80%), while the lowest values occur in Nakhchivan AR and the Greater and Lesser Caucasus mountain areas (55-65%). The lowest relative humidity in summer was recorded in Nakhchivan AR (35-50%), Talish high mountains (50-55%) and Kura-Araz lowland (50-60%). The highest values are observed in the coastal and high mountainous areas of the Greater and Lesser Caucasus (60-85%). The highest values in winter are in coastal areas, while the lowest values are typical for high mountainous areas.
Evaporation: The annual average of evaporation for Nakhchivan AR, Araz lowlands is 1200-1400 millimeters and more; for the and Kura-Araz lowland ranges from 1,000-1,200 millimeters, for the lowlands and for other plains it ranges from 800-1,000 millimeters. It decreases with altitude in mountainous areas. The average annual values of evaporation in the middle mountainous areas are 300-400 millimeters, it reduces to 200 millimeters in the mountains
Cloudiness: The regime and distribution of cloudiness is connected with air circulation and orography of the area. The maximum cloudiness occurs in the high mountains regions (2,000 meters) in the spring and during the early summer in the middle of the mountains and foothills (2,000-500 meters).
Winds: Fyon (dry hot winds) occur in the mountainous areas in the coldest period of the year, white winds are observed in the foothills and plains.
The average annual wind speed in the country is 5 meters per second. However, in the coastal areas of Absheron Peninsula it changes between 6-8 meters per second. The total number of days here with a wind speeds of 15 meters per second or more is 100-145 days. Ganja-Kazakh plain differs by the occurrence of strong winds (25-70 days). Strong winds are less frequent in other regions of Azerbaijan.

5.2. Assessment of current climate variations

Temperature: Anomaly of temperature during 1991-2010 years ranges between 0.2 – 1.5 ^{0} C. The highest increase occurred in Lesser Caucasus region during spring season. Increase of temperature was observed mainly during summer season which was about 0.90 C in Absheron-Gobustan region, 1.1^0 C in Lesser Caucasus region, 0.8^0 C in Lankaran-Astara region and 0.90 C in Kura-Araz region. Increase of temperature in Nakhcivan region was observed in summer and autumn seasons (0.8^0 C). Annual anomaly of temperature was observed mainly in Ganja (1.1^0 C) and Dashkasan (1.2^0 C) stations of Lesser Caucasus.
Precipitation: The amount of the precipitation decreased over all territory during 1991-2010.This decrease was about -4,2- (-19,8%) in winter, -2,3- (-28,8%) in spring, -1,4- (-23,9%) in summer, -0,4- (-3,3%) in autumn.
The tendency in temperature and precipitation on the territory of Azerbaijan is different by regions and highlands. These differences are shown in the following tables.

Highlands, m	≤ 0	1 - 200	201-500	501-1000	>1000	Through the country
Norm 1961- 1990	**14.6**	**14.3**	**13.3**	11.9	7.8	12.3
Annual T Average, 2007	15.3	14.9	13.7	12.4	8.5	12.9
Difference from the norm,^{0}C	***+0.7***	***+0.6***	***+0.4***	***+0.5***	***+.0.7***	***+0.6***
Annual T Average, 2008	***15.4***	***15.1***	***14.2***	***12.5***	***8.9***	***13.0***
Difference from the norm, ^{0}C	***0.8***	***+0.8***	***+0.9***	***+0.6***	***+1.1***	***+0.7***
Annual T Average, 2009	***15.2***	***14.9***	***14.1***	***12.3***	***8.8***	***12.9***
Difference from the norm,^{0}C	***+0.6***	***+0.6***	***+0.8***	***+0.4***	***+1.0***	***+0.7***
Annual Average, 2010	15.7	15.5	14.4	13,1	9,7	**13.6**
Difference from the norm,^{0}C	***+1.1***	***+1.2***	***+1.1***	***+1.2***	***+1.9***	***+1.3***

Table 5.2-1: The increase in temperature in 2007, 2008, 2009, and 2010 on different highlands comparing with long-term norm (1961 -1990), ^{0}C

Altitude, m	≤ 0	0 - 200	201-500	501-1000	>1000	Through the country
Norm 1961- 1990	334,5	327.5	478.0	534.3	639.7	476,5
Average annual, 2006	390.1	321.7	436.8	592.4	569.7	462.3
Difference	55.6	-5.8	-41.2	58.1	-70	-14.2
Average annual, 2007	313.1	319.8	540.5	623.1	664.2	492.8
Difference	-21.4	-7.7	62.5	88.8	24.5	16.3
Average annual, 2008	340.4	298.3	307.2	681.9	644.3	445.1
Difference	5.9	-29.2	-170.8	147.6	4.6	-31.4
Average annual, 2009	372.8	396.3	471.0	551.2	650.2	482.6
Difference	38.3	68.8	-7	16.9	10.5	6.1
Average annual, 2010	364.5	396.9	450.7	766.1	619.3	527.0
Difference	30.0	69.4	-27.3	231.8	-20.4	50.5

Table 5.2-2: Distribution of precipitation and its long-term norms (1961-1990) according to different altitudes in Azerbaijan for 2006, 2007, 2008, 2009 and 2010, in mm

5.3. Climate change scenarious

IS92a and IS92c scenarios of economic development were used with MAGICC/SCENGEN 2.4 climate model. The results from the models were compared with the baseline average (1961-1990), for the period 2015-2050. Each line in these figures covers the average values of thirty years period.

Years	Month												Forecasted Annual Temperature Change Average in ^{0}C
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
2015	0.8	0.7	0.8	0.7	0.6	0.6	0.9	0.8	0.8	0.7	0.6	0.6	0.72
2020	0.9	0.7	1	0.8	0.7	0.7	1	0.9	0.8	0.8	0.6	0.8	0.81
2025	1.1	0.8	1.1	0.9	0.8	0.7	1.1	1	0.9	0.9	0.7	0.9	0.91
2030	1.2	0.9	1.3	1	0.9	0.8	1.3	1.2	1	1	0.8	1	1.03
2035	1.4	1.1	1.5	1.1	1	0.9	1.5	1.3	1.2	1.1	0.9	1.1	1.18
2040	1.6	1.2	1.6	1.3	1.1	1	1.6	1.5	1.3	1.2	1	1.3	1.31
2045	1.7	1.3	1.8	1.4	1.2	1.1	1.8	1.6	1.5	1.4	1.1	1.4	1.44
2050	1.9	1.4	2	1.5	1.3	1.2	2	1.8	1.6	1.5	1.2	1.5	1.58

Table 5.3-1 Forecasted monthly temperature changes compared with the baseline average

Calculations according to all scenarios of GCM models forecasts an increase of monthly average temperature in a range of 0,72-1,58^{0}C during 2015-2050 years in comparison with average values of 1961-1990 years.
Calculations according to all scenarios of GCM models forecasts increase of precipitation in winter (0,4-0,8%),summer(2,2-12,4%) and decrease in spring (-0,9- (-1,7%)), autumn (-0,9 - -1,9%). Annual change of precipitation forecasted to range between -0.3- (-0.5%.)

		2015-2050	
	Scenario	**Average**	**Likely range**
Annual average Temperature change (^{0}C)	CSIRO	1.2	0.7-1.8
	Echam4	1.7	1.0-2.4
	HadCM2	1.0	0.6-1.4
	UKTR	1.4	0.9-2.0
	Scenario	**Average**	**Likely range**
Annual average Precipitation change%	CSIRO	-1.8	-1.1- -2.6
	Echam4	-2.8	-1,7 - -4.0
	HadCM	0.7	0.4 - 1.0
	UKTR	2.5	1.5 - 3.5

Table 5.3-2 Echam 4, HadCM 2,UKTR models: Forecasted annual average temperature changes in comparison with baseline-1961-1990

Results of analysis for all scenarios and models revealed that the regional model HadCM, has the best skill for Azerbaijan, This model was able to replicate more accurately past and future temperature and precipitation parameters As a result of long-term climate analysis, the projections on temperature and precipitation of the HadCM3 regional model are shown below:

Figure 5.3-1 Forecasted changes in temperature for the period between 2011 and 2040

Figure 5.3-2 Forecasted changes in temperature for the period between 2041and 2070

The HadCM3 model forecasts a 1.5^0 C increase of temperature in comparison with the 1961-90 average values in all the regions of Azerbaijan during the period of 2011-2040.
This increase is expected to be in a range of 1.0 - 1.5^0 C in Nakhichevan and in several regions of Lesser Caucasus.
The HadCM3 model forecasts a temperature increase of more than 2.5^0 C in comparison with 1961-90 average values in the central territories of Azerbaijan for the period of 2041-2070. These increase is expected to be above 3^0 C in Nakhichevan and in several regions of the Lesser Caucasus and Gazakh-Ganja region. In Guba –Xachmaz region this increase expected to be in a range of 2-2.5^0 C.

Figure 5.3-3 Forecasted changes in temperature for the period between 2071 and 2100

The HadCM3 model forecasts an increase of temperature in a range of 3.5- 5.0 ^{0} C in comparison with 1961-90 average values, in most regions of Azerbaijan during the period of 2071-2100.

Forecast of annual precipitation in Azerbaijan based on HadCM3 model

The HadCM3 model forecasts a 5.0 % decrease in precipitation in comparison with the 1961-90 average values in Nakhichivan and Lesser Caucasus areas during the period of 2011-2040. The forecasts does not project any significant changes in other areas of the Republic.

Figure 5.3-4 Forecasted changes in precipitation for the period between 2011and 2040

Figure 5.3-5 Forecasted changes in precipitation for the period between 2041 and 2070

The HadCM3 model forecasts a 10% decrease of precipitation in comparison with 1961-90 average values in Nakhichivan and Zangazur areas during 2041-2070 years. Precipitation is forecasted to decrease in a range of (-5) – (- 10) % in the Lesser Caucasus region. An increase of precipitation in a range of 0-5% is forecasted to occur in the Absheron peninsula and seaside areas during the period of 2041-2070. The forecast does not show any significant changes in other areas of the Republic.

Figure 5.3-6 Forecasted Changes in precipitation for the period between 2071and 2100

The HadCM3 model forecast a 20% decrease of precipitation in comparison with 1961-90 average values in Nakhichivan and Lesser Caucasus areas for the period between 2071 and 2100. Precipitation is forecasted to decrease in a range of 5 % in Absheron peninsula. The precipitation is projected to decrease from 15-20% in Kura-Araz lowland area. In the Great Caucasus and Lankaran areas the precipitation is forecasted to decrease in a range of 10 -15%.

5.4. Sectoral vulnerability analyses and adaptation measures

5.4.1. Agriculture

Agriculture plays an important role in the economy of Azerbaijan and 48% of the population lives in rural areas. Agriculture employs 38% of the country's population. Though favorable soil and climatic conditions of the country and a comparative advantage of traditional agricultural production, the agricultural sector provides less than 6% of the national GDP. The agro-pasture production system suffers from low productivity because of exposure to severe land degradation; limited natural resources. In order to restore the degraded lands it is important to be able to manage natural resources in a sustainable way and it is also important to increase the productivity of the agricultural sector, in order to achieve this agricultural production system needs to be modernized. After the agrarian reform in 1997, approximately 817,000 families owned 1.3 million hectares of land. In addition, the country had more than 620,000 households with land of 2.8 hectares (FAO). Agricultural production is made from the three main agro-ecological zones distributed among collective farms, private gardens/farms:

- Valleys, dry / hot, irrigated
- Plateaus-low precipitation, irrigation
- Plateaus, high precipitation

Agriculture is also strategic sector in Azerbaijan and one of the key components of the non-oil economy. Despite the fact that, the share of agriculture in GDP is only 5.3 %, it is one of the sectors that employs most of the country's population and provides jobs and income for about 40% of the total labor force. Agriculture plays an important role in food security and improving the socioeconomic situation of rural regions.

According to the climate change scenario (HadCM3 model) temperature increase of 1.5-2.0 ^{0}C, and a 5% decrease in precipitation will be observed in the period of 2015-2050. The following years until the 2100 temperature increase expected to be 5 ^{0}C and decrease in precipitation to be 15-20%. Irrigation is one of the key factors in the development of agricultural crop production. This factor plays an important role in increasing the vulnerability of the agriculture sector. The increasing temperature will bring losses due to evaporation and will also cause water shortages. Without proper irrigation technology the farmers will increase the volume of irrigation water 10-15%. As a result of intensive evaporation the groundwater movement in the unsaturated zone will be activated, this will again cause the salinization of soil, its degradation and decrease in productivity in the future.

The observed increase of days with high-temperatures has led to droughts and has also reduced sharply the productivity of rainfed crops in some areas such as Shaki, Shamakhi and Gobustan. As a result of the 2014 drought, grain yields fell. In rainfed areas, mentioned above– a large part of grain fields were lost because of the drought, this is a serious future indicator. The unstable weather conditions are having a negative impact on tea planting in the southern regions.

Of the 4,768.3 hectares of areas suitable for agriculture 38.9% is covered by arable crops, 4.8% by perennial crops, 2.5% of grass, 52.9% of hayfields and 0.9% by derelict lands. 1,684.2 hectares are under cultivation, of which 40.9% are used for winter wheat, 18.6% for winter barley, 4.3% for spring cereals and legumes, 2.5%, for technical crops, 3.9% for potato, 4.6% for vegetables, 1.7% for plants, and 23.5% for forage crops. It is clear that grains and legumes are 63.8%.

The main effects of climate change on agriculture:

- Increase in temperature will cause the increase in the number of dry days (drought periods);
- Lack of irrigation water due to a decrease in precipitation;
- As a result of the break in the precipitation cycle, periods of excessive precipitation can occur, causing landslides, floods that leads to crop losses;
- Loss of productivity of agriculture products that are not drought-resistant (cereals, grapes, fruit crops, vegetable crops, etc.), particularly in areas of rainfed agriculture;
- Increase in the levels of summer and winter pastures degradation due to decrease in precipitation.

As a result of vulnerability analysis the agricultural areas more vulnerable to climate change were identified. The most important crops in the country are: cotton, fruits, grapes/viticulture, vegetable, and tobacco. The most affected crops are listed as follow:

- Grains: Wheat production, the most common cereal in terms of hectares planted and important for ensuring food security;
- Grapes/viticulture: A historically important crop but uprooted in the past, now the cultivated area is expanding rapidly and attracting investment because of its high profitability;
- Pastures, summer and winter: Very important for livestock and animal production;
- Cotton: A traditional crop, the production has decreased but could be important in the future.

Climate change risks for the agriculture sector show the need to visualize a clear adaptation plan that takes into account institutional capabilities, aligning agricultural policies with climate change, and investing in infrastructure and new technologies. Developing an adaptation plan should involve consultation with key stakeholders and a quality quantitative analysis.

The following adaptation measures are expected to be taken to mitigate the impact of climate change and to increase the resilience of the agricultural sector.

- Under current climate change conditions it is required to cultivate new sorts of long vegetation, heat-loving, drought-resistant, and salt-resistant agricultural crops;
- In order to increase the country's food security it is necessary to continue the work of winter wheat breeding.
- The implementation of modern irrigation techniques and technologies, the use of alternative water sources is more appropriate;
- Continuation of the work in breeding, introduction, and implementation of drought-resistant cotton varieties with high productivity;
- Considering the water and wind erosion processes, it is necessary to put forest shelterbelts across the areas, to register eroding and soiled lands, mapping, etc.;
- Establishment of greenhouse farms that meet the needs of the market;
- Establishment of artificial water reservoirs to collect precipitation and use it for irrigation;
- Improvement of irrigation and drainage systems in order to fight against salinization, etc.;
- Rehabilitation of vineyards in the traditional areas and increase the size of vineyards by constructing new terraces in the mountains;

• Restoration of tea plantations in the traditional regions and construction of new gardens in other areas;
• Soil salinization and erosion, continuation and expansion of reclamation measures against drought and white winds;
• In order to increase competitive production development the preparation and implementation of government assistance programs are necessary.
• Establishment of small enterprises for perishable products in rural areas; Expansion and improvement of existing storage system for agricultural products (storage, refrigerators, ets)

5.4.2. Water Resources

The water resources in Azerbaijan are allocated as follows:

• River waters: 28,500-30,500 million m_3, 9,500-10,00 million m_3 of it refers to the inner rivers and the rivers flowing into the Caspian Sea
• Lakes: 30-50 km_3
• Reservoirs: full capacity is 20,600 million m_3, portion suitable for use is 12,400 million m_3
• Exploitation potential of groundwater: 8000-9000 million m_3
• Glacial water resources: 80-85 million m_3

Water resources play a major role in the economy of the country. Annually 10,000-12,000 million m^3 of water is taken from rivers for agriculture irrigation purposes. Lack of water resources, non-equal distribution of water and seasonal fluctuations cause problems in water availability. Only 5-20% of the annual river flow is used for irrigation. On the other hand, there is a shortage of water during drought periods, however, during the rainy season floods could occur.

Vulnerability of water resources to climate change: Studies show that there is a decrease in the country's major rivers and water resources. In particular, decrease is observed in winter precipitation and snow water resources, as well as in spring precipitation. This also led to a decrease in both surface and ground water. According to the analyses after the First and Second National data decreases in river water resources continued.

Adaptation measures: In order to mitigate the negative impact of climate change on water resources, the following adaptation measures have been identified:

• Reconstruction of existing water facilities to reduce water loss;
• Creation of additional water sources such as usage of rain water and purified seawater;
• Use of recycled water such as underground water, and other waters coming from industries;
• Water flow regulation and the efficient use of water during droughts and low precipitation seasons;
• Forest restoration (reforestation) in flood risk regions;
• Construction of small HPP (hydropower plants) on acting irrigation canals;
• Implementation of engineering and protective measures in the basins and flood rivers;
• The construction of HPP (hydropower plants) on the mountain rivers and the establishment of new water reservoirs;
• Construction of small HES on existing irrigation channels;
• Re-use of waste water after treatment
• Implementation of modern irrigation technology and techniques.

The adaptation measures prepared in collaboration with relevant government agencies and various experts are expected to reduce the water deficit and are listed in table 5.4-1.

Indicators of water balance	Water amount, (in 10^6 m3)			
	Real	2011-2040	2041-2070	2071-2100
Water shortage	- 2,500	-9,000	-9,500	-10,000
Increase the amount of used groundwater	3,000	3,000	3,000	3,000
Improvement of water consumption system	3,000	3,500	3,500	3,500
Cleaning and use of 40% of used water (recycling waste waters)	2,000	2,500	2,500	2,500
Efficient use of water by implementation of modern irrigation technologies and use of rainwater and other alternative water sources	2,000	2,000	2,000	2,000
Avoiding water shortage periods as a result of measures undertaken	+7,500	+2,000	+1,500	+1,000

Table 5.4-1. List of recommended adaptation measures

5.4.3 Forests

The total forest area in Azerbaijan is 1,213,700 hectares. In the last ten years 1,021,000 hectares were covered with forest, the area has increased from 11.4% to 11.8%. 49% of the country's forest resources is in the Greater Caucasus region, 34% is in the Lesser Caucasus, 15% is in the Talish zone and 2% in the Aran zone (along with the Nakhchivan AR). Forest area per capita in Azerbaijan is equal to 0.12 hectares.

Forests in the occupied territory by Armenia, especially in the mountain forests have suffered from fatal damage. 261,000 hectares of forest area are under occupation as a result of Armenian invasion.

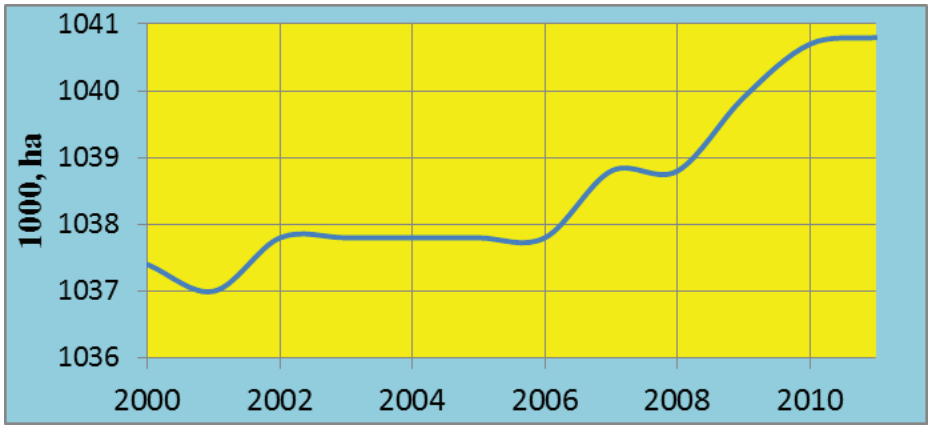


Figure 5.4-2. Change of total area of forest fund lands.
(State Statistics Committee -www.stat.gov.az)

One of the vast forest areas is located on the slopes of the Lesser Caucasus Mountains. The main mountain forests here cover the regions in arrays that separate branches in the Northern, North-eastern and Eastern slopes. The forest tract is interrupted only in the South Karabakh and does not reach the Iranian border. In addition, forests in the form of islets are found in Shakhbuz region

in Nakhchivan AR. One of the vast forest tracts cover the Talish mountain slopes. Forests stretch along the lower part of the Kura and Araz rivers and take the form of a belt.
The area is covered with forests dominated by species distributed as follows:

Forest Type	Percent
Pine	0.04
Juniper	2.37
Hazel	31.68
Oak	23.4
Hornbeam	26.01
Ash	0.01
Maple	0.22
Poplar	3.58
Alder	1.87
Lime	1.71
Elm	1.16
Other species	7.95

Table 5.4-2 Forest distribution by species

Despite the difference in composition of forests, deciduous forests consist of hazel, oak, and hornbeam. 85.5% of the territory is covered by forest containing these three species.

The distribution of forests differs with regard to age. Thus, 11.2% of the area covered with young forests, 63.3% with middle-aged trees, 13.4% with growing trees, and 12.1% with over-aged forests.

Most of the forests (85%) are located on the highest mountain slopes and are valuable for soil protection, water purification, and as climate. Distribution of forests also varies according to the intensity. 13.7% of the forests have low density (0.3-0.4), 2.62% average (0.5-0.6), 18,3% of normal (0.7-0.8), and 2.62% have higher (0.9-1.0) density. The average density of forests has been identified as 0.56.

Table 5.4-2 Forest distribution by species

Reforestation: During the last years Azerbaijan succeeded to stop illegal wood-cutting. Forest restoration measures were conducted on 10,528 hectares in 2012, forest planting and sowing took place on 3,078 hectares. Support for natural restoration of forests was made on the remaining 7,450 hectares. However it is still necessary to increase the amount of protection forests in the low-lying areas and non-forested areas in several places. The works in the direction of restoration and reconstruction of Tuqay forests located in the valley of Kura and Araz Rivers are being carried out.
Large areas of protective forests have to be planted in the mountainous areas to prevent erosion, as well as comprehensive measures for the rehabilitation of major rivers basins (reforestation, agro-meliorative and hydromeliorative) should be carried out

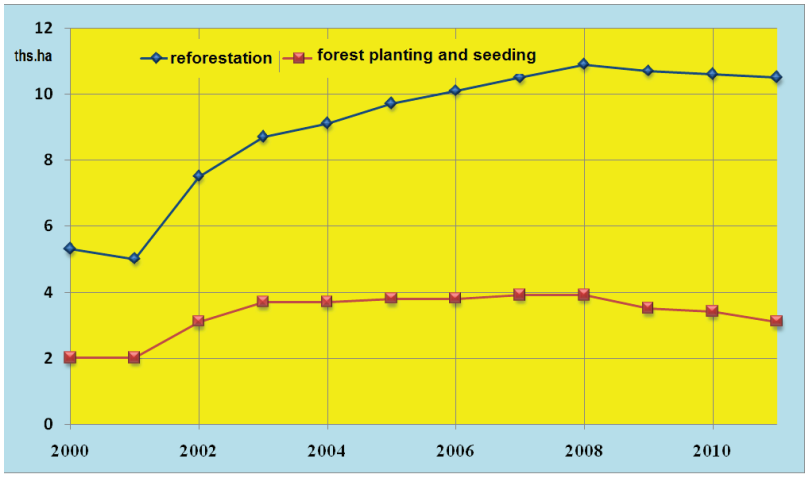


Figure 5.4-3. Key indicators of forest restoration, planting and sowing (State Statistics Committee -www.stat.gov.az)

Impact of climate change on forest sector

- Sharp increase in temperature and decrease in precipitation during the summer months could cause droughts that has and will have negative impacts on the forest sector.
- Strong water flooding and mudslides cause the destruction of forest cover in near coastal

areas. Kura River water flows has suffered from periodic increases in different years and has caused the flooding of coastal areas and had a negative impact on Tuqay forests.

• Increasing strong winds, especially Southern (fyon) winds in mountainous areas have caused trees to fall in some forests.

• Temperature increase during the summer months may lead to forest fires. Increasing wind conditions at the same time can spread fire to a larger area.

• In 2014 the hot and dry weather during the summer has led to drought. Record temperatures were recorded in separate regions in August. Forest cover has been damaged as a result of drought. Twelve fire incidents were recorded during that year, resulting in 58.8 hectares of burned forest.

Suggested Adaptation measures

• Design and implementation of forest planting programs: The trees should be fast growing and drought-resistant species, preferable local species should be used;

• Reforestation and restoration measures should be carried out in arid areas;

• Reforestation activities in regions with high risk to flood;

• Preventive measures should be taken to avoid forest fires;

• Prevention of the spread of pests and diseases;

• Prevention of illegal cutting and other forest-related measures;

• Study the current state of forests, inventory them and draft a new forest structure;

• Development and implementation of measures for the restoration of forests to ensure efficient use of renewable forest resources (fruits, medicinal, etc.);

• Identification of forest areas for recreation, determine the amount of pressure, the identification and use of the potential of tourism-oriented recreation;

• Planting of fast-growing trees on farms to reduce the shortage in forest products;

• Design and planting of forests and gardens that meets the needs of a new agricultural system;

• Establishment of specialized operational chemical-fire stations in order to prevent forest fires;

• Identification of phytosanitary conditions of forests, implementation of appropriate measures on a regular basis in order to prevent various diseases and pests;

• Establishment of forest protected areas in order to protect the agricultural land from water erosion, drought and dry winds.

5.4.4. Coastal areas

The length of the Caspian Sea coastline in Azerbaijan sector is 850 kilometers. Ten administrative regions are located on the coastal areas (including Absheron peninsula) and population size has reached to 4 million. The country's largest cities - Baku, Sumgayit and 75% of industrial resources and infrastructure of the country is located in the area of Caspian Sea.

Figure 5.4-4 Geographical state of Caspian Sea

The Caspian Sea is a complex system of mutual influence of geological, hydroclimatic, anthropogenic, and space factors. In order to study the nature of sea level fluctuations and to give long-term scientific prognosis it is necessary to consider the joint influence of these processes. However, a solution to the problem is quite complicated. In this case, the identification of factor influencing the sea level should be done and the work in it should be started. We should mention here that the main role of climate conditions have been identified among many researchers. Therefore, we have to examine the extent of climate impact on Caspian Sea level, because this will help to prepare to the long-term changes as forecasted.

The climate impacts the Caspian Sea levels through the rivers flowing into the sea, precipitation, and surface evaporation processes. The hydro climatic factors that affect the level of the Caspian Sea are as follows:

- Climate factors – 85%
- Tectonic factors – 10%
- Anthropogenic factors – 3%

Adaptation measures suggested for coastal zones:

I. Special mode boundaries of economic activities should be identified by the government for the flooded areas:

a) The first zone - covering regions that go from -29.0 m till current shoreline areas that are under water;

b) The second zone – covers the areas from modern shoreline till -26.0 m areas that are formed as a result of high winds. These are areas of short-term and permanent rising of ground water levels;

c) The third zone - covers the areas that can stay under water if the level reaches -25.0 m and groundwater level increases.

II. Two-staged approach for the solution of problems relating to the changes in the level of the Caspian Sea should be used. The firs scenario assumes that the water levels will increase till -25.0

m. Protection measures should be implemented to protect the areas from water pressing and avoid the increase of groundwater level. In the second case, if the level will pass -25.0 m height, regulation of level issue is resolved with the consent and active participation of Caspian countries. The analysis of different climate scenarios for Caspian Sea level fluctuations.

Specific surfaces of the Caspian Sea	Scenarios
Maximum (-20,0 m exact)	The highest level in history, recorded 2,600 years ago. According to the average level its anomaly is +7 meters, its provision is 0.38%, and the iteration is 1-2 times in 2,600 years. Sea area is 472,200 km^2, its anomaly is +85.6 thousand km^2. Extreme climatic conditions with prevailing high humidity. Transport of air masses from the west. Cloudiness is very high. Produces the max amount of precipitation. There is a decrease in sea evaporation. Prevalence of river floods. Amu-Darya waters can flow into Caspian Sea. Qara-Boghaz-Gol and Krasnovodsk bays become a part of the sea.
Maximum (-25,0 m exact)	The maximum level during the period of instrumental observations was recorded in 1882. Its anomaly is +2 meters, provision is 33.25%, and iteration occurred 15 times in 60 years. Sea area is 414,700 the anomaly is -21,1 thousand km^2. Decrease in the temperature of the sea and air. The winds from west predominate, increase in river water, evaporation and reduction in sea levels. The flow into Qara-Boghaz-Gol increases.
Middle (-27m exact)	This level was observed in 1937 and 1992, during the instrumental observation period. Its provision is 45, 38%, iteration is 110 years. Average area of the Sea is 392,600 km^2. Transitional period. Changes in atmospheric circulation processes will possible occur. The water level of the river is close to its long-term average.
Minimum (-29 m exact)	Minimum level in the period of instrumental observation and it was observed in 1977. Anomaly is -2 meters. Its provision is 65.77% and it iteration is 20 times. Sea area decreases to 357,000 km^2. Air and sea temperature is high. The weakening of the western air masses. Cyclones and humidity decreases in the basin. Reduced water basin of the Volga and Ural rivers. Increase in the waters of the Caucasus coast rivers. The flow into Qara-Boghaz-Gol decreases.
Lowest (-34 m exact)	Recorded around 2,250 and 1,420 years ago. The average value anomaly is +7 meters, provision is 99.62% of supply. The sea area is reduced by 293,300 km^2, its anomaly is 99,300 km^2. It presents a high degree of drought and extreme hot climate conditions. Meridional flow dominates the air masses. Underdeveloped cloudiness. Cyclones and river waters are decreased. Evaporation from the surface of the sea increased. **-Boghaz-Qol**, a shallow lagoon located east of the Caspian Sea, could turn into a lake, due to the fact that waters of the Caspian sea are not flowing, there is also the possibility that the sea will dry.

Table 5.4-3. Assessment of forecasted changes of hydro-climatic conditions and levels

Studies carried out shows the impossibility of 100% forecast of the future change of the Caspian Sea level. Thus, the main reason for the change in sea level is the hydro-climate factor, climate forecast is the same issue. As it is known, the scientists did not solve the problem. Therefore, the scientist refuse to provide an accurate long-term forecast of sea level and identify the change level. There are a number of Caspian Sea level forecasts in the literature. Some of them predicted the decrease in the sea level by -31.0 meters or even -32.0 meters. These forecasts were given in the 1960-1970 and were not confirmed. According to other forecasts the level will increase to -25.0 meters in the next 5-10 years. Such forecasts were given in the 1980 in the period of intensive rise level. These forecasts did not come true and in 1996 the increase in sea level stopped.

Based on available materials and forecasts, as well as taking into account the factors of rise and fall of sea level the upper and lower sea-level recommendations were given to design of hydraulic structures.

Upper line: -26.0 m. Numerous factors give little opportunity to exceed this limit. Currently the amount of water taken from the rivers of the Caspian basin reaches 60 km_3. This amount is approximately equal to 10 centimeters of the water layer thickness, price is artificially kept up every year as a result of human activity. This means that if the rivers of the Caspian Sea, with plenty of water resources, will remain like this for a long time, -26.0 m level are unlikely to be excessive. This situation has now been confirmed in practice. Although the rivers flowing into the Caspian Sea were abundant during the last 20 years (since 1978), the level did not exceed the value of 26.5 meters. The idea of the authors that at the end of the 20th century and beginning of 21st century the value level will increase is not correct.

In addition, in the period of level increase of 26.0 meters, the low-lying flat areas in the Eastern and Northern coast of the Caspian Sea will be covered by water. These areas are shallow, so intensive evaporation will occur. It is estimated that 25 km_3 of water per year will evaporat and it is still the 6-7 centimeters layer of water per year. The above mentioned considerations and the probability and statistical calculations show that the probability of increasing the level of -26.0 meters is 0.1%. In any case, it should be kept in mind that, currently, the value level is around -27.0 meters, i.e., it is 1 meter below than -26.0 meters. Taking into account this fact, all the calculations and explanations, the probability of increasing the value level from -26.0 meters until 2030 is 0,1-0,3%.

Lowest line: -30.0 m. According to specialists from Russian Hydrometeorogical Center (Sidorenkov and others, 1996) at the beginning of the 80s era of atmospheric processes that create an enormous amount of cyclones started in the Caspian Sea basin. This situation will continue for a minimum of 30 years. At the same time, a fall in level to -29.0 meters and even more decreases the amount of evaporated water and the surface area. The probability of decrease in water level to -30.0 meters in the next 30-40 years will be 0.1-0.3%, though the amount of water taken from the Caspian Sea rivers is high (60 km^3/year).

In order to prevent this, the implementation of adaptation measures is recommended to be held in the areas of flood threat:

c) The coastal zone is not allowed to carry out major construction projects, the existing economic activity areas should be restricted. The construction of complex and expensive defense systems can be justified only for available important objects.

d) The two main areas of adaptation measures in the coastal zone during the current rise in sea level are the following:

- Resettlement of industrial, recreational and other facilities to the safe areas;
- Construction of protection devices in the coastal zone. In this case, objects or the whole area should be protected. The most economically advantageous way is to establish local protection facilities for settlements.

3. The concept of engineering protection of the coastal zone should be based on following principles:

- All protection measures should “prevent maximum damage with lower costs” and these security installations and structures must be highly durable and reliable;
- Protection measures should be complex, and provide protection from waste materials from the sea.

In 2012 several technologies were assessed and four priority technologies for the water sector were identified.

1) Rainwater Collection from Ground Surfaces - Small Reservoirs and Micro-catchments
2) Flood warnings
3) Water reclamation and reuse
4) Reduce water leakages in water management facilities

5.4.5 Human Health

The population of the Republic of Azerbaijan suffers mostly from respiratory diseases, circulatory system, infectious diseases, and parasitic diseases. Diseases of the circulatory system in the last 20 years have grown while infectious and parasitic diseases have steadily decreased.

The diseases of the circulatory system are on the first place among the main causes of death cases in the country, and therefore the number of deaths is steadily increasing. The death cases because of neoplasms are on second place.

Impact of hot weather on the population: Last decades temperatures signigicantly higher than normal has been observed during the summer months in major cities. Positive temperature anomalies are dominated (Table 5.5-1). According to the long-term meteorological observations it is normal to observe temperatures of 30-32^0 C during the daytime during the months of July and August in Baku. The local population has adapted to such conditions. However in recent years during the long term abnormal summer heat, the process of adaptation becomes difficult, and complications arise. The research show, that the strong heat replication and its continuance is significantly increased in comparison with the length of the base period.

Years	Difference, ^{0}C		
	June	July	August
2004	**- 0,4**	**-1,8**	**+1,1**
2005	**-0.7**	**+0.8**	**+1.0**
2006	**+2.4**	**+0.3**	**+3.1**
2007	**+0.6**	**-1.0**	**+2.2**
2008	**-0.1**	**+0.1**	**+1.8**
2009	**+1.1**	**+0.6**	**-1.6**
2010	**+2.9**	**+3.1**	**+3.2**

Table 5.4.5-1 Difference in values of the average monthly temperature compared with base years (1961-1990) during summer months in Baku

Thus, in 1961-1990 the average number of days with a maximum temperature of 35^0 C and even higher was 3, during 2001-2010 the number of such days increased 5 times and became 16.

In 2010, during the summer season, the number of days with temperatures of 35^{0}C and above in Baku was 44, 160 registered cases of sunstroke and 48 hospitalizations occurred despite the warnings and precautions.

There is a direct connection between the increases in the average temperature in the summer months with a strong increase in the number of hot days. According to all models a strong rise in summer temperatures and number of hot days are expected in the future. As a result, the direct impact of heat waves on human health, especially in the big cities, will increase. According to forecasts, the “Heat Island effect”, by 2050, will have a negative impact in people aged over 65 years, and also will be exacerbated due to the increase of the population in big cities.

However, some measures can reduce some of the negative effects, and prevent some of them. Rapid greening of the city, establishment of green areas in Baku and its surroundings, will reduce the gap between the microclimate to 1.50. People can protect themselves and others from sun-

stroke by establishing a proper daily regime. The development of appropriate adaptation measures along with the importance of learning of an assessment of the impact of high temperature days on public health should be carried out.

The following adaptation measures for implementation are recommended:

- Improvement of medical-meteorological warning systems for heat waves, including increase in the period of advanced warnings about future risks;
- Building design and construction should take into account the expected climate change, take into account the effect of "Urban heat islands" during the construction of residential and public buildings, and urban planning;
- Rapid greening of cities and creation of green areas around the city;
- Establishment of ventilation air systems in buildings;
- Establishment of air ventilation systems for public transport in the city;
- Take into account the increase of summer heat waves during the establishment of bus stops throughout the city;
- Establishing a surveillance system for individuals at-risk, based on census data, in collaboration with social services, etc.;
- Public campaigns including the organization of TV programs and interviews with specialists to guide the public on how to respond to the changing weather conditions during these periods (e.g. daily regime, activity levels, nutrition, clothing, etc.);
- Educating the population about first aid help in the case of sunstroke.

Climate change and malaria disease: Infectious diseases are prevalent in Azerbaijan and one of the priorities areas in the health sector. Fight with infectious diseases is one of the priority areas of the health sector in Azerbaijan. Among the main causes of death infectious and parasitic diseases hold one of the most important places. As a result of the measures realized in the last 15 years the continuous reduction of infectious diseases, revocation of some of them has been achieved in practice. Purposeful measures combating infectious diseases show positive results. The three-day outbreak of malaria in 1990s was prevented and the situation in the country was stabilized as a result of realization of the National Malaria Control Programme in 2005-2009 and National Strategy for Malaria Elimination in the Republic of Azerbaijan in 2008-2013.

The success of the National Strategy for the Elimination of Malaria in the country has sharply reduced the number of patients, and the epidemiological situation was stabilized. As a result of measures directed towards the full elimination of three-day malaria, in 2013, for the first time, no malaria case was registered (Figure 5.5-1) .

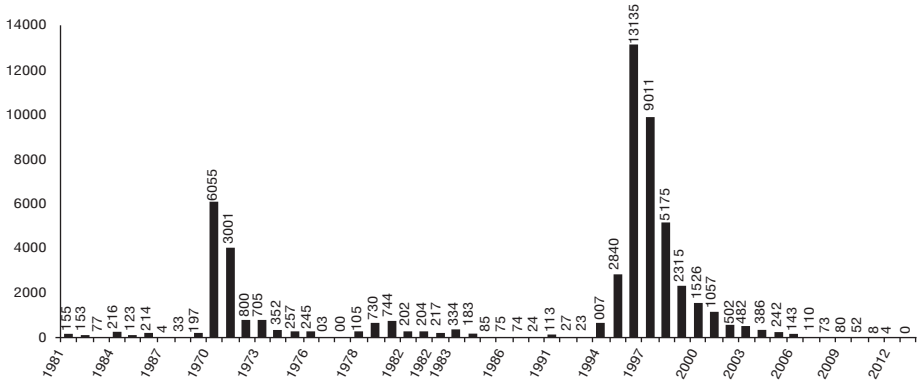


Figure 5.4.5-2. Number of patients with the first time malaria disease (State Statistics Committee –www.stat.gov.az)

Identification of climate conditions that create the disease and malaria period, assessment of climate change impacts are also important for maintaining and strengthening the achievements of the fight against malaria along with implementation of the long-term complex measures. Taking into account the importance of epidemiological conditions and assessments in the malaria period and calculation of its individual elements. Evaluation of climate change impacts were done based on information from meteorological stations located throughout the country. In various natural landscapes favorable temperature period for the three-day malaria disease was observed based on information received during 1961-1990 and 1991-2010.

For this purpose, the dates when average daily temperature was over 16° C (for three-day malaria) and the duration of that period have been identified (Table 5.5-2). Analysis of the data shows that the favorable temperature for malaria disease is observed at altitudes where there was no such temperature in the base period (1961-1990), in some areas of epidemic zone such conditions are met every year. The continuance of epidemic period in the Kura-Araz lowland increased to 12 days in 1991-2010, the long period is also observed in the mountains. Thus, the duration of effective temperature of 16 ° C in Gadabay in the base period was 61 days, in 1991-2010 the number of days increased to 82 days.

Station	Altitude above sea level, m	1961-1990			1991-2010			The difference in duration of effective temperature period in 1961-1990 and 1991-2010
		Start Date	End Date	Duration	Start Date	End Date	Duration	
Mashtaga	27	11.05	13.10	156	07.05	17.10	164	8
Guba	550	23.05	18.09	119	19.05	25.09	130	11
Shaki	639	11.05	30.09	143	10.05	05.10	148	5
Ganja	312	03.05	10.10	161	01.05	16.10	169	8
Gadabay	1480	28.06	27.08	61	19.06	08.09	82	21
Nakhchivan	875	06.05	03.10	151	03.05	12.10	163	12
Lankaran	37	06.05	13.10	161	04.05	18.10	168	7
Yardımlı	730	16.05	26.09	134	15.05	29.09	138	4
Zardab	-5	26.04	13.10	171	23.04	18.10	179	8
Salyan	-21	30.04	15.10	169	27.04	22.10	179	10

Table 5.4.5-3. The days with average daily temperature of 16 ° C in spring and autumn and the duration of effective temperature period (days)

A warming of the climate in the future is expected according to all above-mentioned models. The possible duration of malaria was assessed according to the average indicators of temperature in 2040-2059 based on CGCM3.1, CSIRO MK3.5, UKMO HadCM3 models. According to all three models the increase in duration of highly effective temperatures that are more than 16°C will extend, also the difference in comparison with the base period will be observed in the mountain with an increase in altitude. Thus, the effective temperature duration in the lowland areas for three-day malaria is 17-22 days according to CGCM 3.1 model, 16-20 days according to CSIRO MK3.5 model, 20-24 days according to UKMO HadCM3 model, in the mountain areas 21-29 days, 21-32 days, 24-49 days, 30-65 days, 31-63 days.

Thus, it is possible to maintain progress made towards the elimination of the disease by implementation of adaptation measures, though Azerbaijan historically was a malaria-risk area, especially the probability of increase of sensitivity is high in the mountainous areas. The implementation of

following adaptation measures is recommended:

- Improvement of malaria control measures operating system and programs on constant surveillance, prevention, and control programs;
- Forecast of epidemic cases; improvement of early warning systems in a case of epidemics;
- Continuation of eucalyptus trees planting in order to eliminate permanent and temporary water moor places or reduce their area;
- Continuation of implementation of hydraulic measures in order to eliminate permanent and temporary water moor places or reduce their area;
- Organization of health awareness events (lectures, conversations) for the prevention of malaria cases in the cities and regions of the country;
- Realization of measures designed to prevent malaria brought into the country;
- Coordination and information exchange in preventive measures against malaria with the neighboring countries.

5.4.6 Tourism

Tourism sector is an activity whose effects are distributed in many economic sectors, such as transport, accommodation and agriculture[9]. Tourism is also characterized by both the significance of its contribution to GHG emissions and its substantial economic importance, and overall for his close dependence on weather- climate conditions.

Azerbaijan is located in the region with unique geographical and climatic characteristics.

The country has a beautiful landscape, from vast steppes to high mountain ranges and amazing forest. Azerbaijan is home to very unique fauna and flora and the tourism sector has great potential. Azerbaijan became famous all over the world for its amazing beauty, rich natural resources, flora, and fauna. 4,500 species of plants referring to 125 families and 930 generas and species are spread in the country. Azerbaijan also has a good number of mineral water deposits.

It should be noted that before the establishment of the MENR, National Parks did not exist in Azerbaijan. Since 2003 the Ministry of Ecology and Natural Resources established Ordubad National Park named by Hasan Aliyev, Shirvan. Aghgol National Parks, in 2004 Hirkan and Altiaghaj National Parks were established, 2005 – Absheron, 2006 – Shahdagh, 2008 – Goygol National Park. In 2008 the territory of Hirkan National Park was expanded and covered 40358 hectares. On November 25, 2009 by decree of the President of the Republic of Azerbaijan the territory of Ordubad National Park was expanded at the expense of Shakhbuz State Nature Reserve, Julfa, Ordubad regions and covered 42797,4 hectares. By the same order the name of National Park was changed and became the Zangezur National Park named by Hasan Aliyev. According to the order of the Cabinet of Ministers of the Republic of Azerbaijan dated July 8, 2010 the territory of Shahdagh National Park was expanded from 14613,1 hectares to 130508,1 hectares. By the Order of the President of the Republic of Azerbaijan dated November 5, 2012 Samur-Yalama National Park was established at the expense of 11772,45 hectares of forest land from Forest Protection and Restoration Institution.

At present national parks cover 3.7% of territory of the country. There are plans for opening new national parks and natural reserves and also expansion of existing one such as Gizilaghaj state natural reserve.

State Natural Reserves are organized on the lands of landowners, leasers, and users in accordance

[9] *UNWTO-UNEP.2008 Climate Change and Tourism – Responding to Global Challenges. http://sdt.unwto.org/sites/all/files/docpdf/climate2008.pdf*

with legislation. The protection and restoration of natural complexes here is carried out by the Ministry of Ecology and Natural Resources. State nature reserves are areas of special importance for the protection or restoration of natural systems and their components as well as for the maintenance of ecological balance.

The first reserve in Azerbaijan was established in 1961. The process of reserves establishment continued until 1993. Since 2003 the establishment of reserves started again and in 2003 – Gakh, in 2005 – Arazboyu and Hirkan, in 2008 – Zaqatala, in 2009 – Arpachay and Rvavud State Nature Reserves were established.

There are about 450 lakes in Azerbaijan. Goygol surrounded by wooded mountains located at the foot of the Kapaz Mountain at an altitude of 1,556 meters above sea level. The Caspian Sea is the largest lake in the world (water surface is 378,400 km_2), its origin is unique and has rich biodiversity. 1,332 species of marine fauna including sturgeon, bream, herring and etc. are found there. Many seals the only mammals in the Caspian Sea are protected by the state. Absheron National Park was established in order to increase their population.

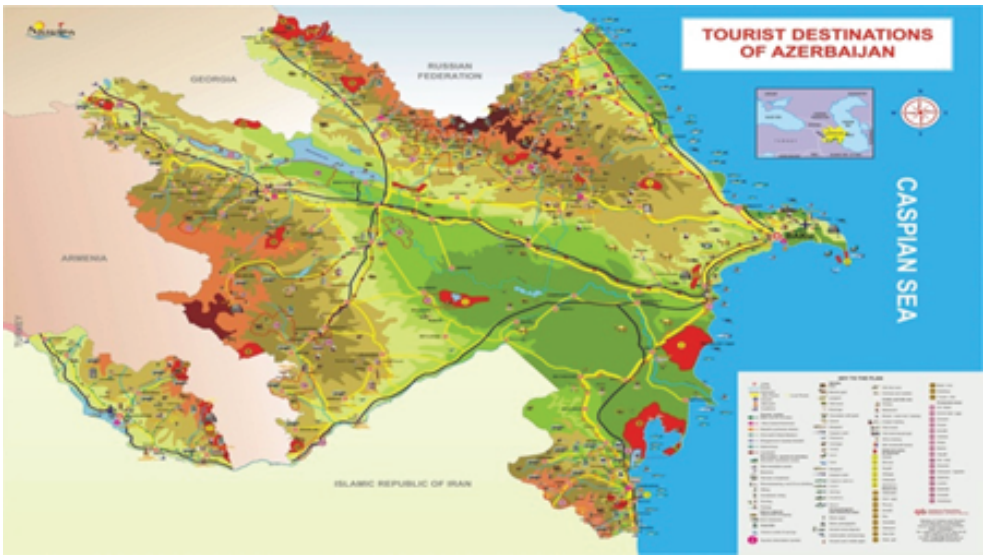


Figure 5.4.6-1. Tourism map of Azerbaijan (Ministry of Culture and Tourism- www.mtc.gov.az)

Naftalan oil, found in Naftalan, Azerbaijan, is known for its healing properties is widely used in the treatment of various diseases. Mineral waters such as Kalbajar-Lachin, Badamly, Sirab, and Vaykhir mineral waters from Nakhchivan became famous outside the region. In other words, there are ample opportunities for the development of tourism in Azerbaijan.

Ecological tourism: National parks that can contribute to the development of ecological tourism in Azerbaijan are also available. Currently the total area of Specially Protected Natural Areas is 890 thousand hectares, including 9 National Parks, 11 State Nature Reserves, and 24 State Nature Sanctuary. Charming waterfalls are located in Lerik and Yardimli, Goygol lake is located in Ganja and Batabat lake in Nakhchivan AR. Plant species in Azerbaijan cover the 0.84% of the world's plant species, and 66% of the Caucasus plant species. The number of endemic species growing in the territory of Azerbaijan are more than 370. Endemic plant species constitute about 9% of the country's flora. Flora of Azerbaijan is rich with relict (residual) plants of the Tertiary. Their ultimate abode is the Talish Mountains, although some species can be found in other areas of the country (Greater Caucasus, Jeyranchol etc.). The iron tree, chestnut oak-leaf, Lankaran acacia, yew, box-

tree, Caucasian persimmon, Eldar pine and others can be an example. Nearly 20 fauna species are available in the country. Azerbaijan has a diversity of natural environment in Azerbaijan and a vast richness of wildlife. There are more than 600 animal species in Azerbaijan, which is 5.6% of the world's animal species. It is possible to characterize a few zoogeographical regions. Fauna of the dry lowlands are characterized with a majority rodent and reptile species. It is possible to see a Central Asian gazelle or jeyran on the plains. Over 200 species of birds gather in winter in Gizilaghaj reserve, Lankaran lowland wet forests and moors, and it means a combination of more than one million birds during the migration. Fauna of Greater and Lesser Caucasus is also rich. Nocturnal birds can be found everywhere in the foothills. Local aurochs and mountain goats are found in the meadows of Greater Caucasus Mountains. Wild rams and goats can be found in the Lesser Caucasus Mountains. The bearded vulture and jackals inhabit the mountain meadows. Leopards from Iran and porcupine differ the ones from the Talish Mountains. The Caspian Sea is also rich with marine life. Such types of fishes as herring, Caspian salmon, sturgeon, white sturgeon and kutum are caught here. 23 out of 50 species of fish in the Kura River have a commercial importance. Very rare Zander fish can be found on the shoreline. During their migration South in March and April it is possible to observe seals. They come back to the north in October and November. In order to protect rare and valuable plants, fish, and wildlife species the reserves were established. More than 100 species of animals have been included in the "Red Book".

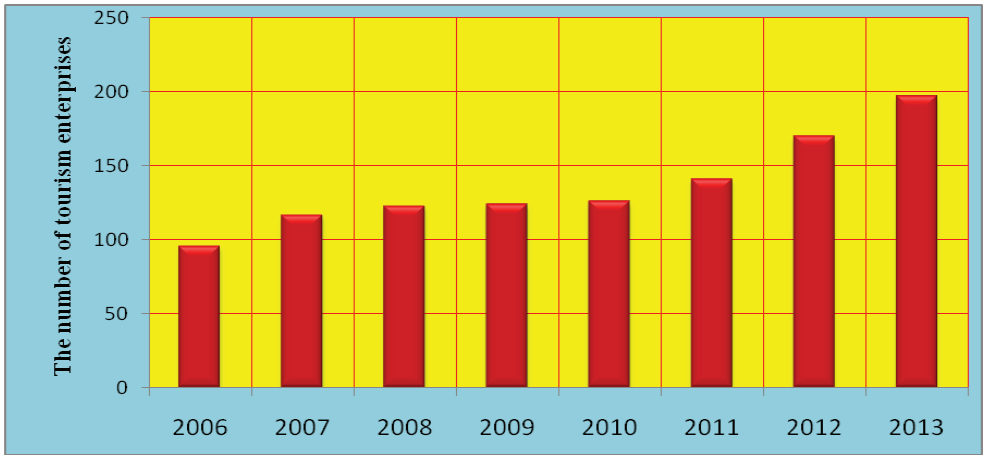


Figure 5.4.6-2 Numbers of tourism enterprises

Tourist areas in river basins: More than 8,350 large and small rivers are available in Azerbaijan. 850 of them have lengths of more than 10 kilometers, 24 of them have lengths of more than 100 kilometers.

Kura and Araz rivers are ones of the biggest rivers of Azerbaijan and the Caucasus. The length of Kura River on the territory of Azerbaijan is 906 kilometers and it passes through Gazakh, Tovuz, Mingachavir, Yevlax, Sabirabad, Shirvan and Salyan regions. Kura River is the only navigable river. The Araz River's origin begins in Turkey and is connected with the Kura River in Sabirabad region. The length is 1,072 kilometers.

Samur River is the largest river in the Northeast. The length of the Samur River is 216 kilometers and begins on the territory of Dagestan. Samur River flows through the popular tourist areas in Azerbaijan.

Tourism regions located in the forest surrounding areas: Vast forest areas are on the south and the Northeastern slope of the Greater Caucasus mountain range. These forests begin in Azerbaijan and extend to the border of Dagestan. Forests in the Northeastern part of Gusar, Guba, Devechi, Siyazan and

Khizi cover an area in the direction to the Southwest of the region. Tourism capacity of these regions was developed, a variety of tourism services are offered to domestic and foreign tourists in the region.
Reforestation is taken place in the Shamakhi region of the Greater Caucasus this is helping to stabilize the mountain slopes that extends to the border with Georgia. Forests here mostly cover the mountainous parts of Ismayilli, Oghuz, Shaki, Gakh, and Balakani regions. The region is very attractive due to the range of tourism services and a well-developed tourism infrastructure.
One of the vast forested areas is on the slopes of the Lesser Caucasus Mountains. The main mountain forests are located on the branches in the Northern, Northeastern and Eastern slopes. The forest tract is only interrupted in the South Karabakh. Tourism capacity is less developed in these regions, there is a need in establishment of modern tourist facilities.
One of the vast forest tracts covers the Talish mountain slopes. Forests are spread through the Astara, Lankaran, Lerik, Masalli, Yardimli, Jalilabad, and Bilasuvar regions. The region has a well-developed infrastructure and services to cover the needs of tourists visiting the area.
A little part of forests also cover the lower part of the Kura and Araz rivers and stretches along in the form of an array-type. The area has a wide range of tourism possibilities, but the infrastructure is still underdeveloped.
The impact of climate change on the tourism sector. In recent years an increasing number of natural disasters has taken place in the world. Global climate change seems to be increasing the number of natural disasters (floods, strong winds, hurricane, hail, drought, forest fires, sea level fluctuations etc.). This has a negative impact on the individual countries and world economy as a whole, unfortunately, sometimes it has caused human casualties.

- During the summer months due to a sharp temperature increase and little precipitation some mountain rivers, waterfalls, and small lakes dry up, forest fires occur; this has an impact on the tourism sector.
- Heavy rains after the long drought cause flooding in the river basins of rivers. As a result a big damage to infrastructure is caused.
- There might be a shortage in drinking water and the amount of water will decrease 1.5 times in 2011-2040 and will be 650 m_3, 1.75 times in 2041-2070 and will be 575 m_3, 2 times in 2070-2100 and will be 500 m_3.
- Thus, it is possible to maintain progress made towards the elimination of the disease by implementation of adaptation measures, though Azerbaijan historically was a malaria-risk area, the probability of increase of sensitivity is high, especially in the mountainous areas.
- According to the climate scenarios an increase in temperature and a decrease in precipitation will have a significant impact on the adaptation of rural agriculture.
- Irrigation of agricultural crops is one of the key factors in the formation of the product. The sensitivity of this factor to climate change may play an important role in the loss of the product. In the light of increasing temperatures the increase in evaporation losses will lead to water shortages.
- As a result of intensive evaporation in the unsaturated zones mineral groundwater movement is activated; this will be observed by the salinization of soil, its degradation in the future and by a decrease in productivity.
- The increase in number of high-temperature drought days will lead to the decline in the amount of irrigated crops, or even its complete destruction in some areas.
- Considering everything mentioned the impact of climate change will lead to future declines in agricultural production.

• Azerbaijan is included in the area of the world with the highest number of floods. The more intensive formation of flood incidents occurs in the Greater and Lesser Caucasus mountain systems, which cover nearly half the country's territory.

• The expected climate change will increase the repetition of flood incidents in the future and will create serious difficulties for the tourism sector. Floods can cause serious damage to tourist facilities and infrastructure.

• The length of the Caspian Sea coastline in Azerbaijan is 850 kilometers. Ten administrative regions, including Absheron Peninsula, are located on the sea coast and the majority of the tourism infrastructure is also located here. The large areas in the Eastern coast of the Caspian Sea could be flooded due to sea level rise. The tourism sector will be under threat, because many tourist's facilities and services are located here.

• Climate change will also affect forests and biodiversity. If the temperature increases by an average of 1.5-2.5 ^{0} C, 20% of animal and plant species will be in danger of extinction. As a result of the predicted increase of temperature, the number of forest fires will also increase. This will affect tourism infrastructure in the forest surrounding regions, and it will decrease the resilience of the tourism sector.

• Winter tourism activities depend on climate and weather conditions. This type of tourism could face serious problems because of changes on the length of the season, and because of reduction in snow precipitation. In other words, the normal functioning of this type of tourism needs adequate amounts of snow. In order to be involved in winter sports the snow cover thickness should be between 20-30 centimeters. Expected increase in temperature and decrease in precipitation will have a negative impact on winter tourism.

Adaptation measures: Serious and substantial changes are necessary in the tourism industry. The implementation of preventive measures is essential to determine the location of tourism facilities and infrastructure, its construction should take into account risks such as floods, landslides, droughts, avalanches, forest fires, and changes in water levels, etc.). The warning systems on expected extreme hydro-meteorological events need improvement.

However changes should begin with/include all members of the community from Individual tourism industry, associations and businesses and also individual regions and its population.

CHAPTER 6. OTHER INFORMATION

6.1 Activities related to climate change

The first step the Republic of Azerbaijan has taken to meet its commitment to the Convention was to completed in May of 2000, the "First National Communication to the Conference of Parties" The First National Communication (referred as Initial National Communication -INC) of Azerbaijan Republic was prepared by the National Climate Change Center established under the State Committee on Hydrometeorology of Azerbaijan Republic and within the UNDP/GEF project of technical assistance to developing countries.

The INC presented national greenhouse gas emissions inventory for the period from 1990-1994, and also included: a vulnerability assessment; identification of mitigation options to reduce negative effects of climate change on ecosystems and different sectors of the economy.

In 2000-2001 the country received additional funds to continue the job started during the INC and implemented the II phase of the "First National Communication," the report of the activities were published as "Capacity Improvement Activities on Climate Change in Priority Sectors of Economy of Azerbaijan II Phase of First National Communication to the Conference of Parties. This report aimed at providing a solution for the following:

- Identifying technology needs for capacity improvement in the priority sectors of Azerbaijan economy; study of technology acquisition and opportunities; assessment and preparation of projects
- Developing capacity for participation at the Systematical Observations Network
- Implementing additional research on vulnerability and adaptation of fish resources and desertification processes to climate change.

The second step undertaken by Republic of Azerbaijan to meet its commitment under the Article 4 and Article 12 of the Convention was to prepare the "Second National Communication to the Conference of Parties," the report was submitted in 2006.

In the framework of the "Second National Communication to the Conference of Parties" and in accordance with the regional model 'PRECIS' proposed by British Hadley Meteorological Center, the climate change sceneries were developed. From 1990 to 2005 using the IPCC Good Practice Guidance, the GHG inventory was carried out.

During the last years the Government of Azerbaijan has adopted a few important programs related with GHG mitigation, among them are:

- Governmental program on using alternative and renewable sources of energy;
- National program on regeneration and forestry development;
- Sustainable development program from an ecological point of view;
- Governmental program on hydrometeorology development.

From 2003 to 2004 the Canadian International Development Agency helped train the experts and trainers on CDM. Four demonstration projects were implemented. With the support of French Government the project "Forests planting on Kura-Araks lowland by irrigation" was implemented. The project "Technical support to the countries of Caucasus and Moldova to meet its commitments in the field of climate change" was implemented through the TASIS program of the European Commission. In 2004-2006 by the financial support of GEF the regional project "Creation of the potential on increasing of the quality of GHG inventory for the countries of Eastern Europe and FSU Countries" was implemented. The Norwegian Government helped Azerbaijan with develop procedures concerning a Clean Development Mechanism (CDM).

In 2012 the country implemented the Technology Needs Assessment project, funded by the Glob-

al Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) and the UNEP-Risoe Centre (URC) in collaboration with the Asian Institute for Technology (AIT), for the benefit of the participating countries.
Currently, to show the commitment of the national government of Azerbaijan to the reduction of GHG emissions, a project called Nationally Appropriate Mitigation Actions (NAMAs) for low- carbon, is going to be implemented by the Azerbaijani Oil Company-SOCAR.

6.2 Climate change research and systematic observation

6.2.1 Hydrometeorological network and systematic observation

Complex meteorological observations are carried out at 63 stations every three hours, while limited meteorological observations are carried out at 75 stations. Observations for water level and temperature are carried out twice in the morning and in the evening and observations for water consumption are carried out once a week at 103 hydrological points (87 of them are located in the rivers, five in the lakes and nine in the water basins). Sea hydro-meteorological observations are carried out at four stations and nine points on the western shore of the Caspian Sea and its Azerbaijan water area islands four times a day. These observations have been carried out for sea level, waving regime, water temperature, salinity, color, transparency and sea flows. Agro-meteorological observations have been carried out at 14 points for agro-meteorology. The observations for atmospheric air pollution are carried out in seven cities (three times a day). Water sample taking from 30 hydrological stations is given to the laboratories to be investigated its chemical composition.
Observation data is transferred to the Department for operative data plan. Observation data of 63 stations are recorded in the bulletins after receiving it at the Forecasts Bureau and are used in daily reviews and forecasts after being reviewed. Hydrological, agro-meteorological and other observation materials are operatively used in the proper manner. The part of observation data is transferred for the purpose of international broadcasting according to the catalogues approved by the World Meteorological Organization; therefore the international commitments of the Republic of Azerbaijan are implemented based on WMO Convention. Synoptic information taken from seven meteorological stations are transferred to the international broadcasting every three hours, while information taken from 17 stations are transferred to the regional broadcasting through international cooperation according to the commitments arising from Conventions. Information related to Astara station, operative and regime information included into Global Climate Observation System are presented for exchange.
For the purpose of increase the staff's capacity regarding the calibrating of Automated Meteorological Stations (AMS), two experts have taken courses in China and Turkey. Turkey has agreed to carry out calibrating the sensors of the AMS. On September 25, in 2013, a meeting was held with the representatives of a Finnish company-Vaisala, the technical condition of the AMS was discussed and they recommended that the sensors of stations should be replaced in five years.
Technical service activities are regularly carried out to provide integrity of views at five video view stations (Shahduzu, Kabosh, Laza, Kura-Neftchala, and Kish) under operation.
Five scientific-research activities of the Department under four areas are being continued, according to the working plan approved at the Hydro-meteorological Scientific-Research Institute. The complex has carried out meteorological observations in Merkez, Kabash and Tufandaghi, as well as hydrological observations and line snow measurement activities at the Shahnabad, and Mahmuddere Rivers according to the working and observation plan approved during reporting period within Hydrometeorology Scientific- Research Institute.

6.2.2 Observation network

The observation network includes the following facilities:

1. Number of meteorological stations 80
2. Number of radiological stations 4
3. Number of agro-meteorological stations 14
4. Number of meteorological posts 23
5. Number of sea posts 9
6. Number of Hydrological posts 103
7. Number of laboratories 8
8. Number of agrological stations 1
9. Number of automated meteorological station..... 31
   (Only eight of them are still in operation)

6.3 Information on education, training and public awareness

Activities in education, training and public awareness are carried out through the goverenment and private sector.

The country's public education system includes environmental subjects in middle and high school programs. Specialists in climate studies and scientific basics of climate change are educated at the Geography department of the Baku State University. Environmental protection programs are also offered at other universities and institutes, particularly at technical universities and institutes.

Discussion of climate change issues in higher international forums has raised the interest on the topic in Azerbaijan. Climate change issues are addressed in nearly all mass media, and MENR specialists and NGOs representatives have solicited ideas and proposals from the public to address the problem. Climate change specialists have participated in events organized by international organizations, televised meetings, and made speeches at schools on the subject.

With the help of non-governmental organizations, climate change awareness raising campaigns were implemented in rural communities within the framework of projects, such as protection and sustainable use of agro bio-difference and struggling with desertification in arid and semi-arid zones of Southern Caucasus for adaptation to climate change. Training courses have been organized in Azerbaijan in 2011-2012 by the German Development Agency (GIZ) in order to strengthen the capacity for adaptation to Climate Change.

Programs for informing the general population on utilization of alternative energy are carried out with the support of NGO Contribution Funds.

The International Dialogue on Environmental Action (IDEA) was established in 2011 for the expansion of youth participation related to environmental protection and climate change and is currently active. Azerbaijan's volunteer group 'Public Union - Education and Monitoring' prepared a booklet on "Climate Change and Rules for the Utilization of Alternative Energy" with the help of Ministry experts. The group also held public meetings in Sumgayit and other districts of the Republic on the booklet topic.

The State Agency on Alternative and Renewable Energy Sources, SAARES (Azerbaijani: ABEMDA) is a governmental agency under the Ministry of Energy and mandated by the Cabinet of Ministers. It serves as the principal regulatory institution in the field of alternative and renewable energy in the Republic of Azerbaijan. SAARES and alternative energy facilities hold regular meetings with public representatives, students and youth, as well as, experts from different organizations and other interested parties.

Climate change news and information is regularly provided to all news web-sites and newsletters. Annual reports on climate change are available at: www.eco.gov.az.

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