Second Biennial Update Report of the Republic of Azerbaijan to UN Framework Convention on Climate Change

submitted in accordance with the decision no. 1/CP.16 of the Conference of Parties of UN Framework Convention on Climate Change

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ABBREVIATIONS

AFOLU	Agriculture, Forestry and Other Land Use
AZN	Azerbaijani manat (national currency)
CDM	Clean Development Mechanism
CJSC	Closed Joint Stock Company
EBRD	European Bank for Reconstruction and Development
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Global Environment Fund
GHG	Greenhouse Gases
GIZ	German International Cooperation Organization
GUAM	Georgia, Ukraine, Azerbaijan and Moldova
IEA	International Energy Agency
IPCC	Intergovernmental Panel for Climate Change
IPPU	Industrial Processes and Product Use
HPS	Hydropower Station
OJSC	Open Joint Stock Company
KfW	KfW German Development Bank
MENR	Ministry of Ecology and Natural Resources
MRV	Measurement, Reporting and Verification
NAP	National Action Plans
NC	National Communications
NGO	Non-governmental Organization
NMVOC	Non-methane Volatile Organic Compaund
OSCE	Organization for Security and Co-operation in Europe
SAARES	State Agency for Alternative and Renewable Energy Sources
SOCAR	State oil Company of Azerbaijan Republic
SSC	State Statistics Committee
TACCC	Tranparency Accuracy Completeness Comparability Consistency
TPS	Thermal Power Stations
UNFCCC	UN Framework Convention for Climate Change
UNDP	United Nations Development Program

INTRODUCTION

Global climate change is one of the most challenging environmental problems of mankind and its prevention requires joint activity and cooperation of all the countries in the world. The Republic of Azerbaijan supports international efforts towards mitigation of negative impacts of global climate change, carrying out appropriate measures in this field.

The Republic of Azerbaijan joined UN Framework Convention on Climate Change in 1995 and ratified Kyoto Protocol, an international agreement linked to the Convention, in 2000. In fact, Azerbaijan, A Party of Framework Convention on Climate Change and non-Annex-1 country, made commitments, such as developing, implementing and publishing national and regional programs aimed at reduction of possible impacts of global climate change. In addition, one of the commitments made by Azerbaijan under the Convention is to raise awareness about possible impacts of climate change and train scientific-technical personnel in this field.

Despite the fact that Azerbaijan, as one of Non-Annex 1 countries of the Convention, did not make commitments to reduce greenhouse gas emissions, several actions were taken towards climate change mitigation in the country. Such measures include use of renewable energy sources, application of more efficient technologies in energy sector, forestation, and minimization of fuel oil use in thermal power stations.

Doha Amendment to Kyoto Protocol was ratified by Milli Majlis (Parliament) of the Republic of Azerbaijan in April 14, 2015. Paris Agreement was signed in April, 2016 and ratified by Milli Majlis in October 28, 2016. In accordance with Paris Agreement, the Republic of Azerbaijan submitted Intended Nationally Determined Contributions to Convention Secretary in October, 2015 and contributed to the global climate change initiatives by setting the target to reduce greenhouse gas emissions by 35% by 2030, as compared to 1990, base year.

The Republic of Azerbaijan submitted First National Communication (2000), Second National Communication (2010), Third National Communication and First Biennial UpdateReport (2014) to the Convention Secretariat.

Azerbaijan's Second Biennial Update Report was developed in accordance with the recommendations and innovations made by the UN Framework Convention on Climate Change Conference of the Parties, as well as using experience of other projects implemented in the country. The aim of the report is to join the global integration process related to climate change and help to ensure the continuity of the institutional and technical capacity building process by pursuing national and sector-wide development policies.

The results of greenhouse gas inventory carried out thus far in the Republic of Azerbaijan were analyzed, the greenhouse gas emissions as of 2011-2012 were recalculated, while emissions inventory for 2013 was carried out for preparing this report. Furthermore, this report includes re-evaluation of emissions coefficients and uncertainties, analysis of the actions taken towards climate change mitigation, forecasts for the next years, analysis of the demands related to finance, technical assistance and capacity building, as well as the evaluation of existing status with the view to

establishing National Measurement, Reporting and Verification (MRV) system in the country, and relevant proposals in this field.

Current report is prepared with the support of UNDP/GEF and contribution of the Ministry of Ecology and Natural Resources with the participation of relevant experts representing related Ministries and Agencies (Ministry of Economy, Ministry of Energy, Ministry of Agriculture, Ministry of Transportation, Ministry of Communications and High Technologies, Azerbaijan Railways CJSC, State Maritime Administration, State Civil Aviation Agency, Azerbaijan Airways CJSC, Azerenergy JSC, ABEMDA (State Agency for Alternative and Renewable Energy), SOCAR, Azeristiliktajhizat JSC, Azerishiq JSC etc.), as well as experts from academic and NGO sectors.

I. NATIONAL CIRCUMSTANCES

1.1. Geographic position

The territory of the Republic of Azerbaijan extends about 400 km from North to South, 500 km from West to East, and is located at 38°25'-41°55' North Latitude and 44°50' - 50°51' East Longitude.

Located at the crossroads of Europe and Asia, Azerbaijan is having a unique geopolitical and geographical position, maintaining its importance to the global economic and cultural ties from the ancient times up to now.

The Republic of Azerbaijan shares borders with 5 countries. The length of its borders is about 2.850 km. The country borders Russia to the North - 289 km., Georgia to the North-West - 340 km., Armenia to the West - 766 km., Turkey to the South-West with - 11 km. and Iran to the South - 618 km. The Eastern part of the country in about 825 km area is washed by the waters of the Caspian Sea

1.2. Population

Azerbaijan's population is about 9.810 thousand people according to information as of the end of 2017. 53% of its population is urban, while the remaining 46.8% is rural population. Azerbaijan is considered to be one of the densely populated countries. The average population density is 113 people per km^2 and this number is higher than country average level in Baku city, Absheron and Lankaran economic regions. 49.9% of the population is men, while remaining 50.1% is women, the population disparity is 1006 women per 1000 men.

Historically, Azerbaijan had high birth rate. There were such periods when birth rate was 40-50 per thousand people. However, from 1991 to 2003 this figure has dropped, but since 2003, there has been an increase in this indicator and it reached 16.5 in 2016.

Alhough, 95% of population of Azerbaijan is Muslim, it is considered to be one of the leading countries in the field of religious tolerance. Tolerance in the country is distinguished for its solid foundations, rich traditions, deep historical and cultural roots. Tolerance is also supported by state policy. It is no coincidence that the year 2016 was declared as "Year of Multiculturalism" in Azerbaijan and number of international conferences were held in the country during the year. 793 religious agencies have been registered in the country as of today, 765 out of which are Islamic, while 28 are non-Islamic (Christian – 17, Jewish – 8, 1 – Krishna, 2 - Baha'i) agencies. There are 2250 mosques, 14 churches and 7 synagogues in the country.

1.3. Political profile

Azerbaijan declared its independence on October 18, 1991 and was recognized as a sovereign state by the World community. Azerbaijan is a member of the United Nations, the Organization for Security and Cooperation in Europe (OSCE), NATO's Partnership for Peace, the Euro-Atlantic Partnership, the World Health Organization, the GUAM (Georgia, Ukraine, Azerbaijan, and Moldova) Organization for Democracy and Economic Development, the Council of Europe, the International Monetary Fund (IMF), the Organization of the Islamic Conference and the Nonaligned

Movement. In 2011, Azerbaijan was elected as a non-permanent member to the UN Security Council, representing the Eastern European Group for the 2012–2013 terms.

As in majority of contemporary political systems, the political system of Azerbaijan is characterized by pluralism - the existence of more than one political party.

Structural formation of political system in Azerbaijan was completed on November 12, 1995, by the adoption of the new Constitution. In accordance with the Constitution, Azerbaijan is defined as a democratic, secular and unitary republic. So, form of state power in Azerbaijan's political system corresponds to the national parameters of the presidential system

In accordance with the principle of the division of power, independently formed and functioning branches of power were established: the legislative, executive and judicial powers. The activity of each of these branches is regulated by the Constitution and legislative acts.

In the Republic of Azerbaijan the legislative power is executed by the Parliament (the Milli Majlis), the executive power -by the President, the judicial power - by the courts of the Republic of Azerbaijan.

The Executive power in Azerbaijan belongs to the President of the Republic of Azerbaijan. The President establishes the Cabinet of Ministers for implementation of the executive powers of the President. The Cabinet of Ministers, is the supreme executive body of the President, is under the subordination of the President and is accountable to the President. The Cabinet of Ministers includes the Prime Minister, Vice Premier (Deputy Prime Ministers), Ministers and other heads of central executive bodies. The President appoints the prime minister and the Cabinet of Ministers, which are subject to approval by the Milli Majlis. The Cabinet of Ministers oversees the implementation of the state budget, financial, credit and monetary policies, as well as state social programs.

From administrative point of view, Azerbaijan consists of one autonomous republic - Nakhchivan Autonomous Republic, and 63 districts. There are 78 cities (towns) in Azerbaijan, the capital - Baku - is the largest city. There are 14 urban districts, 264 settlements and 4.248 villages in Azerbaijan.

1.4. Economic Profile

The territory of the Republic of Azerbaijan has favourable natural and climatic conditions and rich natural resources. Industrial sector is driven mainly by oil and gas production and processing industry, chemical and petrochemical industries, metallurgy, machinery, textile, food processing; the agricultural sector consists mostly of grain, cotton, wine, fruit, tobacco, tea, vegetables, and cattle-breeding.

During 25 years of its independence, the modern Azerbaijan has taken a complicated, but at the same time, an honourable course. At the beginning of the 1990s, the deep crisis in socio-political structure of socialism resulted in the economic stagnation and social degradation in Azerbaijan along with other post-Soviet countries. At that time, the situation in the country was exacerbated by the military aggression against the country, so about 20 percent of the territory wes occupied and more than one million Azerbaijanis were expelled from their homeland.

After gaining independence, one of the major challenges faced by the country was the establishment of the national economy based on the market principles that meets the requirements of a sovereign country and integrates effectively to the modern world economy.

From the mid-90s of the last century, under the leadership of Heydar Aliyev, the country gradually began to take decisive steps towards revival. First of all, the sustainability of the country's independence was secured and political stability was established. Thus, Azerbaijan began to pursue the market oriented policy for transition to a free market economy that was started in 1995.

As a result of the "Contract of the Century" signed with the prominent oil companies as well as the economic reforms adopted by the State in the course of partnerships with local and international organizations, since 1995 Azerbaijan's economy showed initial gradual steps towards the progress. In the following years, economic stability was observed and in 2005 economic growth increased more than twice compared to the previous year.

The highest gross domestic product (GDP) indicator (34.5%) was observed in in 2006 in Azerbaijan. At present the country's economy is mainly driven by oil and gas sector. In 2016, 41 million tons of oil was produced in the country. In the same year, gas production in the country equalled to 18.7 billion cubic meters.

The economy of Azerbaijan has grown dynamically from 2005 to 2015. But since the end of 2014, decline of oil prices in the world market had negative impacts on Azerbaijan economy. Consequently, in 2016 GDP decreased by 3.1% and was AZN 60.4 billion. In 2016, 37.1% of the GDP in the country was produced in industry, while 5.6% in agriculture, forestry and hunting, 10.5% in construction, 8.5% in transport and communication, 30.2% in other fields and 8.1% from net taxes.

In order to align with the current calls raised by newly created challenges as well as to minimize the negative impacts of existing global economic crisis, since 2016 scientifically justified appropriate economic reforms have been implemented in the country. To ensure sustainability of economic policies and reforms being implemented, with the Decree dated March 16, 2016, President of the Republic of Azerbaijan approved "Main directions of Strategic Road Map on National Economy and major sectors of economy". In accordance with this Decree, strategic road maps on national economy and 11 sectors have been prepared and approved by the Decree of the President of the Republic of Azerbaijan dated December 6, 2016. Strategic Road Maps include economic development strategies and action plans for 2016-2020 years, long-term outlook by 2025 and target vision for the period after 2025.

Furthermore, Strategic Road Map targets the average annual real GDP growth of more than 3 percent by 2025 and, in addition, establishment of more than 450 thousand new workplaces. Thuswise, it is forecasted to establish 150 thousand new workplaces in commercial goods and services sector, such as production and tourism sectors, by 2025. Meanwhile, 20 thousand new workplaces will be opened in the agricultural production and processing sector through implementation of actions to be taken in regions of the country. 7700 new permanent work places will be opened in heavy industry and machinery, new iron-ore processing and steel processing factories will be constructed. The share of small and medium entrepreneurship will reach 15% of

GDP, 20% in employment, while 10 % in non-oil export. Appropriate actions will be taken towards turning Azerbaijan into one of the 20 famous touristic zones favoured by world tourists in the post-2025 year period. It is forecasted that about 27 billion manats will be invested in the economy to fulfill the priorities set up by 2020.

Over the past two years, Azerbaijan has intensified its efforts to further improve economic policy and accelerate institutional reforms in order to rehabilitate economic activity in Azerbaijan. A number of important measures were taken towards improvement of economic development, investment and business environment, creation of favorable conditions for entrepreneurs, enhancement of state support, increase of non-oil export potential, and import substitution. Consequently, significant decisions were made on improvement of business environment, decrease in the numbers of activities requiring license from 59 to 37, reduction of numbers of permits for entrepreneurial activities for about 4 times (from 330 to 87).

According to the Law of Azerbaijan Republic on "Suspension of inspections in entrepreneurial activities" inspections in the area of entrepreneurship were suspended for 2 years since November 01, 2015. However, the period of suspension was prolonged until 2021 in October, 2017.

One of the notable actions taken recently in the country is the establishment of Commissions and Commission Secretary based on the Decree dated July 12, 2016 by the President of the Republic of Azerbaijan, with the view to ensure sustainability of rapid development achieved in the field of entrepreneurship in recent years, enhancing competitiveness and improving the position of Azerbaijan in international ratings. These actions also include establishment of Financial Stability Board, Financial Markets Supervision Chamber and the public legal entity to enhance macroeconomic stability and ensure financial sustainability in the country.

In order to involve existing natural and economic resources to economic turnover and ensure efficient management of the property of legal entities owned by state, establishment of "Azerbaijan Industry Corporation" JSC is an integral part of reforms. Whereas, establishment of "Loan Guarantee Fund of Azerbaijan Republic" JSC in an attempt to expand access of Azerbaijani entrepreneurs to financial resources. Significant efforts have been taken towards guaranteeing manat credits received by entrepreneurs and providing subsidies for part of the interest accrued on these loans.

As continuation of such reforms, Food Security Agency was established in the country. To accelerate the development of the agrarian sector, "State Program on development of cotton-growing in 2017-2022 years in Azerbaijan Republic", "State Program for the development of tobacco industry in 2017-2021 years in Azerbaijan" and "State Program for Development of Silkworm Breeding and Sericulture in the Republic of Azerbaijan in 2018-2025" were adopted.

As positive results of implementation of economic reforms and strategic road maps in the country, Azerbaijan has moved up two spots to rank 35th among 137 countries in the Global Competitiveness Report 2017-2018 published by the World Economic Forum (WEF). Azerbaijan has climbed 8 spots to rank 57th among 190 countries in the Doing Business 2018 prepared by World Bank. Moreover, Azerbaijan is one of the top three reforming countries in Europe and Central Asia region.

Generally, In "Doing Business 2018" report, Azerbaijan has improved its position on six out of 10 indicators. The similar tendency is also observed in "Global Competitiveness Report". Thus, according to the final report, Azerbaijan has improved its positions on 9 out of 12 indicators. Within the report, one of the most notable issues is the challenges faced during the implementation of institutional structural reforms in the countries all over world. Azerbaijan has improved its position on this indicator for 15 spots to rank 33th.

Thus, as a result of reforms implemented in the country, the tension in the economy has been prevented and stabilized. In 2017, 2.7%, 3.8% and 4.2% increase was observed respectively in non-oil sector of economy, non-oil industry and agriculture. The year 2017 was characterized by signature of the agreement, which envisages the extension of the Production Sharing Agreement for the development of the Azeri-Chirag-Gunashli and opening of the Baku-Tbilisi-Kars railway.

Energy industry - has been rapidly developing in the recent years in Azerbaiajn. Currently there are 14 thermal and 14 hydroelectric operating power stations that meet the country's energy needs. As a result of investments made in the electric power industry both new thermal and hydro power plants are being built in the country and the existing ones are being re-constructed to meet modern requirements. Moreover, due to the efficient policy carried out in the existing thermal power plants, the use of fuel oil was replaced by the use of gas, which benefits the environment, and contributes to the mitigation of climate change impacts.

As a result of the works done in recent years, Azerbaijan is not only fullfils domestic demands of electricity, but it also exports electricity to neighbouring countries. According to official statistics in 2016, 24.9 billion kilowatt/hour of electricity was generated in the country. Currently, annual per capita production is 2.538 kW/h, that can be compared with the registered indicator for many European countries.

The Agency for Regulation of Energy Issues was established under the Ministry of Energy of the Republic of Azerbaijan, on the base of State Energy Control Agency and State Gas Control Agency, in accordance with the decree dated December 22, 2017 by President of the Republic of Azerbaijan.

Alternative and Renewable Energy **–** Azerbaijan pays close attention to the development of Alternative and Renewable energy. Ensuring the increase of the energy obtained from alternative and renewable energy sources in energy balance of the country, providing the consumers with sustainable electric power, reducing technical and technological losses by creation of energy-generating sources in the areas close to consumers, and efficient management of existing resources appear to be priority reforms in energy sector. Significant work has been done in terms of the efficient use of alternative and renewable energy, and creation of modern infrastructure in this field. All of this work made it possible to expand the use of alternative and renewable energy in the economic and social fields and created favourable conditions for the implementation of measures related to the production, consumption, efficiency of this type of energy. As a result of the work done in this area, the State Program on the Use of Alternative Energy Sources was adopted in 2004. In order to improve management system in the field of alternative and renewable energy, The State Agency for Alternative and Renewable Energy Sources was established in 2009. Later by the Presidential Decree N 810, dated February 1, 2013 the State Company was reorganized and

renamed as ―Azalternativenerji Limited Liability Company and was transferred to the subordination of the newly formed SAARES (State Agency on Alternative and Renewable Energy Sources). "Strategic Plan of the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan for 2015-2018 years" was approved under Resolution dated December 10, 2014 by the State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan.

According to the Decree dated December 22, 2017 of the President of Azerbaijan Republic on "Additional measures on the use of alternative and renewable energy", Wind Farm Electric Park, which was previously owned by State Agency for Alternative and Renewable Energy Sources was transferred to the ownership of Azerishiq JSC. This park is located at 55th kilometer of Baku-Guba highway.

Industry **-** development of the industrial sector is one of the main priorities of economic policy in the country in terms of improving the competitiveness and improving economic structure. Industrialization is important not only from the economic point of view, but also from a number of social, scientific and cultural aspects, such as employment, income level, urbanization, specialized workforce, research and investigation.

Since 2004, industrialization rate has increased, and improvement of regional structure of industry has been determined as one of the main priorities. Purposeful measures have been taken towards solution of power supply issues which is viable for industrial production. The country has turned from importer into exporter of natural gas and electric power. Industrial Infrastructure has significantly improved. State investments have been allocated not only on infrastructural projects, but also on several production projects. Moreover, suitable business environment has been created in the country. State funding with soft terms has been ensured for projects implemented by private sector and the Government has been involved in share participation in such projects.

As a result the work done, the industry has entered the new stage of development and the year 2014 was announced as "Year of Industry" in the country. "State program on development of industry in Azerbaijan Republic" was adopted taking into consideration activities identified in Development Concept "Azerbaijan-2020: Outlook for the Future" to turn Azerbaijan into a strong industrial center of the region by usage of more efficient existing potential of Industry in new phase. The State Program has focused on strengthening operation of existing industrial and technology parks, establishment of new industrial parks and industrial points, launching special economic zones and increasing industrial potential of the regions.

Moreover, "Strategic Road map for the development of heavy industry and machinery in the Republic of Azerbaijan" adopted in 2016 considers actions by and for the period after 2025. This Road Map Priority 1.2 targets to achieve optimized efficiency in energy use.

Agriculture is historically strategic sector in Azerbaijan, and the driving component of the non-oil economy. Although 47% of the population in Azerbaijan works in agricultural sector, agricultural products make up only 5.6% of the total GDP and this provides employment and income for only about 36.3% of the total labor force (employed and self-employed individuals). At present, 4534 thousand ha area (52.4%) out of total territory of Azerbaijan Republic is suitable for agriculture.

In the years of independence crop production in agriculture decreased by an average of 12 percent per year in 1992-1995 years, however it has started increasing constantly since 1996 (except for 1997, 2010 and 2014). Total increase as of 2016 was 6.6%. In 2015, growth in livestock products was 2.5%, while 11.3% in crop production.

Generally speaking, it is possible to conclude that the growth of agriculture in Azerbaijan will be sustainable. The figures as of first sixth month of 2016 show that, despite decrease of GDP in the country, there was 3.1% increase in agriculture. The cost of agricultural product in that period with actual prices was 2500.9 million manats; while 57.4% and 42.6% of this product are respectively shared by livestock and crop production.

"Strategic Roadmap on production and processing of agricultural products in the Republic of Azerbaijan" prepared in accordance with Decree no. 1897 dated March 16, 2016 by the President of the Republic of Azerbaijan "On Main Directions of Strategic Road Map for National Economy and major fields of Economy" describes strategic outlook by 2020, long-term outlook for the period up to 2025 and target vision for the period after 2025. It also shows that the country has clear road map to be implemented systematically in order to achieve medium and long-term strategic development targets. Moreover, Draft "State Program on use of pastures and hay lands for 2018-2022 years in Azerbaijan Republic" and "draft State Program on intensive development of cattle husbandry in Azerbaijan Republic" have been developed and are under approval by relevant agencies.

The forest sector - forests are one of the most valuable national natural resources of Azerbaijan. The forests of Azerbaijan are owned by state and belong to the first group by carrying out their protective functions. Actions towards afforestation has been taken in 159.7 thousand ha area in recent 16 years, while 53.9 thousand ha area has been forested and totally 102.7 million trees have been planted. Total area of the Azerbaijan forests is 1040.3 hectares, and that makes up about 12 per cent of the country's territory. Per capita forest area is 0.11 ha in Azerbaijan. Currently 261 thousand hectares of forest area has been occupied by Armenia.

Since the agricultural development has been identified as one of the priority goals in the country in recent years, significant works are being carried out rapidly towards effective use of forest and non-forest lands with the view to enlarging the green areas, growing ecologically clean agricultural products, ensuring food security, enhancing export potential, opening new workplaces and reducing import dependency. Orchards have been created by planting totally 1.803.400 numbers of young plants (202 thousand mulberry, 237 thousand walnuts, 300 thousand hazel-nut, 517 thousand pomegranate, 154 thousand almond, 30 thousand chestnut, 63 thousand olive and other trees) up to date. Generally, large scale landscaping projects based on modern methods have been implemented during recent years after the arid areas and low-quality lands were cleared and made suitable for tree-planting. 5.386.196 numbers of trees were planted in 4.438 ha area, while nearly 11 thousand kilometre area was provided with modern drip irrigation systems.

II. GHG inventory results and trends

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

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

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

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

It is to note that, the report was developed in accordance with 2006 IPCC Guidelines, Tier 1 approach and default emission factors for developing countries were used in the calculation. Global Warming Potentials used in the report are the potentials determined for 100 year perspective in Second Assessment Report (SAR).

The report includes information about emissions of main gases, such as CO_2, CH_2 and N_2O. Additionally estimations on hydrofluorocarbons, perfluorocarbons, SO_2 and SF_6, ozone precursors (CO, NOx and NMVOC) were provided. It sould be noted that, Greenhouse Gas Inventory Software (IPCC inventory software Ver.2.54) does not provide tools to calculate precursors and indirect emissions. Therefore, the amount of precursors in the country were taken from assessments shown in official statistic summary titled "Environment in Azerbaijan" published by State Statistics Committee. In order to calculate and submit amount above mentioned emissions, all enterprises and companies functioning in the territory of Azerbaijan use questionnaires and guidelines prepared by the State Statistics Committee. It is to note that, estimations for precursors include ony emissions from reporting enterprises and do not include precursor emissions released from other sectors such as Wastes, AFOLU and from households. In addition, 2 TG - air official statistic reports should be approved by relative units of Ministry of Ecology and Natural Resources before final submission to the State Statistics Committee.

2.1. Institutional Framework

After the Republic of Azerbaijan has ratified UN Framework Convention on Climate Change in 1995, one of the obligations taken under the convention is to carry out, update and submit inventory of anthropogenic emissions and absorptions of GHG to Conference of the Parties.

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

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

Publication titled "Information on the amount of GHG's released during operation of enterprises to atmosphere" was developed and proposed by the Ministry of Ecology and Natural Resources to be included in the "Environment in Azerbaijan" reports of State Statistics Committee. GHG emissions/removals shown in the publication are calculated by applying coefficients from IPCC methodology.

Since 2014, this data has started being regularly published in the annual "Environment in Azerbaijan" report prepared by State Statistics Committee.

Climate Change and Ozone Center was established under the Ministry of Ecology and Natural Resources to coordinate the National GHG Inventory. This Center involves 19 employees. There are four divisions: GHG inventory, Climate Change Impact Assessment, Adaptation, Climate and Ozone departments.

2.2. Total emissions from IPCC Sectors.

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

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

This report (Second Biennial Update report) considers GHG inventory as for 2011-2013 years. Due to the changes in data collection process, GHG emissions from Third National Communication report for 2011-2012 years has been recalculated and included in this report. Total emissions from all sectors of Azerbaijan are shown in the following table.

Table 2.GHG emissions and absorptions in different sectors

Sector	GHG emissions and absorptions (Gg CO2 eq.)						
	1990	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**
Energy	63 928	33 006	39216	36596	46173	47789	49232
Industrial processes	1447	554	1781	2108	2322	3440	3389
AFOLU	6261	5368	6469	7244	8157	8468	8542
Waste	1694	1837	2023	2260	733	742	770
Total emission	**73 331**	**40 774**	**49490**	**48209**	**57465**	**60346**	**61842**
Removal	-3690	-4870	-5349	-5410	-7427	-7770	-7953
Net emission	**69 641**	**35 904**	**44141**	**42799**	**50038**	**52576**	**53889**

As shown in the table, amount of emissions from Energy sector has increased since 2011. This increase is explained in calculation of emissions as for 2011-2013 years, through application of 2006 IPCC Guidelines. It is intended to re-calculate emissions as of previous years in next National

Communication document and use Global Warming Potentials for 100 year perspective given in IPCC Fourth Assessment Report in order to follow TACCC principles. Total net emission in 2013 makes 77.3% from 1990 base year level. Thuswise, total net emissions level has decreased by 22.7%, while absorptions have increased by 2.2 times.

Emissions from energy sector decreased in comparison with base year by 23% in 2013.

However, emissions from industrial sector have increased approximately by 2.3 times. This fact might be explained with industrial development, as well as the increase in the production of cement, steel and aluminum and inclusion of new source (CO_2 from Ethylene production) to the methodology.

Decrease in waste sector is explained with variation to the calculation method in "4.A Solid Waste Disposal" category and deletion of several emission sources and decrease of some coefficients in 4.D "Wastewater Treatment and Discharge" category in IPCC (2006), if compared to IPCC (1996) methodology

Diagram 1: Emissions from different sectors in 2013 (in %)

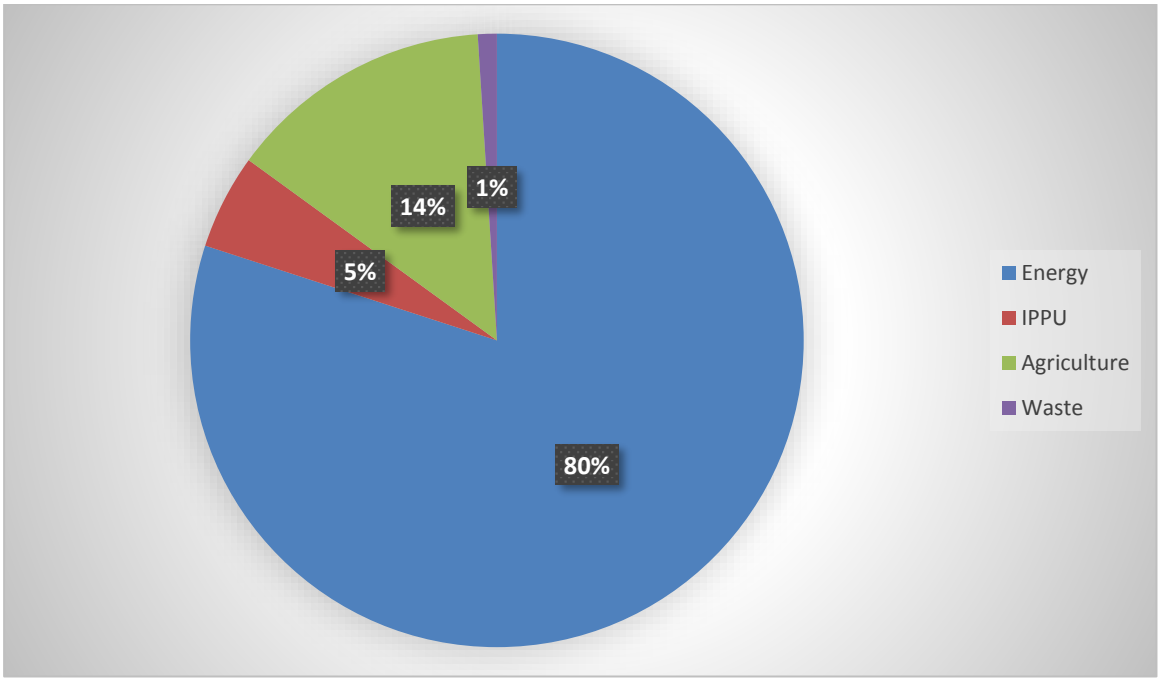
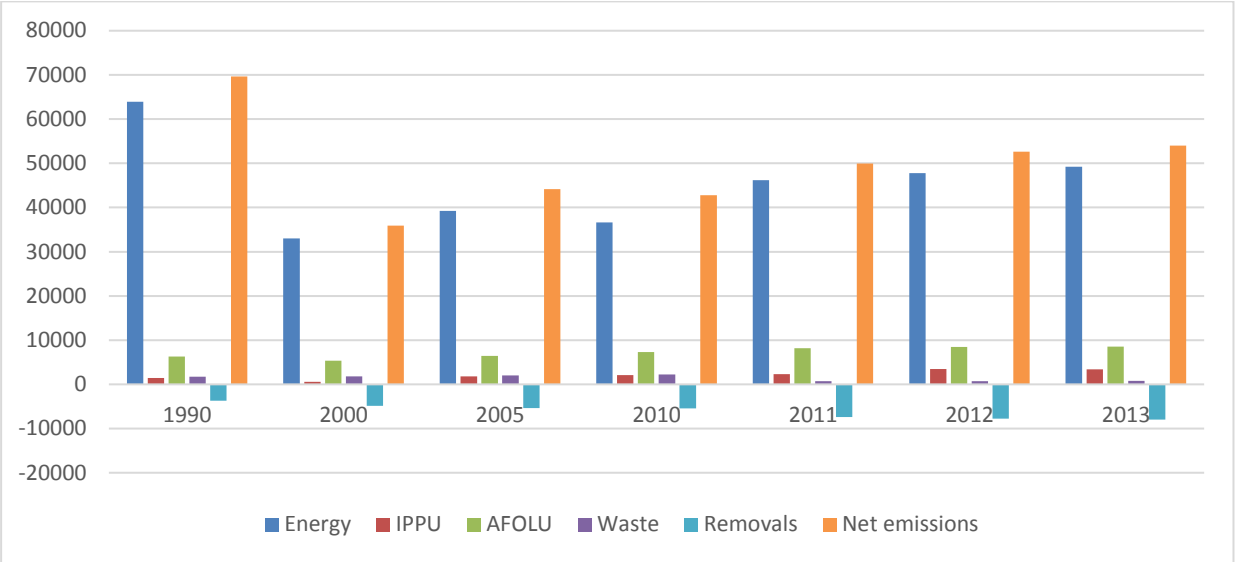


Diagram 2: GHG emissions/removals from different sector, 1990-2013 years, thousand ton, CO_2 eq



The Results of GHG inventory for 2013 are attached in Annex I to this report the table forms recommended in "UNFCCC biennial update reporting guidelines" for Parties not included in Annex I to the Convention .

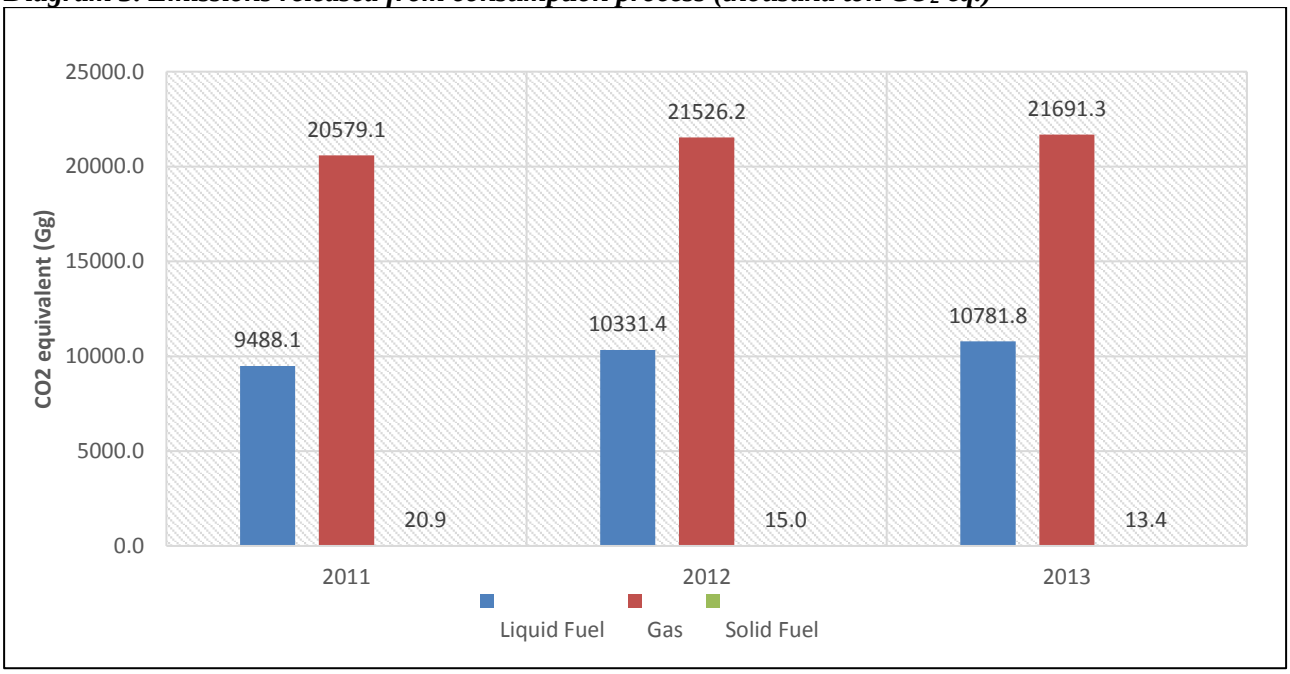
2.2.1. Energy sector

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

1.A. Emissions released from fuel combustion

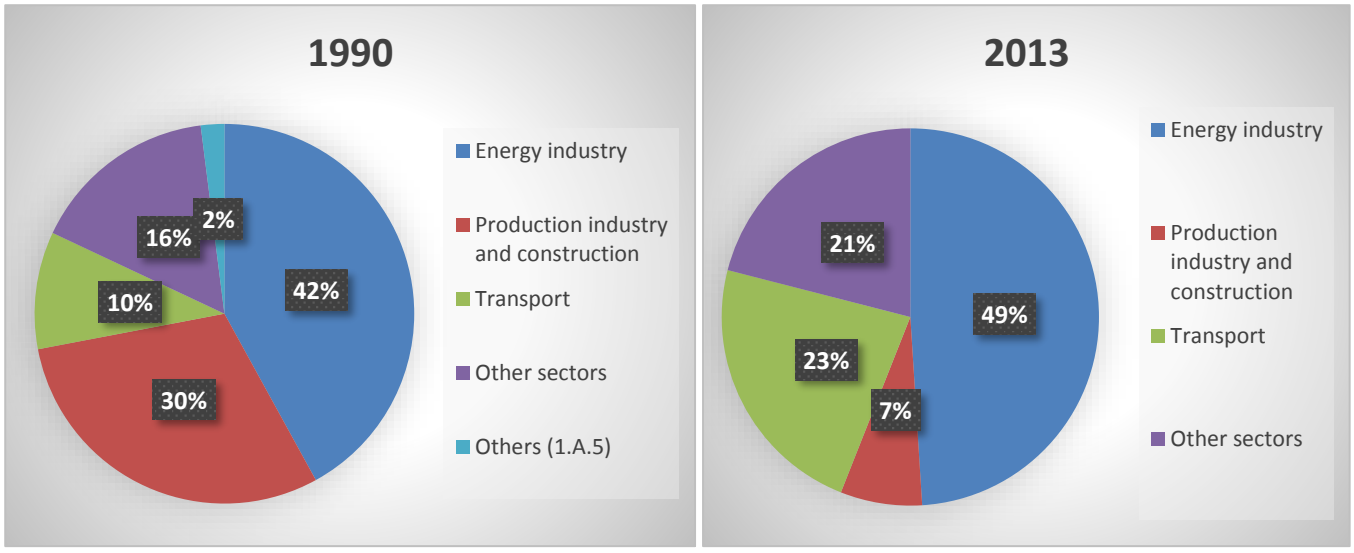
In accordance with 2006 IPCC methodology, emissions released during combustion processes are mainly composed of CO_2 gas. However, small amount of CH_4 and N_20 gas emissions might be released due to uncomplete combustion depending on technological processes. Tier 1 approach and default emission factors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

Diagram 3. Emissions released from consumption process (thousand ton CO_2 eq.)



As shown in the diagram, economy of Azerbaijan mainly based on natural gas , consumption of which is considered to be the most environmentally friendly than other fossil fuel, contributing to Sustainable Development Goals.

Diagram 4. Change in the share of economical sectors in total emissions

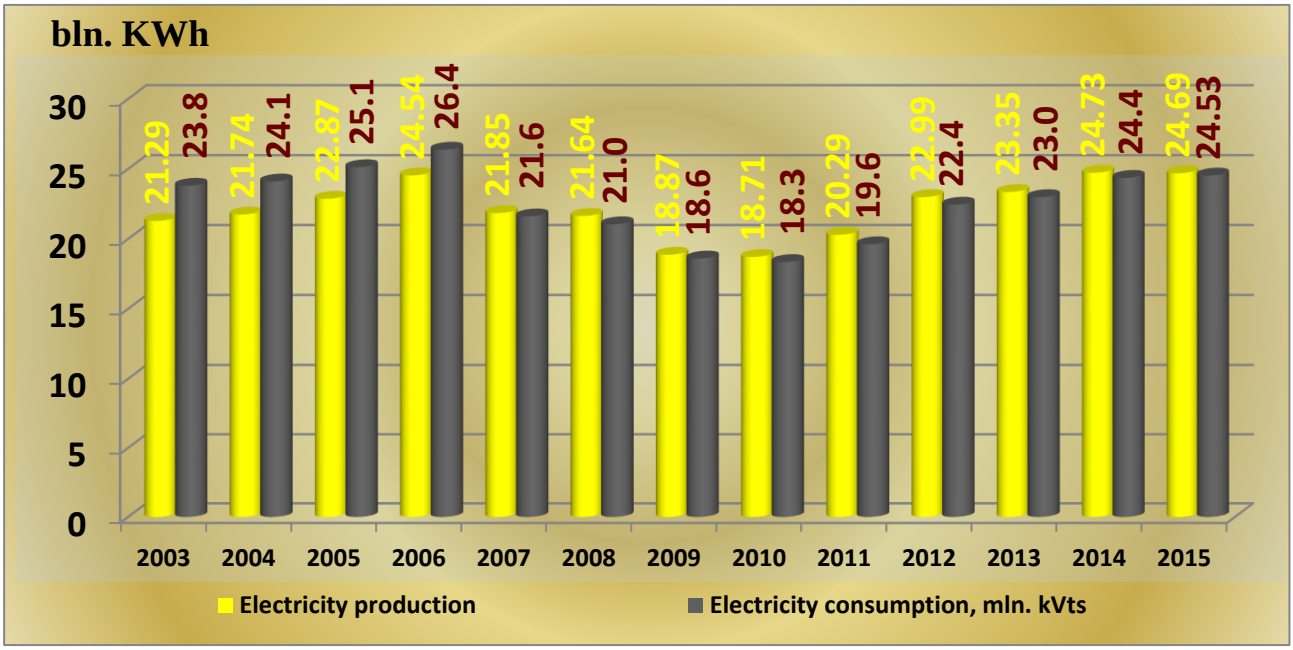


1.A.1 Energy industry

In accordance with 2006 IPCC Guidelines, **1.A.1 – Energy industry** category consists of three sub-categories. Annual information obtained from State Statistics Committee on the amount of fuel consumed for production of electric and heat was used to calculate the emissions from **1.A.1.a –**

Main activity consumption of electric and thermal energy, the first sub category. It is to note that, power demand of the republic is supplied from power stations functioning under Azerenergy JSC. 13 of these stations are power stations with 5132 MVt installed power, while 16 are hydropower stations with 1101,20 MVt installed power.

Diagram 5. Production and consumption of electric power in the Republic in 2003-2015 years



Increase of GHG emissions calculated for 2011-2013 years (Table 2) is explained by the fact that the production and consumption of electric power has increased since 2010 in Azerbaijan (as shown in the diagram).

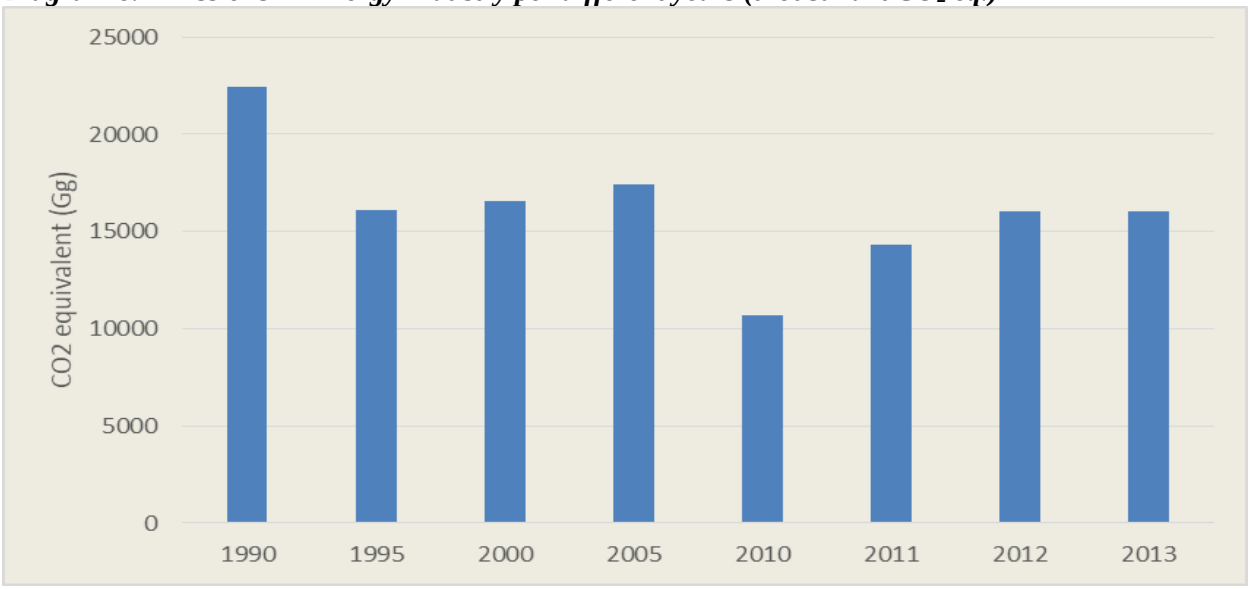
Table 3. GHG emissions from Energy industry (thousand ton CO2 eq).

Category/year	**2011**	**2012**	**2013**
1.A.1 – Energy industry	14313.5	16020.6	16049.2
1.A.1.a – Main activity, Power and Thermal power consumption	10691.5	12064.6	12151.4
1.A.1.a.i – Electricity generaion	5961.5	6166.0	6593.1
1.A.1.a.ii – Combined Heat and Electricity generation (CHP)	4435.8	5601.3	5232.3
1.A.1.a.iii – Heat plants	294.2	297.5	326.0
1.A.1.b – Petroleum refining	1895.5	2108.6	1956.3
1.A.1.c.ii – Other energy industries	1723.5	1844.3	1938.7

Emissions calculated for 1.A.1.b – Petroleum refining and 1.A.1.c.ii – Other energy industries categories are based on information provided by SOCAR. “Baku Oil Refinery named after Haydar Aliyev” and “Azerneftyag” factories were functioning in the field of refinery in Azerbaijan in 2011-2013. 1.A.1.c.ii – Other energy industries includes emissions released from fuel consumed to meet

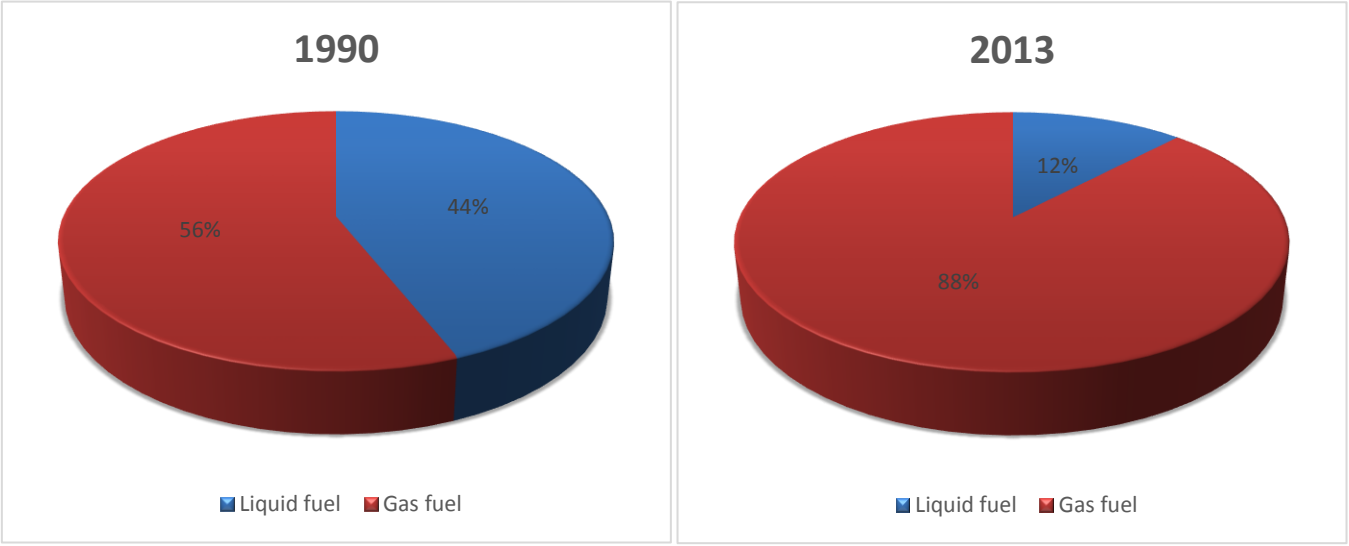
internal demands in Gas Processing Factory, Azneft PU, other operation companies and joint ventures functioning in the field of oil and gas production.

Diagram 6. Emissions in Energy Industry per different years (thousand t CO_2 eq.)



Reduction observed in GHG emissions up to 2010 in "Energy Industry" category was explained by the change in the type of fuel. In fact, liquid fuel was mainly used in 1990, while natural gas has been mostly used in recent years. The increase in recent 3 years shown in Diagram 6 might be explained with increase in production and consumption of electric power.

Diagram 7: Change in the fuel type in Energy Industry in 1990 and 2013 years, in %



1.A.2 Manufacturing Industries and Construction

Manufacturing Industries and Construction (1.A.2) category consists of 13 sub-categories and covers the industrial fields shown in 2006 IPCC Guidelines. It should be noted that, information

obtained from State Statistics Committee was used to calculate emissions of this category. The amount of emissions released from this category reduced by 85% in 2013 compared to that in 1990.

Table 4. GHG emission from processing and construction category (thousand t CO_2 eq.)

Category/year	**2011**	**2012**	**2013**
1.A.2 – Manufacturing Industries and Construction	**1902.7**	**2406.3**	**2423.5**
1.A.2.a –Iron and steel	86.1	91.2	97.0
1.A.2.b – Non-ferrous metals	8.0	11.5	8.8
1.A.2.c – Chemicals	484.8	554.1	554.7
1.A.2.d – Pulp, paper and print	2.2	3.3	3.9
1.A.2.e – Food processing, beverages and tobacco	513.2	794.7	814.5
1.A.2.f – Non-metallic minerals	426.3	496.7	498.8
1.A.2.g – Transport equipment	17.0	17.9	17.9
1.A.2.h – Machinery	34.5	46.7	48.9
1.A.2.i – Mining (excuding fuels) and Quarrying	34.7	34.9	35.6
1.A.2.j – Wood and wood products	4.3	4.6	6.6
1.A.2.k – Construction	247.0	283.1	277.7
1.A.2.l – Textile and leather	8.3	12.1	10.6
1.A.2.m – Non-specfied industry	36.4	55.4	48.6

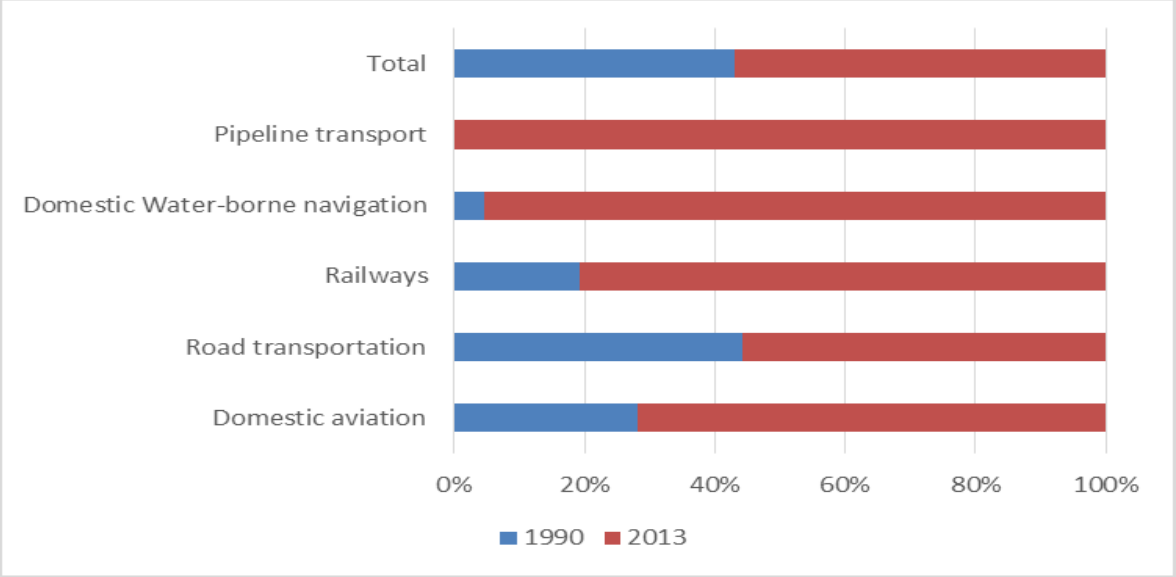
It is to note that, there has been a small increase in the emissions released from this category within last 5-6 years. This increase might be explained with the development of non-oil sector. Davos World Economic Forum, the most influential economic agency of the world, ranked Azerbaijan at 35th place in the world for economic competitiveness in 2017.

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

1.A.3 Transport

GHG emissions of Transportation category were calculated based on information obtained from State Statistics Committee. This category includes emissions from road transportation, domestic air and marine transportation, railways and pipeline transportation. The amount of emissions emitted from transport sector in 2013 increased by 33%, compared to 1990.

Diagram 8. Change in GHG emissions released from Transport category



It is to note that, the information provided in annual statistic summary for auto-transportation subcategory does not meet requirements of 2006 IPCC Guidelines. For example, it does not include information about the quantity of fuel (separately diesel, petrol and LPG) consumed by every vehicle per year, with regard to the type of vehicles (that is, cars, heavy or light trucks, buses and motorcycles).

According to the information obtained from the Ministry of Transport, Communication and High Technologies, the fuel costs in Azerbaijan are cheaper than in neighbour countries. Due to application of visa-free regime for the citizens of neighbour countries, these citizens use petrol stations located within the territory of The Republic of Azerbaijan, which cause artificial increase in the emissions released from means of transportation.

It should be noted that, "Transport in Azerbaijan" statistical yearbook of State Statistic Committee includes information about the number of vehicles, age structure of vehicle park, distribution of vehicles according to fuel type and load capacity, distribution of automobiles for their models, number of cars, trucks and busses in the regions. Unfortunalely no information on annual mileage provided in statistics. Nevertheless, it is intended to use this information in future for calculation of emissions from transportation by appling different assumptions.

Table 5. GHG emissions from Transport sector (thousand t CO_2 eq.)

Category /year	2011	2012	2013
1.A.3 –Transport	5912.8	6518.0	7413.3
1.A.3.a.ii – Domestic aviation	321.7	339.4	485.5
1.A.3.b – Road transportation	5418.8	5999.8	6762.3
1.A.3.c – Railways	61.5	61.3	62.1
1.A.3.d.ii –Domestic water-borne navigation	110.5	117.2	102.2

1.A.3.e.i – Pipeline transport	0.3	0.3	1.2

The quantity of emission released from internal marine transport and international travels was calculated based on information given in "Azerbaijan Energy Engineering" annual summary. It is to note that, information on the number and fuel consumption of different models during takeoff, landing and cruising, as well as international travels was collected and analyzed for 2011-2016 years to calculate emissions of this category at higher methodological level. It is intended to apply Tier II approach in the calculation of emissions from air transport in Fourth National Communication report.

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

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

1.A.4. Other sectors

GHG emissions from "Other sectors category" were calculated based on the information provided by State Statistics Committee. This category covers commercial and public services, households, agriculture, forestry and fish industry. Amount of emissions from this category increased by 21% in 2013 in comparison with 1990.

Diagram 9. GHG emissions from "Other Sectors" category

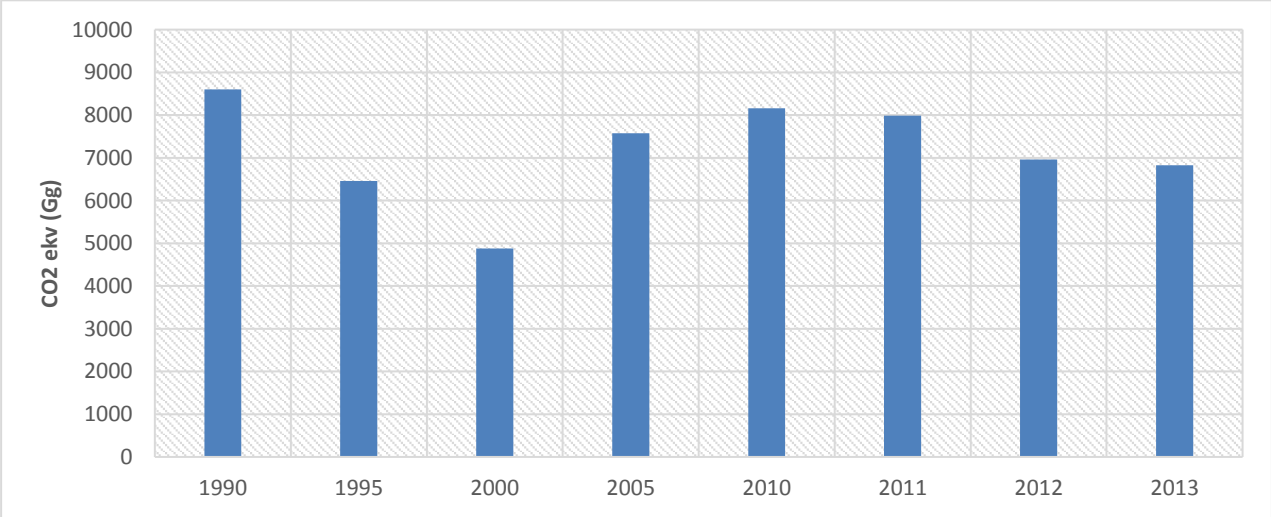


Table 6. GHG emissions from "Other Sectors" category (thousand t CO2 eq.)

Category /year	**2011**	**2012**	**2013**
1.A.4 - Other Sectors	7990.3	6957.9	6827.2
1.A.4.a - Commercial/Institutional	297.7	386.8	420.6

1.A.4.b - Residential	6581.7	5430.3	5227.8
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	1110.9	1140.8	1178.8

It should be noted that uncertainty related to combustion process in Energy category is 1.54% comparing to 1990 year (Uncertainty analysis for 1A Fuel combustion activity).

1.B. Fugitive emissions

1.B.2 Oil and natural gas

Fugitive emissions from "Oil and natural gas" category for 2011-2013 years were calculated in accordance with requirements shown in 2006 IPCC Guidelines. Calculations were carried out based on information obtained from SOCAR and BP Azerbaijan. This report includes calculation of CO_2 and N_2O emissions from "Oil and Natural Gas" category. It should be noted that in accordance with TACCC principles, emissions released to the atmosphere from 1990 to 2010 years are required to be recalculated by the new methodology. These calculations shall be carried out for Fourth National Communication report.

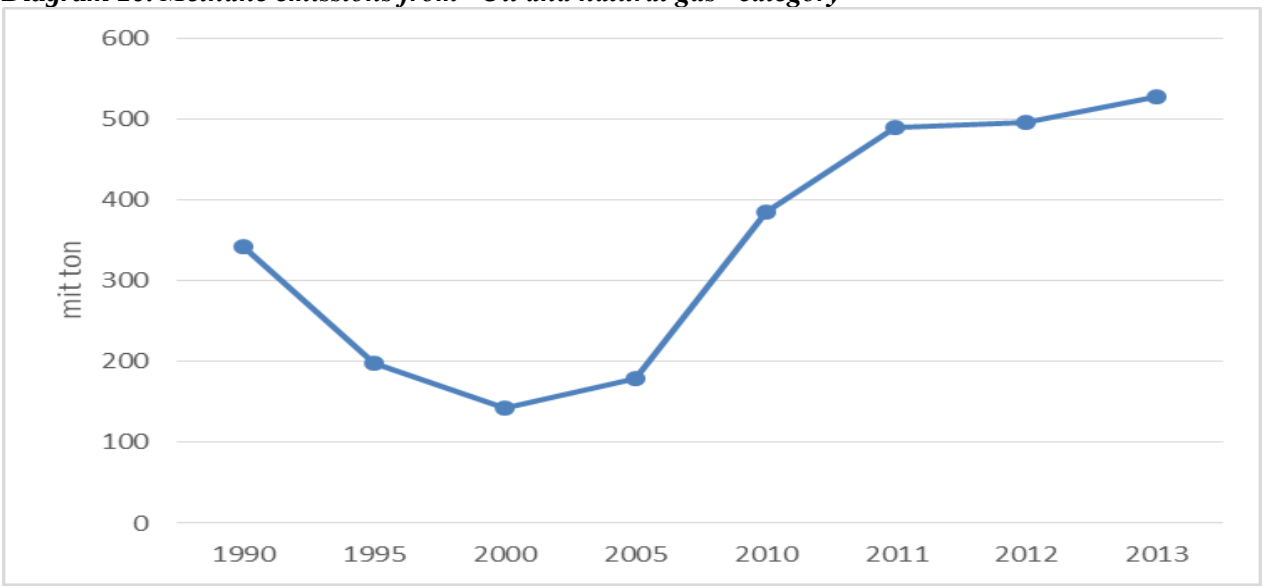
Table 7. Fugitive emissions from "Oil and natural gas" category (in kt)

Category/Year	2011			2012			2013		
	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O
1.B.2 - Oil and natural gas	5771.30	489.32	0.03	5452.58	496.47	0.02	5427.57	527.85	0.02
1.B.2.a - Oil	5758.66	158.06	0.03	5439.99	151.58	0.02	5415.25	152.46	0.02
1.B.2.a.i - Venting	1.29	9.82	NA	1.32	10.06	NA	1.42	10.81	NA
1.B.2.a.ii - Flaring	1630.78	0.99	0.03	1515.62	0.92	0.02	1483.37	0.9	0.02
1.B.2.a.iii - All Other	4126.59	147.24	NA	3923.04	140.59	0	3930.45	140.75	0
1.B.2.a.iii.1 - Exploration	4122.59	87.3	NA	3919.2	83	NA	3926.61	83.15	NA
1.B.2.a.iii.2 - Production And Upgrading	3.98	59.66	NA	3.82	57.33	0	3.82	57.33	0
1.B.2.a.iii.3 - Transport	0.03	0.28	NA	0.02	0.26	0	0.02	0.26	0
1.B.2.a.iii.4 - Refining	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2.a.iii.5 - Distribution of oil products	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2.a.iii.6 - Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2.b - Natural gas	12.64	331.26	0.00	12.59	344.90	0.00	12.33	375.38	0.00
1.B.2.b.i - Venting	0.05	2.98	NA	0.05	3.14	NA	0.06	3.26	NA
1.B.2.b.ii - Flaring	8.75	0.01	0.00	8.58	0.01	0.00	8.10	0.01	0.00
1.B.2.b.iii - All Other	3.85	328.28	0.00	3.96	341.75	0.00	4.17	372.12	0.00
1.B.2.b.iii.1 - Exploration	İE	İE	NA	İE	İE	NA	İE	İE	NA
1.B.2.b.iii.2 - Production	2.50	313.93	NA	2.60	326.64	NA	2.84	356.50	NA
1.B.2.b.iii.3 - Processing	1.02	3.21	NA	1.00	3.15	NA	0.94	2.98	NA
1.B.2.b.iii.4 - Transmission and storage	0.02	5.20	NA	0.02	5.48	NA	0.02	5.69	NA
1.B.2.b.iii.5 - Distribution	0.31	5.93	NA	0.34	6.47	NA	0.37	6.96	NA

SOCAR, BP Azerbaijan and other small operation companies are functioning in Azerbaijan in the field of oil and gas production. It is to note that, all the oil and gas operation companies regularly report to the Ministry of Ecology and Natural Resources and SOCAR about the wastes, as well as emissions emitted as a result of oil and gas production.

GHG emissions from this category increased by 2.3 times in 2013, aas compared to 1990. This increase is explained by the increase in oil and gas production and the calculation of emissions from additional sub-categories shown in 2006 IPCC Guidelines.

Diagram 10. Methane emissions from "Oil and natural gas" category



For the first time, this report includes the amount of NMVOC's released from oil and gas industry.

Table 8. NMVOC from Oil and Gas industry (thousand ton)

Sub-category/year	2011	2012	2013
Natural gas production	16.62	17.30	18.88
Exploration	5.43	5.17	5.18
Gas processing	1.49	1.46	1.38
Gas transportation	0.32	0.33	0.35
Gas storage	0.01	0.01	0.01
Gas distribution	0.09	0.09	0.10
Oil production	102.00	97.74	97.78
Oil transportation	2.77	2.63	2.64
Total	**128.73**	**124.7276**	**126.311**

Reference approach

GHG emissions as for 1990-2013 years were calculated based on Reference approach which considers all the fuel produced and consumed within the country, import-export operations and change in the resources, as well as "Sectoral approach" which considers different categories. Data for the "Reference approach" assessment has been provided by State Statistics Committee. Carbon composition and oxidization coefficients of fuels in the calculations were taken from 2006 IPCC Guidelines.

Table 9. CO_2 comparison in base and sector-wide approaches, thousand ton

Indicators	1990	2000	2005	2010	2011	2012	2013
Reference approach	64494	31832	35905	29172	31311	32932	33596
Sectoral approach	54751	28889	34279	25333	29921	31693	32486
Difference (%)	**17.8**	**10.2**	**4.7**	**15.2**	4.6	3.9	3.4

Reference approach considers calculation of CO_2 emissions released from fuel consumption based on information on energy supply in the country. Whereas, Sectoral approach means calculation of GHG emissions based on information on actual fuel consumption with regard to fuel type and economic sector. The difference between base and sector-wide approaches was raised due to following reasons:

- Non-consideration of the fact that fuel burned during the year, in particular in the field of agriculture, road construction and airport areas, is not considered in the SSC report;
- Non-consideration of fuel oil used for non-energy purposes in reports in the IPCC methodology.

Despite the above mentioned, Table 9 shows that the difference between base and sector-wide approaches was reduced through application of new methodology.

2.3 International Bunker

Emissions from International bunker were calculated based on the fuel quantity filled in the tanks for international travels. It is to note that, diesel fuel was used for ships, while reactive fuel was used for planes. Emissions as for 1990-2007 years were not calculated due to unavailability of information on international marine bunker.

Table 10. Emissions from international bunker, thousand ton

Kategoriya/İl	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
International Bunkers	1039.1	834.3	504.3	580.6	476.7	302.5	577.6	568.4	482.8	430.9	299.5	547.0
1.A.3.a.i - International Aviation	1039.1	834.3	504.3	580.6	476.7	302.5	577.6	568.4	482.8	430.9	299.5	547.0
1.A.3.d.i - International water-borne navigation	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Kategoriya/İl	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
International Bunkers	281.2	577.6	556.2	1103.3	1237.7	1335.4	1495.3	1143.5	1427.9	1571.0	1431.6	1436.3
1.A.3.a.i - International Aviation	281.2	577.6	556.2	1103.3	1237.7	1163.4	1310.4	922.3	1198.3	1322.9	1155.7	1181.8
1.A.3.d.i - International water-borne navigation	NE	NE	NE	NE	NE	172.0	184.9	221.2	229.6	248.1	275.9	254.5

2.2.2. Industrial Processes and Product Use

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

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

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

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

- Nitrogen trifluoride (NF_3);
- Trifluoromethylesulfur pentafluoride (SF5CF3);
- Halogen ethers (such as, $C_4F_9OC_2H_5$, $CHF_2OCF_2OC_2F_4OCHF_2$, $CHF_2OCF_2OCHF_2$), halocarbons including CF3I, CH_2Br_2, $CHCl_3$, CH_3Cl, CH_2Cl not covered under Montreal Protocol, this section of IPCC Guideline on national Greenhouse Gas resources elaborated in 2006 covers assessment methods for halogen greenhouses gases not included to Montreal Protocol and GWP (global warming potential) values not described in IPCC Third Assessment Report, in other cases:
- $C_3F_7C(O)C_2F_{51}$
- C_7F_{16}
- C_4F_6
- C_5F_8
- c-C_4F_8O.

Several methods might be applied for halocarbons not regulated under Montreal Protocol.
Industrial processes and use of products are on the second place after energy production sector in IPCC methodology. Main factors of Greenhouse Gas Emissions Calculation are availability of

necessary data and emission factors. Such data is usually obtained from State Statistics Committee. In addition, other data providers include ministries, governmental agencies, international associations, private and state companies and other relevant bodies. Emission factors are taken from IPCC methodology. If the country has its national coefficient for any emission, IPCC recommends to use that coefficient.

This report describes information about greenhouse gas emissions from Azerbaijan industry by using IPCC (2006) methodology for 2011-2013 years in "Industrial processes and product use" sector and process of studying variations between IPCC 1996 methodology and IPCC 2006 methodology.

Application of Regulation dated 2006 on National Inventory of Greenhouse gas emission and 2.54 version software applied in industrial processes and product use fields have led to the need to analyze changes in some categories. Such analyses include the following categories:

- 2.A.1 Cement production
- 2.A.4 Other Process Uses of Carbonates
- 2.B.8.B Ethylene production
- 2.D Non-Energy Products from Fuels and Solvent Use
- 2F Product Uses as Substitutes for Ozone Depleting Substances
- New categories included in Regulations dated 2006

2.2.2.1. Total emissions in the sector

Inventory of greenhouse gas emissions for the period from 2011 to 2013 in has been done for "Industrial processes and product use" sector of Azerbaijan.

Direct greenhouse gas emissions (CO_2, CH_4 and N_2O), including CF_4 and C2F6 gases were assessed in inventory. Total amount of emissions were converted to CO_2 equivalent amount in accordance with the IPCC methodology and were assessed for each year.

The information on the amount of produced and consumed products was collected respectively for assessment purposes. Information was obtained from State Statistics Committee, Ministry of Energy and Economy, relevant companies and agencies.

Precursor emissions (NO, CO, NMVOC, etc.) might not be calculated according to new methodology. In fact, these emissions are analyzed by using other conversions and coefficients of EMEP/Cornier methodology.

The results of the inventory are shown in the following table 11.

Table 11.Total emission from Industrial Processes and Product Use sector, thousand tons CO2 eq.

Source	**2011**	**2012**	**2013**
Cement production	465,09	658,06	721,76

Lime production	1,65	12,68	8,03
Ethylene production	179,30	159,95	181,52
Iron and Stell production	401,85	470,85	270,51
Aluminum production	107,30	864,74	839,50
Lubricant use	24,70	24,76	26,35
Product uses and substitutes for ozone depletiong substances	1142,57	1248,93	1341,35
Total for IPPU	**2322,46**	**3439,97**	**3389,02**

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

Cement production;

- Lime production;
- Iron and Steel production;
- Aluminum production.

This category also includes "Ethylene production". However, CH_4 emission was estimated for this category, but it did not include CO_2 gas. Since the amount of CH_4 emission was very low, it was not included into the table. In addition, the categories of "Lubricant production" and "Alternate products and permanent cooling systems" were included into Industrial processes and Product use sector.

Recently, industrial sector of Azerbaijan has started developing rapidly. A wide range of products has been and is being used in industry. Obviously, industrial development causes increase of greenhouse gas emissions from technological processes. Calculation of greenhouse gas emissions for 2011-2013 years in Industrial Processes and Product Use sector has been reviewed.

2A. Emissions from production of mineral products

This category includes:

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

First three of above mentioned processes exist in the country. The greenhouse gas emissions from such processes were researched and assessed. Since the glass production volume is much lower than other available production fields, it was not considered, while others were not determined in the calculation period.

2A1. Cement production

The largest waste source in the category of mineral production is the cement production. This process causes CO_2 emissions. Data on cement production in the country per year is shown in the reports of State Statistics Committee. However, these reports do not include data on clinker production, which leads to some uncertainties. So, emission of CO_2 gas into the atmosphere is caused by clinker formation. Information on the amount of produced clinker eliminates uncertainty during double calculation. Because, some part of cement produced in the country are formed from imported clinker.

Considering the above mentioned, the ministry of Ecology and Natural Resources has requested information from the Ministry of Economy and obtained the following information (table 12).

Table 12. Clinker production, 2011-2013, thousand tons

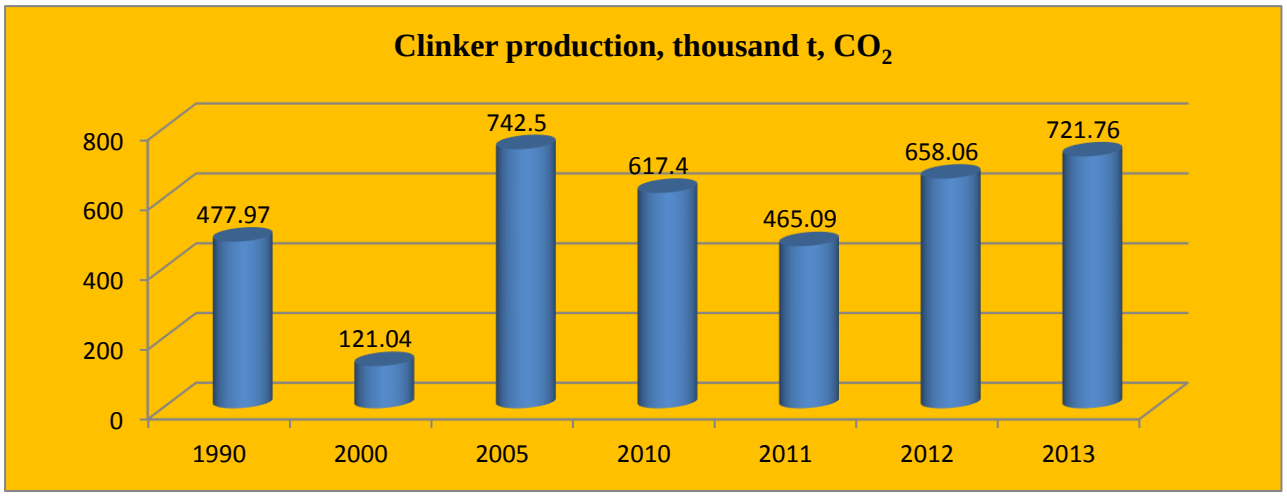
Product	**Unit of measurement**	**2011**	**2012**	**2013**
Clinker production	Thousand ton	1425	1966	2296
Natural aluminum, rough production	Thousand ton	6,8	54,8	53,2
Production of construction glass	Thousand sq m	1,4	1,5	0,1

At present, there are four cement factories in Azerbaijan:

- "Holcim-Azerbaijan" – annual production capacity is 1.7 mln ton. This factory meets modern requirements and is supplied with equipment made in USA, Germany, Italy, Switzerland, and other developed countries. Old four furnaces working by "wet method" were replaced with one furnace lining, working by "dry method". It caused decrease of carbon gas amount per unit product.
- "Norm" cement factory with 2 million ton annual production capacity. "Norm" cement factory has been functioning since 2014. This cement factory is the largest factory involved in cement production not only in Azerbaijan, but also in South Caucasus.
- "Gazakh Cement Factory" with 1 million ton annual production capacity. Cement production lining was put into operation in April, 2013 while clinker production line was put into operation in August, 2014.
- Nakhchivan cement factory with 800 t production capacity. All the raw material and additives, including limestone, ferrous clay, quartz, and gyps are obtained from mines located in Kangarli, Sharur and Babek districts of Autonomous Republic.

IPCC general coefficients and information on annual clinker production were used to calculate CO_2 amount released to atmosphere from cement production. Selection of coefficient was carried out based on % share of CaO substance (more than 65%) in the composition of raw material. CO_2 emission released from cement production was calculated in accordance with annual production data and composition related coefficient (diagram 11).

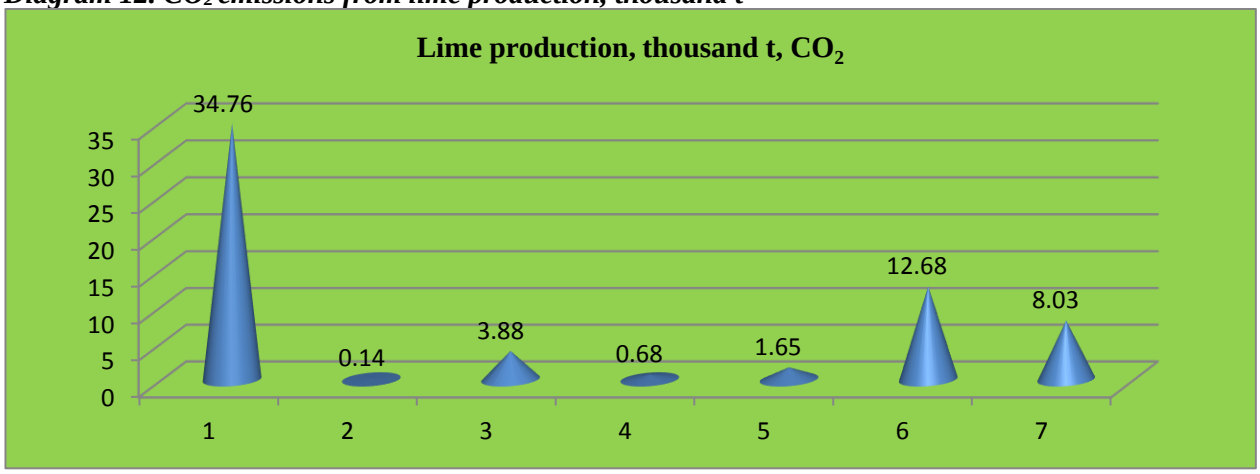
Diagram 11. CO_2 emissions from cement production



2A2. Lime production

Lime production was one of the most developed fields in the country until 1990's. Large lime manufacturing factories and many small enterprises were functioning the country. However, lime is produced only in small enterprises according to the demand (diagram 12). This information can also be found in the data. In fact, the amount of lime produced in 2012 was more than that in 2013.

Diagram 12. CO_2 emissions from lime production, thousand t



2B. Emissions from chemical industry

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

- 2B1. Ammonia production;
- 2B2. Nitric acid production;

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

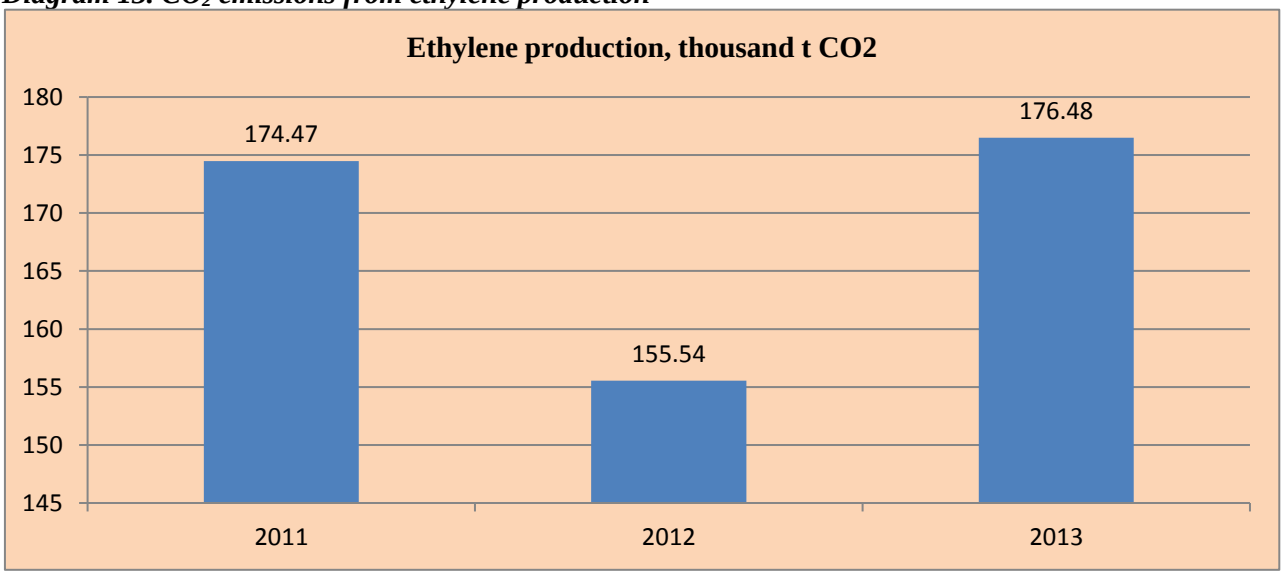
The chemical industry in Azerbaijan, being part of the former Soviet Union, has undergone enormous development. After the collapse of Soviet Union, chemical industry was subject to a decline. Only ethylene-polyethylene production field of large chemical industry has survived thus far.

2B8. Petrochemical and Carbon Black Production

Ethylene production

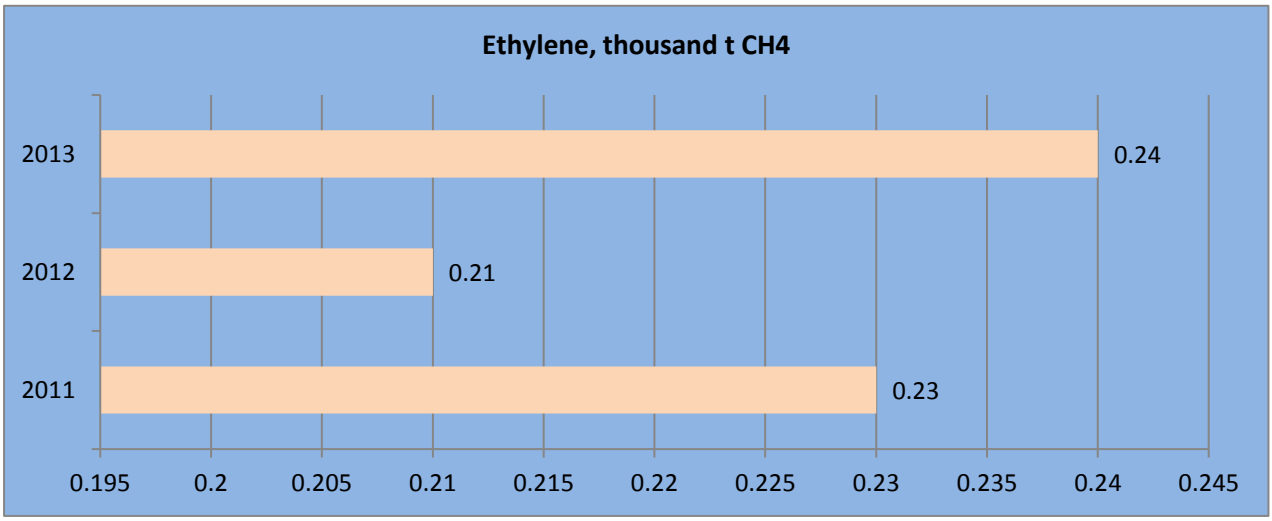
Based on IPCC (2006) methodology, CO_2 and CH_4 emissions are released to the atmosphere from ethylene production (diagram 13 and diagram 14). Ethylene production is carried out in Ethylene-Polyethylene Factory of "Azerikimya" PU as intermediate material. The factory has been recently reconstructed.

Diagram 13. CO_2 emissions from ethylene production



Note: Despite ethylene, propylene, butadiene, aromatic hydrocarbons or other substances released from steam cracking process, total CO_2 emissions are calculated based on total amount of produced ethylene. In accordance with IPCC practice, emission factor released from every unit of ethylene production was 1,73ton CO_2. CO_2 released from ethylene production was not taken into consideration in IPCC (1996) methodology.

Diagram 14. CH_4 emissions from ethylene production



It is to note that, CH_4 emissions from ethylene production were not taken into account in IPCC (1996) methodology as well. Emissions released from ethylene production were not taken into consideration in this methodology. Emission coefficients in this report were taken from IPCC (2006) methodology.

2C. Emissions from metal industry

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

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

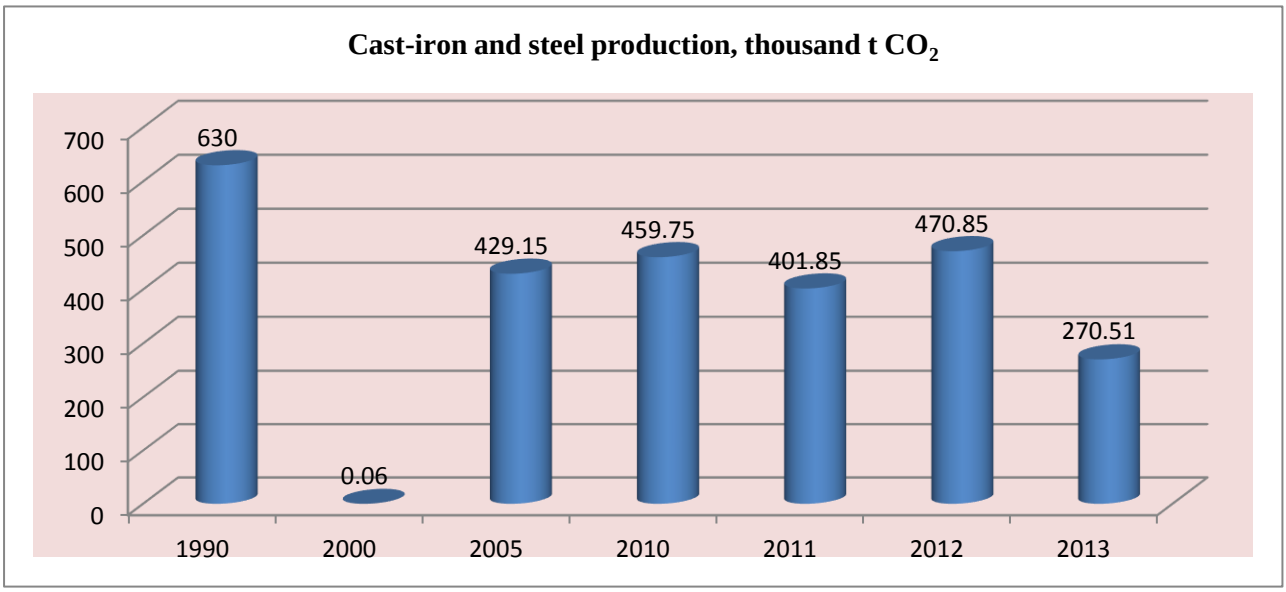
Only two out of above listed subcategories exist in Azerbaijan: 2C1 and 2C3. The emissions from these two categories are assessed below.

2C1. Iron and Steel production

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

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

Diagram 15. CO_2 emissions from cast-iron and steel production



Note: Common emission coefficient was accepted 1,06 ton CO_2/ton in accordance with IPCC (2006) methodology. This coefficient was 1,5 ton CO_2/ton in IPCC (1996) methodology.

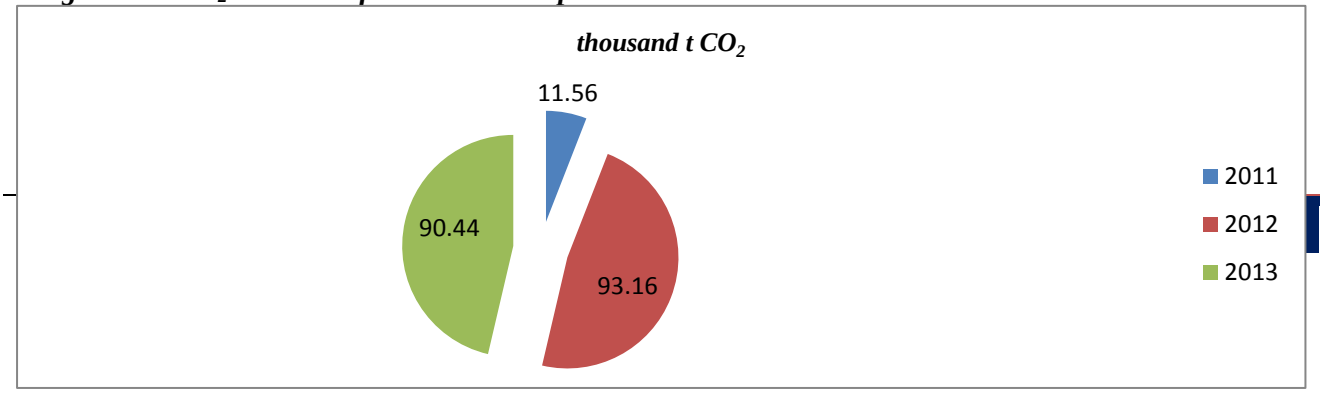
2C3. Emissions from Aluminum production

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

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

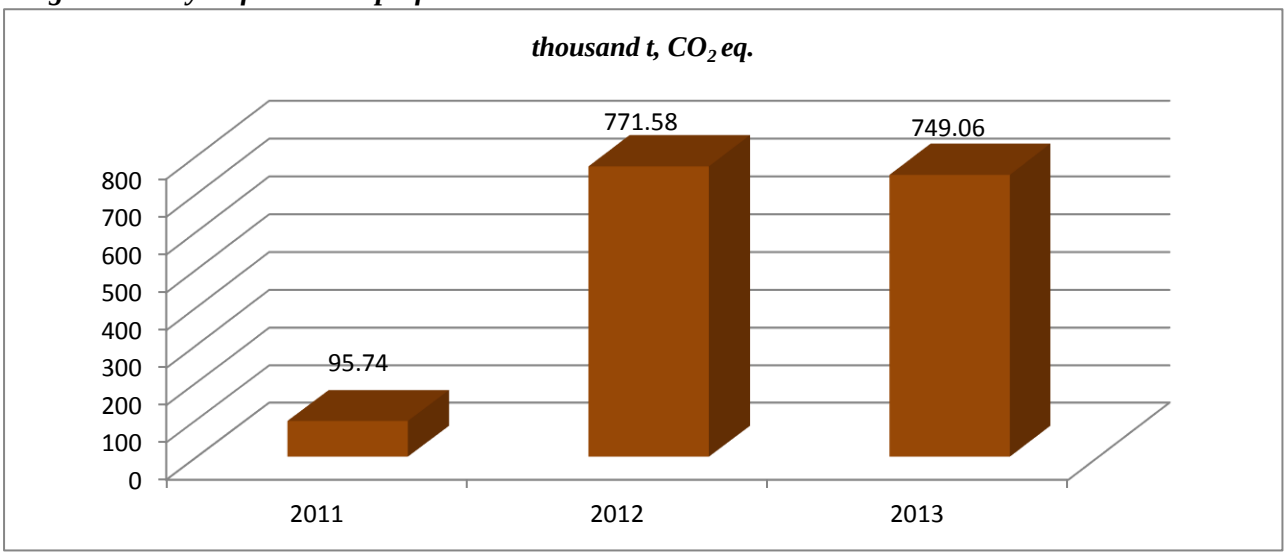
Annual production capacity of the Complex is 50.000 tons. Preliminary production capacity in Sumgait Aluminum Factory is 60 thousand ton/year. Second phase is under completion at present. It is planned to increase annual production capacity of Det.Al Aluminum Complex Electrolysis Plant up to 200.000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

Diagram 16. CO_2 emissions from aluminum production



In addition, CF_4 and C_2F_6 gases are released during production. The amounts of the gases are taken from the final results calculated by the program (diagram 17).

Diagram 17. Hydrofluoro and perfluoro carbons



2D1.Assessment of CO_2 emissions released from use of oil lubricants as raw materials

It might be better to carry out the assessment of greenhouse gas emissions based on the information obtained from enterprises using this raw material. However, obviously, it is not always possible to get such information. Application of "non-energy use" term varies in different countries.

Oil lubricants are the liquids used as lubricants. It is divided into petroleum oil, synthetic oil and half-synthetic oil for its composition. Whereas for the purpose intended is divided into the following groups:

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

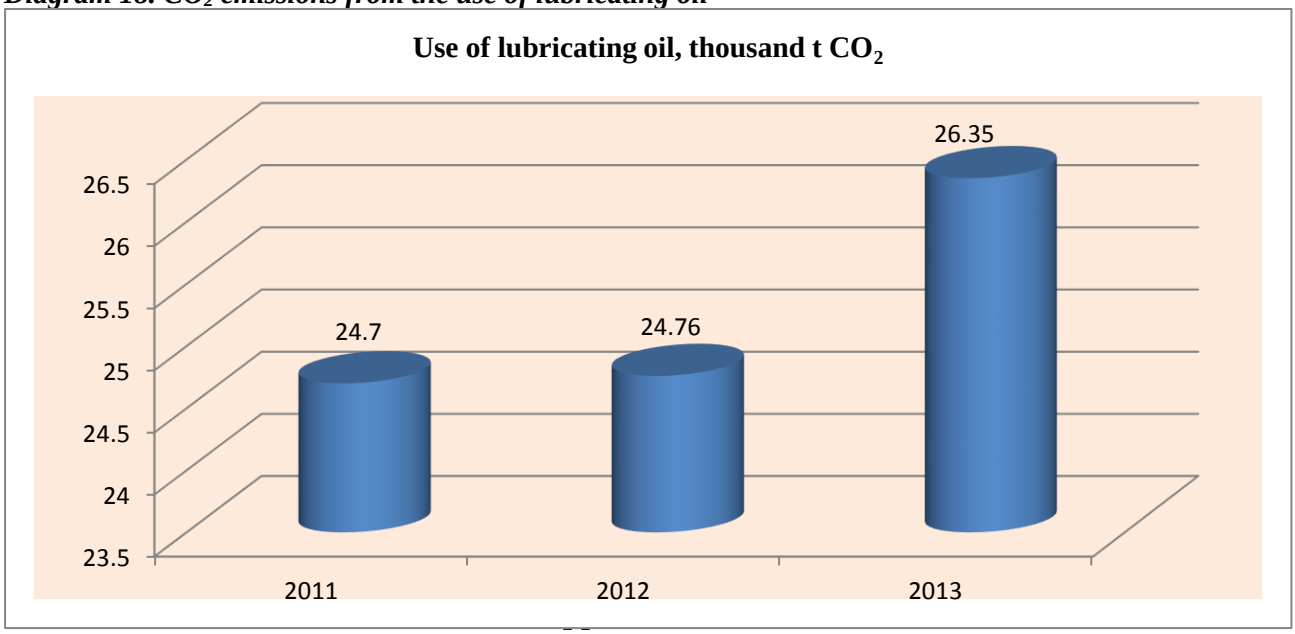
"Alco Lubricant Company" intends to construct a lube producing factory in Sumgait Chemical Industrial Park. The factory with 30 thousand tonsq2 annual capacity will be put into service at the end of 2017. The factory will employ about 100 people. The products to be manufactured by the factory will be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

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

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

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

Diagram 18. CO_2 emissions from the use of lubricating oil



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

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

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

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

Other application fields, such as cleaning with aerosols and solvents might have short-term fund resources; however, they might be considered as temporary emission sources from the point of emission assessment. This statement is applied for flexible foams (usually open cell foam as shown in the figure).

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

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

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

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

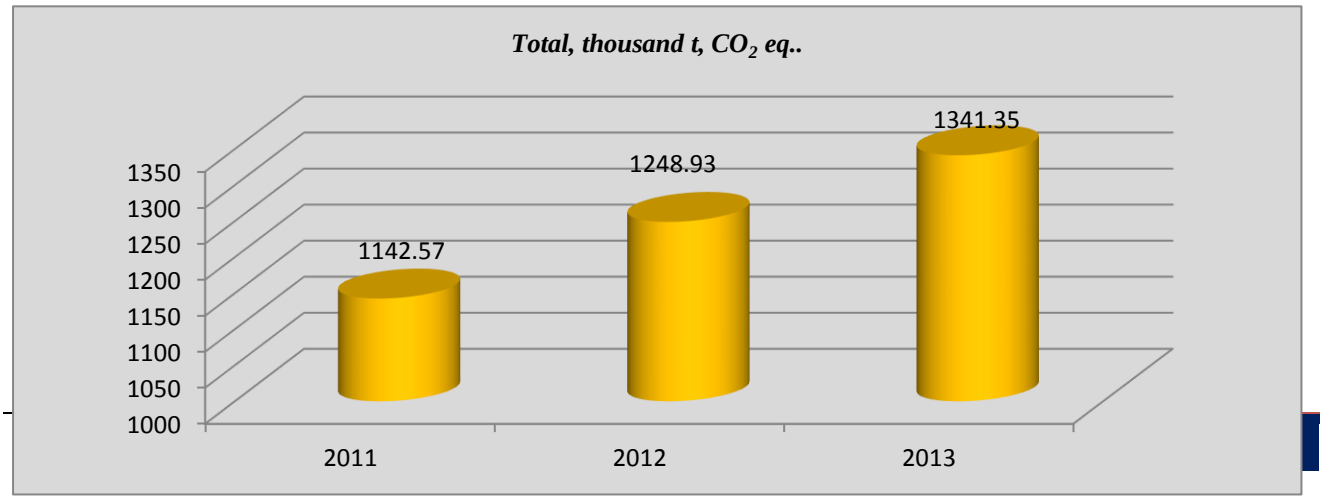
Consumption of individual gas patterns shall be determined. Thus, it is possible to assess emissions from these chemical substance groups to global warming with adequate accuracy.

2F7.5. Use of Chemical substances in ventilation and cooling systems

This category describes the assessment of greenhouse gas emissions released from the use of chemical substances (alternatives of ozone depletion substances) to the atmosphere. Inventory of greenhouse gas emissions from the substances included to this category was described in the report developed by

German Agency for International Cooperation (GIZ) in 2013-2014. The results of inventory from the report are shown below:

Diagram 19. Emissions from the use of chemical substances in ventilation and cooling systems



2.2.2.2. Variations adopted from 1996

Major modifications and additions in this section were made for the “Industrial processes" and "Use of Solvents and other products" sections of *IPCC, 1996 Updated Guidelines on National Inventory of Greenhouse Gas Emissions (1996 IPCC)*. Firstly, this Guideline describes practical guidance on carbon dioxide emission released from fuel burnout in Energy Sector and Industrial Processes Sector, which is not clearly outlined in 1996 IPCC Guideline. Secondly, the principle to carry out emission calculation in industrial fields is applied in this Guideline. As such, several emission categories, especially those released from the use of limestone, dolomite and other carbonates were subject to variations.

A3.1 Mineral industrial emissions

2006 IPCC Guideline includes three main variations related to mineral section if compared with previous guidelines. Firstly, new method is applied for all source categories, and emissions are assessed according to the quantity, type and composition of carbonate participating in production fields. For example, alternative emission assessment method according to carbonate quantity loaded to the furnace is being developed in addition to Level 2 method which is based on clinkerization during cement production.

Secondly, it includes detailed and accurate guideline on distribution of emissions released during use of limestone, dolomite and other carbonates according to sections on inventory. As mentioned above, this Guideline is based on the principle which means that, emissions are to be considered according to industrial fields they are released from. For example, if limestone is used as a flow for steel production, emissions from limestone use shall be calculated in iron and steel production section. Limestone and dolomite emissions used in mineral industry might be considered under Mineral Industry. Inventory developers are recommended to assess carefully the possible impact of this variation particularly on Mineral Industry, Chemical Industry and Metal production.

In addition, the previous guideline considered the use of only limestone and dolomite, while this Guideline describes methods on assessment of emissions from other carbonates such as magnesium and natrium carbonate. Furthermore, this Guideline determines three concepts to assess emissions released during glass production. The Substances composed of carbonate (such as phosphate ore) include CO_2 released from interaction with acids, are not subject to special assessment methods.

A 3.2 Emissions from chemical industry

New emission sources are: Nitrogen 1 oxide (N_2O) emissions from Caprolactam, Glyoxyle and Glyoxylic acid production and CO2 emissions from titanous dioxide production. Sodium production is removed from Mineral Industry to Chemical Industry category. Calcined soda production includes methodology of synthetic calcined soda production process (solvent processes), which is included in Good Practice Guidance and Uncertainty management (GPG 2000) in 1996 IPCC Guidelines and National Inventory of Greenhouse Gas Emissions.

CO_2 emission factors for petrochemical production processes including methanol, ethylene, ethylene dichloride/vinyl chloride, ethylene oxide, acrylonitrile and soot production have been

considered. Methane emission factors for these petrochemical processes were updated. Styrol production is no longer included to this guideline. Systematic description of Level 1, 2 and 3 methodologies for all the source categories is given herein.

Emission related processes, including their chemical and technological aspects have been detailly described.

More systematic guideline is described therein to prevent re-calculation of petroleum products used as raw materials or reductants (cross-cut with Energy Sector). This issue is discussed on the sections on ammonia production, carbide production, titanous dioxide production and petrochemical industry as well.

The use of CO_2 in carbamide production is included to Ammonia Production Section. Emissions released from use of carbamide substances considered within Industrial Processes Sector were re-distributed according to carbamide involving fields (Energy Sector and Agriculture, Forestry and Other Land Use) in order to calculate carbamide export from Ammonia factories more accurately. Other emissions from chemical substances produced by using CO2 released during ammonia production are calculated together with emissions from ammonia production, as before.

Methodology on calculation of HFC-23 emissions released from HCFC-22 production embraces sustainable direct, indirect technological calculations in Level 3, efficiency based material balance methods in Level 2 and main tools applied in industry.

In addition, clear guideline on fugitive and additional product emissions released from production of other fluor combinations, including hydrofluorocarbons (HFC), sulfur hexafluoride (SF_6) and uranium hexafluoride (UF_6) have been added as well.

A3.3 Emissions from metal industry

2006 IPCC Guideline includes several variations in Metal Industry Section. If carbon and carbon-bearing materials (including carbonate-bearing minerals) are used for the purposes other than energy production in metal production process, CO_2 emissions shall be calculated within metal industry. For example, CO_2 emissions from carbon-based electrodes for aluminum production are included into guideline for aluminum, while CO_2 emissions from limestone and dolomite used for cast-iron and steel production are included to the guideline on cast iron-steel production.

Metal Industrial Section includes guideline on assessment of CO_2 and CH_4 emissions from metal (coal) coke production, however CO_2 and CH_4 emissions from metal coke production shall be presented under “Energy Sector”, not under “Industrial Processes and Product use”

Emission factors for the production of raw materials from direct iron, iron ore and other iron-bearing materials are included into cast iron-steel production section. CO_2 emission factors for steel production are represented separately by using blast furnace iron production, oxygen convector, electric arc furnace and open hearth furnace processes.

CO_2 emissions of preliminary magnesium production from raw dolomite and magnesite are included in this section. Furthermore, new guidance was developed to calculate CO_2 emissions from zinc and lead production. CO_2 Emission factors are submitted separately for primary and secondary

lead, zinc production processes. Detailed guidance on iron alloy production processes is included therein. New guidance on magnesium was proposed in *IPCC 2006 Guideline* to describe growing efforts towards substituting sulfur hexafluoride as cover gas. Finally, measurement coefficients of disposals were revised and typical compositions and, in some cases, new equations were added based on the experiences gained recently.

A3.4 Use of solvents and non-energy products from fuel

This source category described in Chapter 5 was copied and updated under Industrial Processes and Product Use sector.

1996 IPCC Guideline reviewed disposals from asphalt pavement with few details. This edition reviews lubricants, solid paraffin, bitumen/asphalt and solvents. Emissions from lubricating materials were included to fuel burnout before; there was no difference between emissions released from use of oils and those released from use of waste oil. This is similarly applied for solid paraffins. Asphalt emissions include the production and use of asphalt for pavement, roofs and other purposes. Asphalt emissions also include emissions released during asphalt cleaning work.

2D3 "Use of solvents" sub category is included in 3A and 3B sub-categories in *1996 IPCC Guideline.* Despite the fact that, asphalt and solvents are not direct and significant greenhouse gas emission sources, they are included in this chapter, because non-methane volatile organic compounds and carbon monoxide (CO) emissions (in asphalt form) are released from ozone precursors. Particularly, solvent use is the main source of non-methane volatile organic compounds.

A3.5 Emission from electronic industry

1996 IPCC Guidelines and GPG 2000 included emission assessment methods on semi-conductor production for CF_4, C_2F_6, CHF_3, C_3F_8, c-C_4F_8, NF_3 and SF_6. In *2006 IPCC Guidelines,* list of gases has been enlarged, other gases production sectors has been included, level 1 emission factors in methodology has been updated and clear assessment of uncertainties on emission factors and performance data has been presented. *2006 IPCC Guidelines* include emissions released from use of heat conductors in liquid crystal displays, photoelectric elements (PV) and semiconductor production. In addition, *2006 IPCC* has increased number of greenhouse gas emissions by inclusion of difloromethane (CH_2F_2), octofluorosiclopenthane (C_5F_8), hexafluorobutadien (C_4F_6) and octafluorotetrahydrofuran (C_4F_8O). Though F_2 and COF_2 are not greenhouse gases, they might form CF_4 when used. New emission coefficients and new level 1 methodology which covers performance data about every sector are adopted in the Guideline.

A3.6 Emission from Fluorinated alternatives of ozone depletion substances

Emissions from some source categories included in this chapter (Appendix) was the research subject after development date of *1996 IPCC Guideline.* This, especially, includes sectors with delayed emissions (such as, cooling, foaming and fire-protection). 2006 IPCC Guideline revises previous emission coefficients and shows adequate intensity of emissions from different sub-categories. Most of these are included in GPG 2000. One of the results of updated definition is that,

potential emission assessment in Level 1 of *1996 IPCC Guideline* is not accepted herein. Potential emission method is considered as a tool to check the integrity of sources, quality of general information about performance of every compound, which shall be equal to total consumption amount within the country calculated under potential emission method.

Currently, Level 1 approaches proposed in this Guidelines are considered as actual emission calculation methods, though their coefficients have often been justified for "default". In case of lack of proper information, world/regional information on performance might be used. Simplified mass-balance methods are applied in different sectors; they, as a rule, are applied to calculate emissions from operation and service of hermetically sealed equipment (cooling and fire prevention). It is necessary to note the properties of calculation of wastes from solvents in aerosols: regardless of their applications, emissions from aerosol products are included to aerosol section.

Performance data, particularly in country level, is still the biggest problem in the field of ozone depletion substance alternatives. Firstly, it is not easy to control trading of products composed of HFC's and/or perfluorocarbons (PFC). Secondly, it is necessary to protect confidentiality of performance data on special chemical substances. Therefore, World/regional information on the performance obtained from reliable sources in some countries might be very useful to develop reports; IPCC might be recommended as a main source of such information. Though, the use of Emission Factor Database assures accuracy of information, inventory developers shall be sure about utility of such information for their countries.

A3.7 Production and use of other products

1996 IPCC Guidelines considered only two methods to assess SF_6 emission from electric equipment:

(1) potential emission method which equals emissions to chemical composition, and

(2) simple method which is based on emission coefficients

According to the practice, national or global emission coefficients are multiplied to SF6 amount in the operation or suspended equipment. *GPG 2000* includes 3 levels and 3 mass balance methods. However, Level 2 which is based on emission coefficients is a more detailed method and considers application of certain coefficient of wastes for each phase of service period. In addition, in *GPG 2000*, regional coefficients of wastes are based on general coefficients for Level 2 methods.

2006 IPCC Guidelines includes following simplification in comparison with GPG 2000. (1) level 3 one elastic method is included instead of Level 3 two mass balance method, which is based on mass-balance component and emission coefficients;; (2) country level mass-balance method is transferred to QA/QC section; (3) Potential emission assessment method is transferred from the section on method selection to different section, where it might be applied for QA/QC; and (4) emission coefficient based method for "default" is used instead of potential emission method, which was transferred from Level 2 to level 1

As a result of such variations, one method has remained out of each Level 3, Level 2 and level 1 methods. Regional emission factors shown in *GPG2000* are updated and coefficients for new equipment types and sections are included in this method.

Finally, this *Guidelines* includes new guidance for selection and use of alternative performance information, in case the information required hereunder is not available for all the agencies. Such updates cover the experience gained within last years of reporting.

Special methods to assess emissions from research and industrial amplifiers and surveillance aircrafts (such as, AWACS) are added to "Use of SF_6 and PFC in other products" section. The list of possible SF_6 and PFC sources was submitted to cadastre developers. In addition, guidance on N_2O emissions from the use of products (such as medical) has been improved.

A3.8 Assignment and integrity of CO_2 emissions from non-energy use of fuel

Two methods were included for quality control (QC) while checking integrity of CO_2 emissions released from use of fossil fuel as a raw material or reductant - *checking CO_2 integrity and raw material balance*. This task covers the following phases:

- Verifying integrity and approval of total amount of CO_2 emissions released from non-energy sources (including its use as a raw material or reducing agent) through calculation of different subcategories in ascending order;
- Checking the balance between process demands/non-energy use and reductant/national statistic indicators and raw material delivery.

2.2.3. Agriculture, forestry and Other Land Use

Calculation of CO_2, CH_4 and N_2O gas emissions (re-calculation as of 2011-2012 and calculation as of 2013) from 3 sub-sectors, such as cattle-breeding, land use and other sources was carried out based on IPCC guidelines during the calculation of greenhouse gas emissions from agriculture, forestry and other land use sector. The results are shown in the following table:

Table 13. Emission from Agriculture, forestry and other land use sector, in CO_2 equivalent, thousand tons

N	Sources	2011	2012	2013
3.A.	***Livestock***	**4306**	**4427**	**4466**
3.A.1	Enteric fermentation	3573	3682	3713
3.A.2	Manure management	733	745	753
3.B	***Lands***	**-5718**	**-6026**	**-6220**
3.B.1	Forest lands	-5908	-6121	-6248
3.B.2	Cropland	1710	1744	1733
3.B.3	Grassland	-1519	-1649	-1706
3.C	***Aggregate sources and non-CO2 emission sources on land***	**2221**	**2204**	**2252**

3.C.1	Emissions from biomass burning	1.7	1.5	1.9
3.C.3	Urea applications	15	21	21.5
3.C.4	Direct N_2O emissions from managed soils	1886	1929	1915
3.C.5	Indirect N_2O emissions from managed soils	10	80	19.1
3.C.6	Indirect N_2O emissions from manure management	271	156	279
3.C.7	Rice cultivations	17	16	15.6
Total emissions		**8237**	**8237**	**8375**
Total absorption		**-7427**	**-7427**	**-7770**

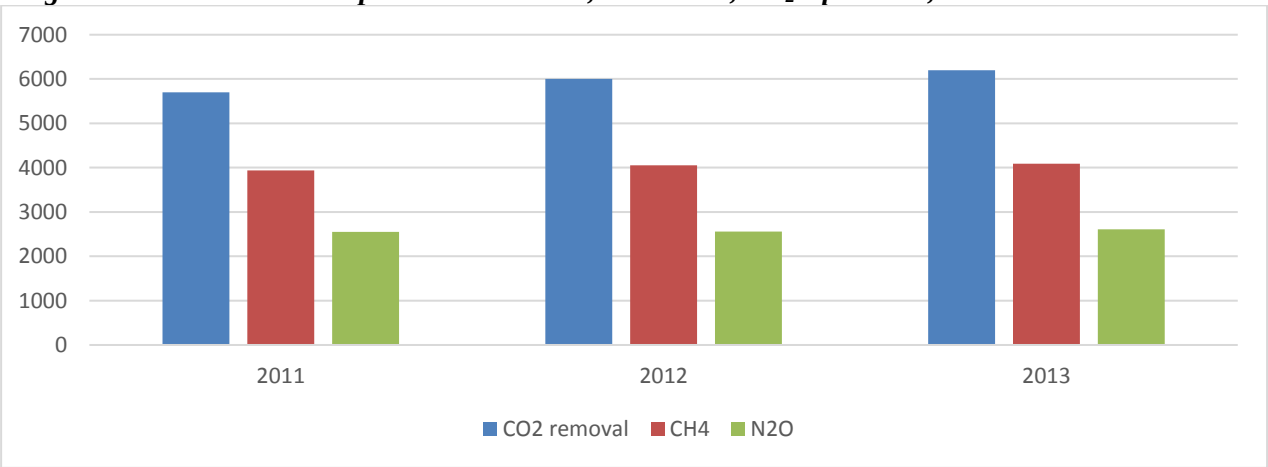
The following table shows greenhouse gas emissions/disposals in 2011-2013 years from agriculture, forestry and other land use:

Table 14. Greenhouse Gas Emissions/absorption of the sector, thousand tons

Sources	**2011**	**2012**	**2013**
CO_2	-5703	-6005	-6200
CH_4	187.47	192.93	194.62
N_2O	8.24	8.25	8.42

As for change tendency of greenhouse gas emissions of the sector in 2011-2013, it is to note that, absorption and emissions increased every year. It is caused by the development of sub-sectors of plant-growing and cattle-breeding and increase in the number of arable land plots and animals. One reason of the increase in absorption in the sector is the expansion of forests and tree-planting, while the other reason is the inclusion of agricultural orchard fields in the calculations based on IPCC new methodology.

Diagram 20. Emissions/absorptions in the sector, 2011-2013, CO_2 equivalent, thousand tons



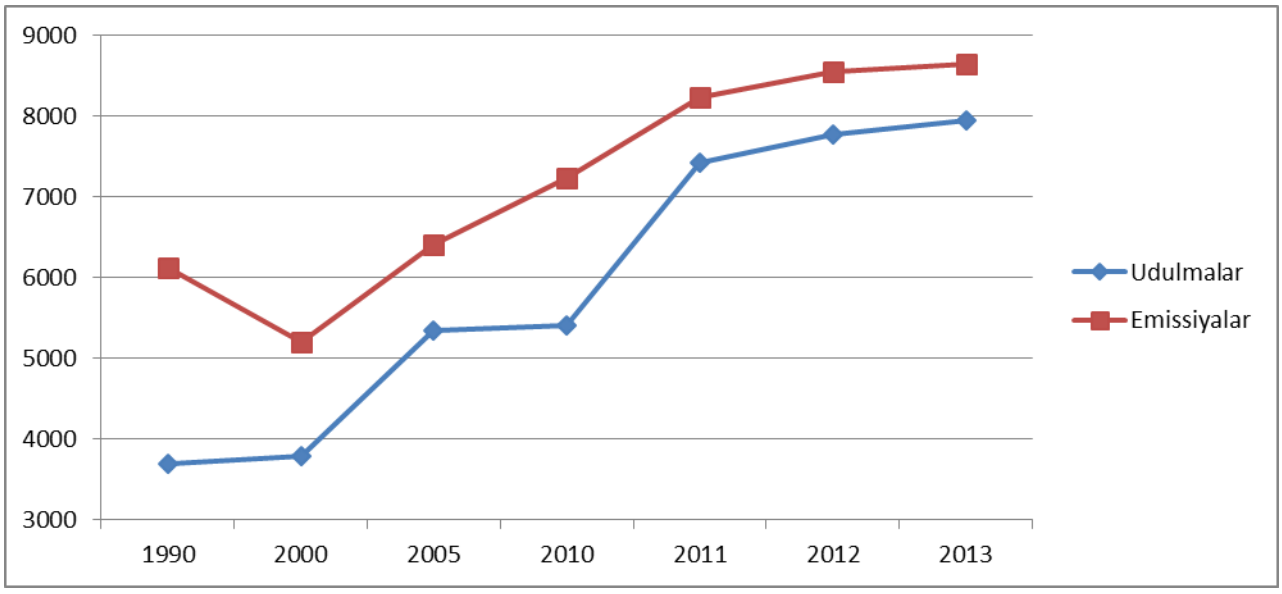
It is to note that, recent significant increase in the number of cattle in the Republic of Azerbaijan has played an important role in the increase of methane emissions (CH_4). Based on the calculations, it was found out that CH_4 emissions in agriculture has increased for 51% in 2013 comparing to 1990. In fact, decrease in the number of cattle in 1990-1994 simultaneously caused the reduction of CH_4 emissions. However, the development of cattle-breeding has had its impact in this field. Consequently, comparing to 1990, 53% increase of emissions during enteric fermentation while 40% increase in manure management was observed in 2013.

Since the rice production covers limited area in the Republic of Azerbaijan, its share in CH_4 emission was only 0.17 tousand tons in 2013. Meanwhile, burning of agricultural residue happens very rarely in the country. On the other hand, Milli Majlis (National Assembly) of the Republic of Azerbaijan made several supplements to the legislation and punishments were determined for burning the arable lands. In fact, New Clause no. 244.1 (Burning Arable lands) was added to the Code of the Administrative Offences. It says that, physical entities shall be penalized from four hundred manats to six hundred manats, while legal entities shall be penalized from one thousand five hundred to two thousand manats for burning arable lands. Consequently, methane emissions from agricultural residue burning decreased for 71% in 2013 comparing to that in 1990.

As a result of successful policy and measures taken in the field of forestry, carbon absorption in the sector is increasing. In general, carbon absorption in the sector (from forests and pastures) of agriculture, forestry and other land use has increased twice comparing to 1990. It is necessary to note that, new IPCC 2006 methodology has resulted in measuring the carbon absorption more accurately.

"Change tendency" in Greenhouse gas emissions/absorption from Agriculture, forestry and other land use is shown in the following diagram:

Diagram 21. Change tendency in emissions/absorption from agriculture, forestry and other land use, 1990-2013, thousand tons



2.2.3.1. Cattle

It is to note that, recent significant increase in the number of cattle in the Republic of Azerbaijan has played an important role in the increase of methane emissions (CH_4). Based on the calculations, it was found out that CH_4 emissions in agriculture has increased in 2013 comparing to 1990.

It is mostly observed during Enteric Fermentation and manure management.

Table 15. CH_4 emissions in cattle-breeding sub-sectors, thousand tons

Sources	**2011**	**2012**	**2013**
Enteric fermentation	170.17	175.35	176.82
Manure management	16.44	16.77	16.96
Total	**186.61**	**192.12**	**193.78**

As for N_2O emissions in cattle-breeding sub-sector, emissions from manure management increased in 2013.

Table 16. N_2O emissions in cattle-breeding sub-sector, thousand tons

Sources	**2011**	**2012**	**2013**
Manure management	1.25	1.27	1.28
Total	**1.25**	**1.27**	**1.28**

It is to note that, during inventory for cattle-breeding sub sector, Tier 1 emission coefficients were used based on IPCC 2006 method. The probability level was taken $\pm$20%. Official statistic data was used for inventory.

Re-calculation carried out in 2011-2012 showed the figures which are different from the inventory figures for cattle-breeding sub sector obtained during development of Third National Communication report. The difference in the figures might be explained by the fact that, the previous inventory was carried out by updated IPCC 1996 method, while the present inventory was carried out by IPCC 2006 method.

2.2.3.2. Land use

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

causing low share of agriculture in emissions. It is to note that, invasion of more than 20% territory of the Republic of Azerbaijan, that is, some part of arable lands by Armenia is one of the main factors causing probability in the calculation of emissions in this field.

IPCC 2006 guideline was used while calculating the greenhouse gas emissions in this sub-sector. Emissions/absorptions were re-calculated as of 2011-2012 and calculated separately as of 2013.

Forestry

The forests in the Republic of Azerbaijan are of no industrial importance; however they are exposed to sanitary cutting. Forests play the role of land protector, adjuster of water regime, shelter for biodiversity, microclimate controller, carbon saturation, etc.

In Azerbaijan, total area of the forest is 1021 thousand ha, which covers about 12% of the country. At present, 261 thousand ha of the forest area is under Armenian invasion.

It is to note that, the areas covered by forest, as well as the trees and bushes in non-forest fields and orchards in agricultural lands have been taken into account during the present inventory. However, IPCC 1996 method which was applied in the previous calculations did not consider them, which caused incorrect calculation of absorption levels in these sub-sectors.

Based on official statistic data, in 2013, the last inventory year, the total area of orchards was 134.231 ha in Azerbaijan Republic. The number of fruit-bearing trees (113.936 ha) was also taken into consideration during the calculations. Young plants and trees will be taken into account in the calculation during the next inventory.

Trees and bushes growing in areas of non-forest fund were also taken into account during this inventory. According to the information obtained from relevant regional agencies of the Ministry of Ecology and Natural Resources and local authorities, fields (parks in the rayon centers, gardens in the settlements and villages, the areas owned by municipalities, fields around the highways, railway roads and water facilities field-protecting forests) with trees and bushes of non-forest fund covered 262.318 ha area in 2013.

Criteria such as variations in forest and other tree resources, fires occurring in the forests and deforestation were considered during the inventory and calculations were carried out accordingly. It is to note that, biomass burned as fuel for heat and power was not considered in forest sector. This item was shown in the category of energy.

Table 17. Emission/absorption in forestry, thousand tons CO_2 eq.

Source	**2011**	**2012**	**2013**
Forests	-4474.88	-4595.26	-4616.58
Trees and bushes of non-forest fund	-724.75	-744.02	-778.96
Orchards	-709.01	-781.95	-852.92
Total	**-5908.64**	**-6121.23**	**-6248.47**

These calculations have been based on IPCC 2006 Guideline. In fact, the forests were divided into 4 categories according to climate regions. Proper types of trees were selected for such regions, while some forests were grouped as coniferous and deciduous. Ages of the trees were determined. Meanwhile, relevant emission coefficients for the volume of above and below ground biomass, carbon resources in forest humus and other indicators were determined. The level of probability was determined at ± 30 during calculations. Official statistic data, as well as the information obtained from Forests Development Department of the Ministry of Ecology and Natural Resources and Regional Ecology Agencies was used for inventory.

Re-calculation carried out as of 2011-2012 resulted in figures which are different from inventory figures obtained for forestry during the development of Third National Communication report (in the previous inventory the indicator as of 2011 was -5435 thousand ton while -5442 thousand ton as of 2012). The difference in the figures might be explained in two ways: the main reason is that the previous inventory was carried out by IPCC 1996 method, while the present inventory was carried out by IPCC 2006 method. On the other hand, the orchards in agricultural fields were taken into account in the present inventory.

These results prove that, forest restoration and rehabilitation works, as well as orchard planting in agricultural lands have caused increase of areas covered with forests and trees and this has also caused increase in the amount of carbon absorption. In fact, emission absorption was -3367 thousand ton in 1990, while it increased up to -3694 thousand ton in 2000 (calculated based on updated IPCC 1996 method) and -6.248 thousand ton in 2013 (calculated based on updated IPCC 2006).

Cultivated lands

Limited area of arable land plots in Azerbaijan is one of the factors causing low share of agriculture in emission. It is to note that, invasion of more that 20% territory of Azerbaijan, that is, some part of arable lands by Armenia is one of the main factors causing failure of accurate calculation of emissions in this field.

During calculation of greenhouse gas emissions in cultivated lands, such lands were grouped as annual and perennial according to IPCC 2006 method and Tier 1 emission coefficients were applied. This calculation mainly considered carbon emissions caused by land use and change of land use. The probability level was taken as ±20 during the calculation. Official statistic data and official data obtained from the Ministry of Agriculture was used for the inventory. It is to note that, agricultural vineyards have been expanded recently. According to official statistic data as of 2013, the total area of vineyards was 13.100 ha. Vineyards and tea plantations were taken into account in the current inventory based on the current methodology.

Table 18. Emissions from cultivated lands, thousand tons CO_2 eq.

Source	2011	2012	2013
Cultivated lands	1710	1744	1733
Use of other lands for sowing	0.03	7.09	8.96
Total	**1710**	**1751**	**1742**

As shown in the table, greenhouse gas emissions from cultivated lands have increased in 2011-2013 years. This has been caused by the expansion of agricultural cultivation areas. Especially, since 2011 the use of fertilizers in cultivated lands has been stimulated by the state. As a result, the import and use of fertilizers has been increased in the country.

Pastures

Pastures and hayfields cover up to 53.1% of arable lands in Azerbaijan (according to statistic data as of 2016, totally 2532.9 thousand ha). These areas are mostly characterized by carbon saturation.

Pastures were continuously expanded until 2005 (from 1970 to 2005, the total area of pastures and hayfields increased for 414 thousand ha). However, the area of pastures and hayfields has decreased since 2005. Comparing to 2005, the area of pastures and hayfields decreased for 161 thousand ha in 2016. In 2017, this tendency was followed. Therefore, assignment of 82888.5 ha area in order to establish large farms was changed in accordance with relevant disposals of the Cabinet of Ministers. The Ministry of Agriculture expressed positive opinion towards change of assignment to 36568.06 ha area, whereas changing assignment to 82742.2 ha area is under review.

During the calculations carried out based on IPCC 2006 methodology, summer and winter pastures, as well as the hayfields were grouped according to the type of climate and sort of lands. The erosion level was determined and greenhouse gas emissions were re-calculated for 2011-2012 and calculated additionally for 2013 by using Tier 1 emission coefficients. The probability level was determined as $\pm$ 40 during the calculations. Official Statistic data and official data from the Ministry of Agriculture were used for inventory.

Table 19. Emissions/absorption from pastures, thousand tons CO_2 eq.

Source	2011	2012	2013
Pastures	-1519	-1649	-1705
Total	**-1519**	**-1649**	**-1705**

As shown in the table, greenhouse gas emissions absorption from pastures increased during 2011-2013. It is mainly caused by the decrease of areas subject erosion as a result of continuous management of pastures.

Wetlands

According to data as of 2013, there are about 250 large and small marshy areas covering approximately 977 km^2 territory in Azerbaijan Republic which are included in hydrological network of the Republic. Marshy areas are distinguished for carbon absorption.

Based on IPCC 2006 methodology, marshy areas are divided into two categories: swamplands and wetlands. According to the methodology, Greenhouse gas emissions from marshy areas are calculated for the emissions released only during treatment of swamplands and any changes observed in the territory of wetlands. Since swamplands do not exist in the country and there is no change in the area of wetlands, emission release from marshy lands has not been taken into account during inventory.

Other lands

According to IPCC 2006 methodology, the category of other lands includes all the areas which are not covered in other categories, as well as bare grounds, sandy and rocky areas. Since these lands are not managed, greenhouse gas emissions or absorption from such areas are not calculated.

During this inventory, total area of other lands has been researched. The results of the analysis showed that, other lands (badlands) cover 27.7% percent or 2.397.725 ha area of our republic. 25.6% or 613.452 ha of this territory is covered by bare rocks, while 31.4% or 747.688 ha by clayey-salty rocks, 10.8% or 256.490 ha by riverbed sediments, 18.6% or 443.835 ha by technogeneous deformation areas, 2.1% or 50.000 ha by coastal sands and 12% or 286.260 ha by non-registered other lands.

2.2.3.3. Other sources and non-carbon emissions

According to IPCC 2006 methodology, emissions from fires in the forests, pastures, cultivated areas and other lands, as well as from rice plantations and other sources were calculated and taken into account during general inventory. (2011-2013)

During the Calculation, Greenhouse gas emissions were re-calculated for 2011-2012 and additionally calculated as for 2013 by using Tier 1 emission coefficients. The probability level was determined as ± 30 for calculations. Official statistic data and official data of the Ministry of Ecology and Natural Resources were used for inventory.

Table 20. Other sources and non-carbon emissions, for gases, thousand tons

Sources	**2011**			**2012**			**2013**		
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**
Biomass burning	-	0.082	-	-	0.070	-	-	0.093	-
Carbamide application	15			20.6			21.49		
Direct N_2O emissions from controlled lands			6			6.22			6.17

Indirect N_2O emissions from controlled lands	-	-	0.03	-	-	0.26	-	-	0.06
N_2O emissions caused by manure management	-	-	0.871	-	-	0.50	-	-	0.90
Rice cultivation	-	0.79		-	0.75		-	0.75	

As shown in the table, greenhouse gas emissions of this sub-sector are very low and have minor share in total emissions of the country

2.2.4. Waste sector

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

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

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

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

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

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

In the 2006 methodology of the Intergovernmental Panel on Climate Change (IPCC), the following categories of Waste sector are reviewed:

4A. Solid waste disposal;

4B. Biological treatment of solid waste;

4C. Incineration and open burning of waste;

4D. Wastewater treatment and discharge;

4E. Other

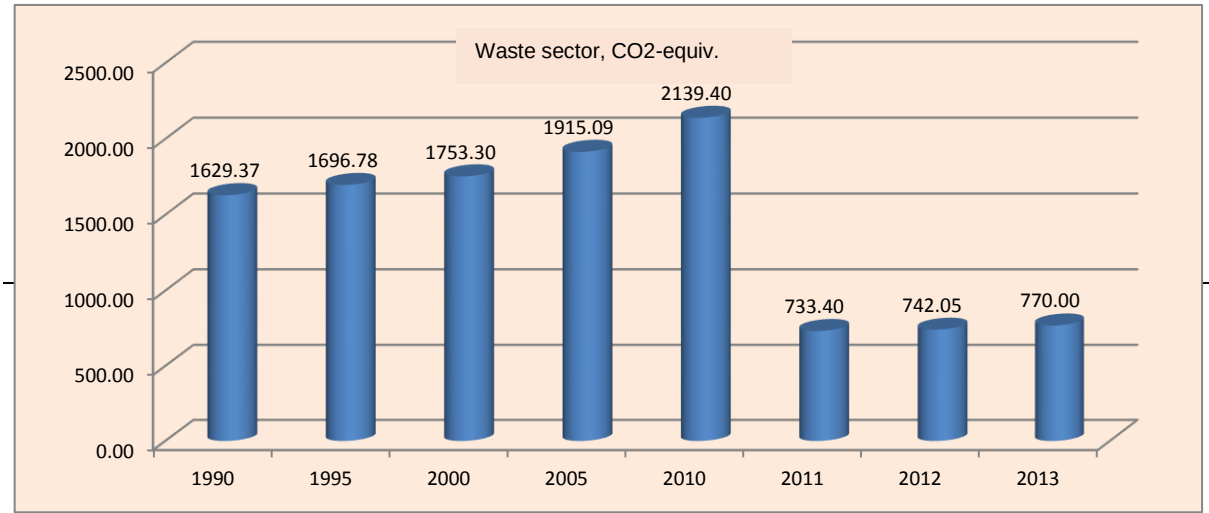
2.2.4.1. GHG Emissions in Waste Sector

Relevant organizational arrangements have been taken in order to perform inventory in the waste sector. Following the organizational arrangements, the collection of information from the respective organizations responsible for waste sources was started according to the IPCC methodology. In this regard, the information on the current situation of all waste landfills, as well as the amount of waste, and controlled and uncontrolled waste has been obtained. Expert opinions on the possible emission sources of existing waste landfills have been learned.

Upon analyzing the collected information, inventory was started. According to the IPCC methodology, many GHG emissions can be separated from the waste sector. They are CO_2, CH_4, and N_2O that are directly considered to be GHG, and also NO_X, CO, NMVOC pollutants that indirectly generate GHG. The report only included and evaluated direct GHG emissions. Other gases are currently calculated using the EMEP / CORINAIR methodology and calculated within the framework of the Convention on Environmental Impact Assessment in a Transboundary Context and are regulated by that convention.

The estimations have identified all three CO_2, CH_4 and N_2O gases in the relevant categories and clarified quantitative and qualitative data (diagram 22).

Diagram 22. GHG emissions in waste sector, thousand t, CO_2 eq.

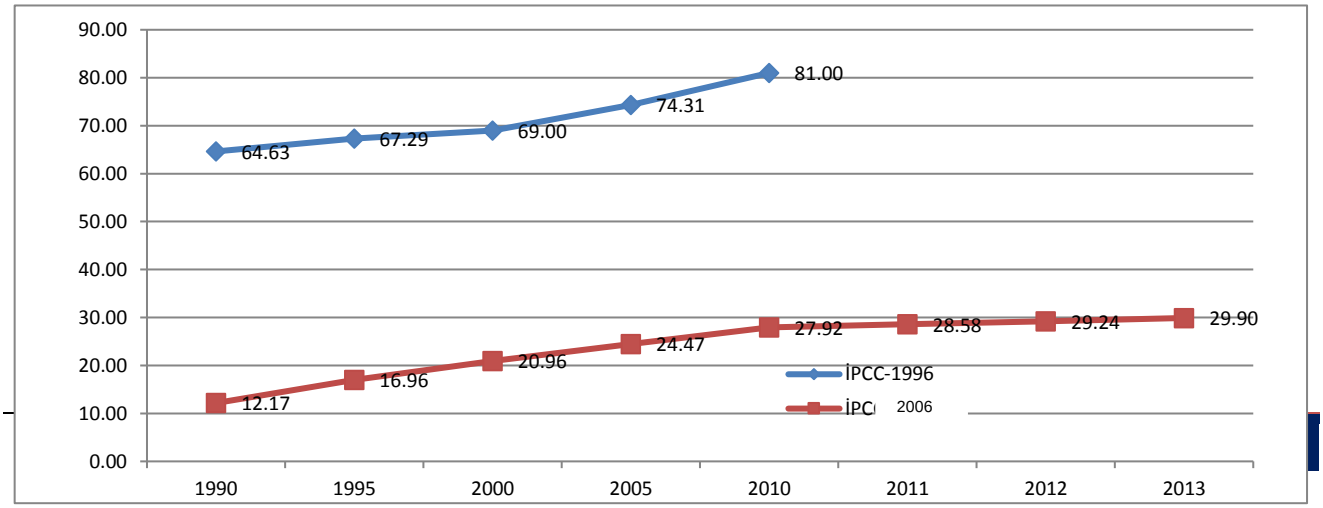


As seen from the diagram, there is a great difference between the figures in the Third National Communication and First BUR calculated by the IPCC 1996 methodology for the 1990-2010 years, and the figures calculated by the IPCC 2006 methodology. This is due to the different methods used in the methodologies. Difference of methodologies took place in the categories "4.A Solid Waste Disposal" and "4.D - Wastewater Treatment and Discharge."

2.2.4.1.1 Solid Waste Disposal

IPCC 2006 methodology based on the "Tier One Default" principle compared to the IPCC 1996 methodology has been used for GHG emissions generated from solid waste disposal subcategory. According to the estimates provided by experts, the process of organized management of waste landfills in the country started in the 1980s. Therefore, 1980 was taken as base year for this process. CH_4 and N_2O emissions are to be estimated in the methodology. Waste landfills for emissions identification should be provided. In Azerbaijan, relatively organized landfills are located in the areas where urban population lives. Considering all the above mentioned, emissions of the Solid Waste Sub-Category of the Waste Sector for 2011-2013 were calculated based on the IPCC (2006) methodology (Diagram 23).

Diagram 23. CH_4 Emissions from Solid Waste Disposal Area



The amount of methane emission calculated by this method was 12,17 thousand tons in 1990

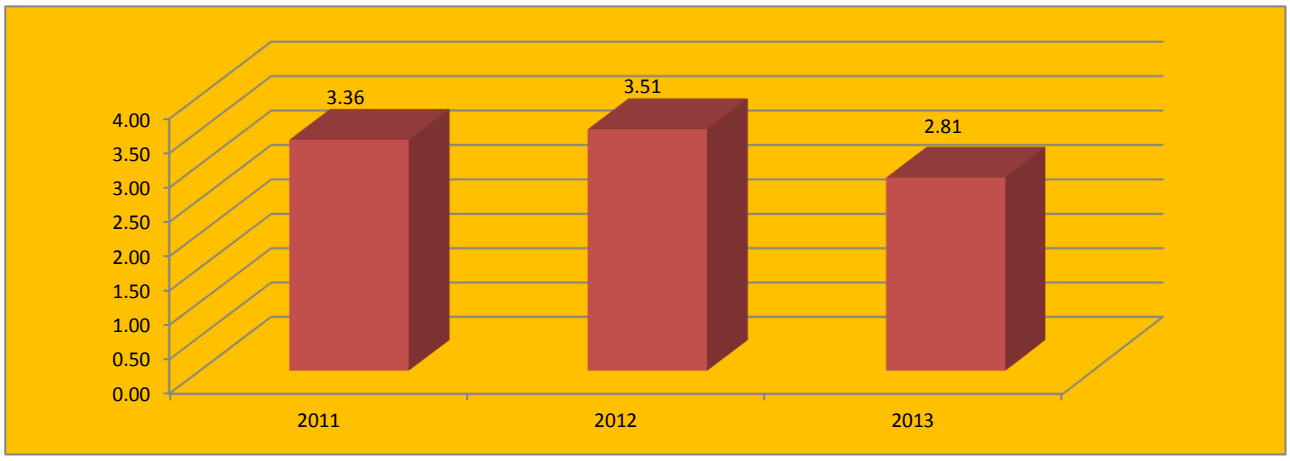
The amount of methane emission calculated by this method was 12,17 thousand tons in 1990 which was taken as a base year in Azerbaijan. It appears to be 5.3 times less than 64,3 thousand tons of previously calculated base year methane emissions. The diagram shows that the calculations based on new methodology are closer to reality. However, usage of proper measurement could eliminate this uncertainty.

These changes in the waste sectors and some uncertainties make it necessary to revise the base year emissions.

2.2.4.1.2 Biological Treatment of Solid Waste

IPCC (2006) methodology on biological treatment of Solid Waste is based on the principle of the organized waste management in the landfills. Currently, Balakhani landfill located in Baku is considered to be the most well-managed landfill waste disposal site in Azerbaijan. Therefore, GHG emissions have been calculated for this category based on the statistical data provided by "Temiz Sheher" and using IPPC 2006 methodology (Diagram 24).

Diagram 24. CH_4 emissions from biological treatment of solid waste, thousand tons



2.2.4.1.3 Incineration and Open Burning of Waste

From 1990 to 2012 only CH_4 and N_2O emissions were estimated in the waste sector. It should be noted that during that time, many landfills were exposed to natural or artificial combustion under open conditions, emitting CO_2 to the atmosphere. However, accurate estimation of CO_2 emissions was not possible at that time. Therefore, there was a need for instrumental measurements to estimate such processes.

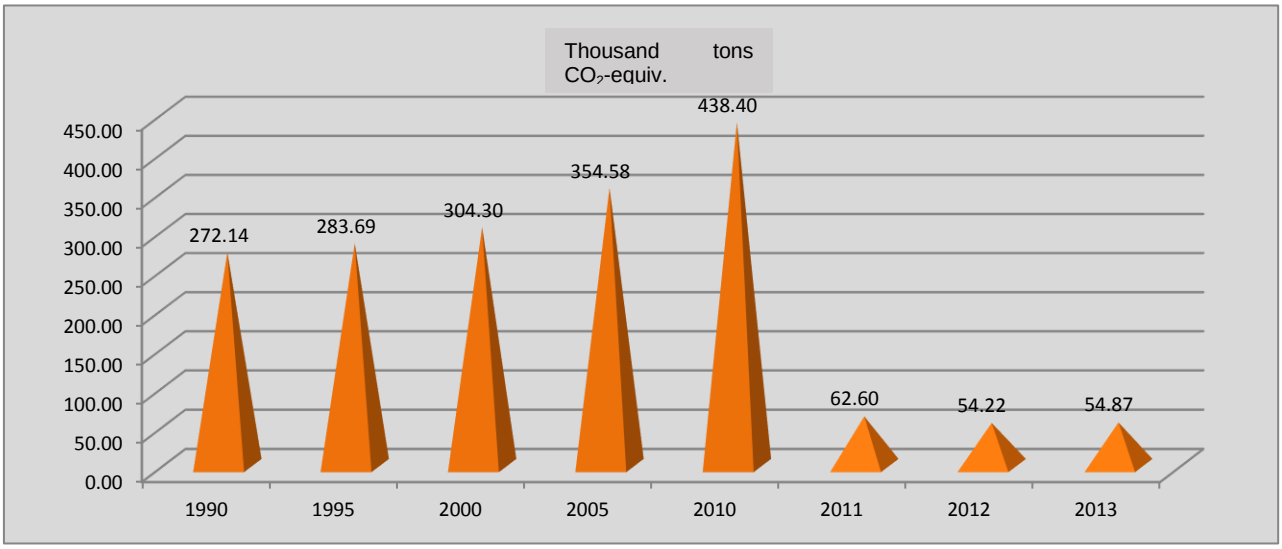
Since 2013, CO_2 gases are being released into the atmosphere.from the organized sources in the waste sector. These sources have been originated from “Waste Incineration Plant” activities. Along

with CO_2, N_2O gases are also released into the atmosphere from the same sources. The amount of emissions in 2013 was 21.81 thousand tons and 0.01 thousand tons respectively.

2.2.4.1.4. Wastewater Treatment and Discharge

The sources of the "Wastewater Treatment and Disposal" sub-category are generated from the domestic and industrial wastewater. These sources generate CH_4 and N_2O. The amount of methane emissions is given in the diagram below.

Diagram 25. GH_4 emission of wastewater, thousand tons



As seen from the calculations, there is a great difference between the previous and the current calculations. Difference in calculations may be explaned by reduction of sources in the new methodology and changes in the methodological coefficients. The previous methodology considered more amount of sources and higher coefficients. Whereas current methodology considers less potential sources and simplified equations.

N_2O gases are separated from domestic wastewater and emit 0.03 thousand tons per 3 years.

2.2.5. Other sources

GHG emissions are not calculated for this sector, due to the difficulties in determining the data in the solvents sector as well as selecting the coefficients.

2.3. Uncertainty analysis

Uncertainties of the data obtained in the inventory process and the emission factors used have been analyzed and evaluated. The analysis conducted for every sector represents the degree of accuracy of the calculated greenhouse gases in that sector.

Uncertainties in the ***energy sector*** arise in oil and gas production, energy consumption for mainly residential sector.

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

In some cases, uncertainties in the residential sector come from the lack of control and measuring instruments. In this case, electricity and gas consumption are calculated according to the regulations and stadarts. Natural gas used by the population is released into the air as the result of leakages. Those leakages are very hard to estimate. Therefore, further studies are needed in order to reduce amount of uncertainties in the inventory of the sector.

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

In the ***industrial processes*** sector, the uncertainty in the calculation of the emissions in a timeframe, i.e. for the base year, has been high for the calculation of F-gases. Thus, due to the lack of information on the sources of these gases for the years of 1990-1999, amount if these gases for the mentioned period haven't been calculated.

AFOLU sector: it has been found out that the uncertainties related to CH_4 gases released from internal fermentation and manure using the best practices method in the Agricultural sector are approximately 19.5%. In reality, this figure could potentially go much further up, as accurate data on the number of cattle in the households are not provided in any source. Further studies and researches are needed to reduce uncertainties. Forestry sector has huge uncertainties as well . Such uncertainties arise due to variety of tree species in the forests as compared to the forests in other countries. Therefore, choosing any average coefficient leads to the major uncertainties. Deep researches should be undertaken in order to find out precise coefficient, which will partially remove uncertainties in the forest sector.

In the ***waste*** sector, the percentage of uncertainty for solid domestic waste CH_4 emissions is lower than the percentage of the CH_4 emissions of waste waters. In total, the uncertainty for CO_2 emissions is nearly 17%.

III. Climate change mitigation analysis

3.1. State policy and programs on climate change mitigation

Notwithstanding that, the Republic of Azerbaijan has not undertaken quantitative obligations on reduction of greenhouse gas emissions after ratification of United Nations Framework Convention on Climate Change and Kyoto protocol, the addition to the Convention; the country has implemented a number of measures to mitigate the impact of climate change by supporting international initiatives and efforts for combating climate change.

Environmental protection problems as well as climate change issues are reflected in the main development priorities and strategies of Azerbaijan. In fact, "Development Concept. Azerbaijan – 2020: Outlook for the future" includes one section, which describes environmental problems. This Conception determines target to decrease the average energy consumed and the amount of carbon dioxide emitted for production of per unit GDP up to the relevant indicators shown for Organization of Economic Cooperation and Development countries for the period covered by the convention.

In addition, climate change mitigation and adaptation issues were prepared for national economy and main economic sectors and described in strategic road maps approved in 2016. In particular, issues related to climate change mitigation are described in "Strategic Road Map for development of heavy industry and machinery in the Republic of Azerbaijan" and "Strategic Road map for the development of utilities (electric, heating energy, water and gas) in the Republic of Azerbaijan", "Strategic Road Map for manufacturing and processing agricultural products in the Republic of Azerbaijan" and specific measures were considered for the period up to 2025 and later on.

Meanwhile, climate change mitigation issues were described in several state programs shown below:

- State Program on social-economic development of the regions of the Republic of Azerbaijan (years 2014-2018);
- State Program for the development of the industry in the Republic of Azerbaijan (years 2015-2020);
- State Program for the development of viticulture in the Republic of Azerbaijan in 2012-2020 years.

It is to note that, draft "State Strategy for alternative and renewable energy sources in the Republic of Azerbaijan" has been developed and is under approval. In addition, interstate procedures on discussions of "Action Plan on improving ecological status and effective use of natural resources in the Republic of Azerbaijan", draft "National Strategy for Solid Waste management in the Republic of Azerbaijan", "State Program for energy saving and efficient utilization of energy sources" are in progress.

Meanwhile, it is to mention that, upon the initiative of the Ministry of Ecology and Natural Resources and instruction by the Cabinet of Ministers, interstate procedure for the development of "National Strategy for Low carbon development" and elaboration of "Climate Change Adaptation Plan" has been started. Accordingly, working groups which consist of the representatives of all the relevant ministries and state agencies have been established.

Furthermore, it should be noted that the obligations of the Republic of Azerbaijan under the Paris Agreement of UN Framework Convention on Climate Change and the role of relevant state agencies to fulfill these obligations are the main priority of the Government. Thuswise, the Cabinet of Ministers intends to have meeting in March, 2018. The resources required for fulfilling the responsibilities taken under Paris Agreement and development of sectoral plans/strategies in this field will be discussed on the meeting.

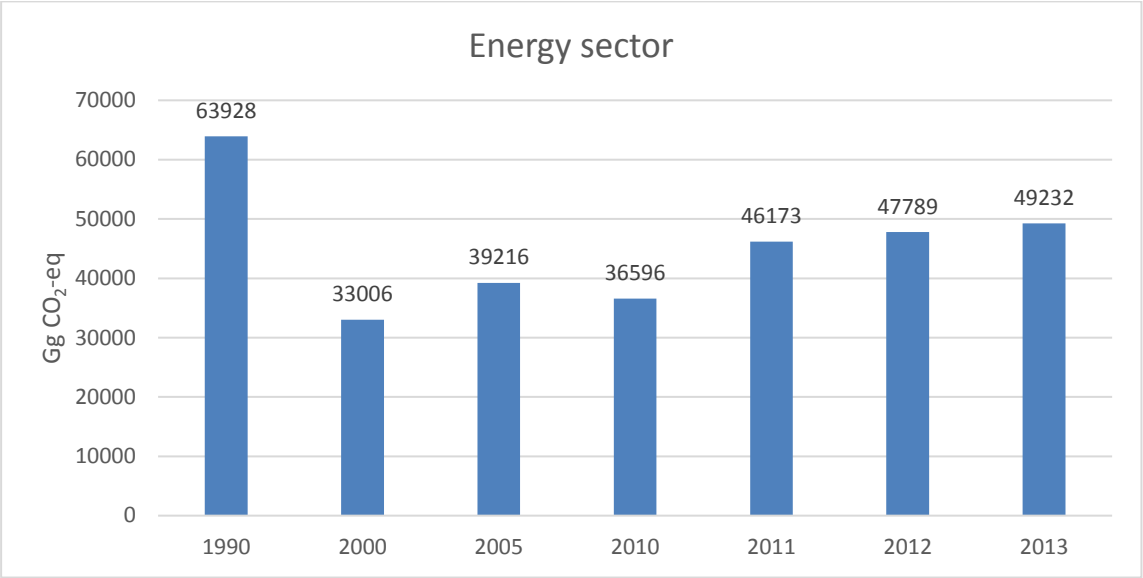
3.2. Measures taken towards climate change mitigation as contributions for emissions reduction pre-2020 and the current capacity

As described in the previous sections, several measures have been taken towards reduction of greenhouse gas emissions in the Republic of Azerbaijan in the recent years. Measures such as application of low waste technologies in energy sector, utilization of renewable energy sources, efficient waste management, expansion of forest areas, etc. caused reduction of greenhouse gas emissions for about 30% in 2013 comparing to that in 1990, the base year. The following sections of the report provide detailed information about measures taken for the reduction of greenhouse gas emissions and existing capacity.

3.2.1. Energy sector

According to the results of inventory carried out under this report for Greenhouse gas emissions, 79.6% of total emissions in 2013 in the country were emitted by energy sector. This proves the importance of the measures towards climate change mitigation in energy sector.

Diagram 26. Change of Greenhouse gas emissions in energy sector in 1990-2013.



As seen from the above diagram, emissions from the energy sector have been increased from 2011 onwards. This increase is explained by the application of IPCC 2006 Guideliness for 2011-2013 years, which includes more sorces of fugitive emissions than Revised 1996 Guidelines. The 3 times increase in natural gas production from 2005 to 2013 also made substantial influence in emissions level.

As shown in the diagram, the reduction of emissions in 1990-2000 was caused by the decrease of the use of oil and oil products and economic shutdown. Despite the fact that, it shows an increase of greenhouse gas emissions in this category in the next years, certain climate mitigation measures such as application of new technologies, collection of associated gases in oil-gas industry, use of gas instead of fuel oil in enegy industry for heat and power generation have encumbered this process.

The following sections provide detailed information about energy sector which includes oil and gas production, electric power industry, power efficiency, utilities, current status of renewable energy sources and transportation sector, measures taken towards climate change mitigation and existing capacity in this field.

3.2.1.1. Oil and Gas production

The Republic of Azerbaijan is rich with its oil and gas resources and is one of the oldest oil countries in the world. Industrial method of oil extraction has 170 years history. The first oil production in the country began in 1847.

After The Republic of Azerbaijan gained its independence, oil production decreased. However, since September 20, 1994, award of "Contract of the Century", oil and gas sector has started its rapid development. On the same date, the first Contract "on joint development and production sharing for the **Azeri** and **Chirag** fields and the Deep Water Portion of the **Gunashli** field located in the **Azerbaijan** sector of the Caspian Sea" was signed. "Contract of the Century" encouraged foreign companies to the execution of new contracts in Azerbaijan. From 1994 up to now, 27 contracts were signed on exploration, production and product sharing of hydrocarbons between State Oil Company of the Republic of Azerbaijan (SOCAR) and foreign oil companies.

One of the main directions of oil strategy is exportation of Azerbaijan oil to the world market. Strategically important Baku-Tbilisi-Jeyhan Main pipeline Project was implemented to export oil to the world market, to ensure long-term protection of Azerbaijan's interests in this filed, development of wide-scale international economic cooperation and increase of oil production in the region.

Significant progress has been made in the field of gas production in recent years. According to Statistic data as of 2016, 18.718 million m^3 gas was produced in the country. At present, it is planned to export gas from Caspian Sea to the markets in Turkey and Europe by opening "South gas corridor" under "Shahdeniz Stage 2" Project.

The researches show that, oil extraction and processing industry has a big capacity to reduce greenhouse gas emissions. SOCAR prepared "SOCAR Assosiation Gas Reduction Plan" which covers 2010-2015 years and "SOCAR Climate Change Mitigation Strategy" which covers 2010-2020 years to enhance actions towards climate change mitigation. The Strategy describes measures such as reducing the release of low pressure associated gases emissions, improving energy efficiency in technological processes, switching to low-carbon energy, using alternative and renewable sources of energy and carrying out landscaping (greening) works.

Pursuant to Order no. 68 dated 24.04.2008 by SOCAR "on Actions for the execution of Framework Convention for Climate Change", Greenhouse Gas inventories are carried out in structural divisions, operation companies and joint entities of SOCAR and the information about these results are included into SOCAR's publically available Sustainable Development Report.

Environmental Monitoring Department of SOCAR carries out laboratory analysis for the monitoring of emission sources, instrumental measuring and studying the composition of APG releases regularly in order to analyze the volume of greenhouse gas emissions per months and

prepares relevant proposals. Below mentioned project proposals were prepared and seeking for internal/external funding:

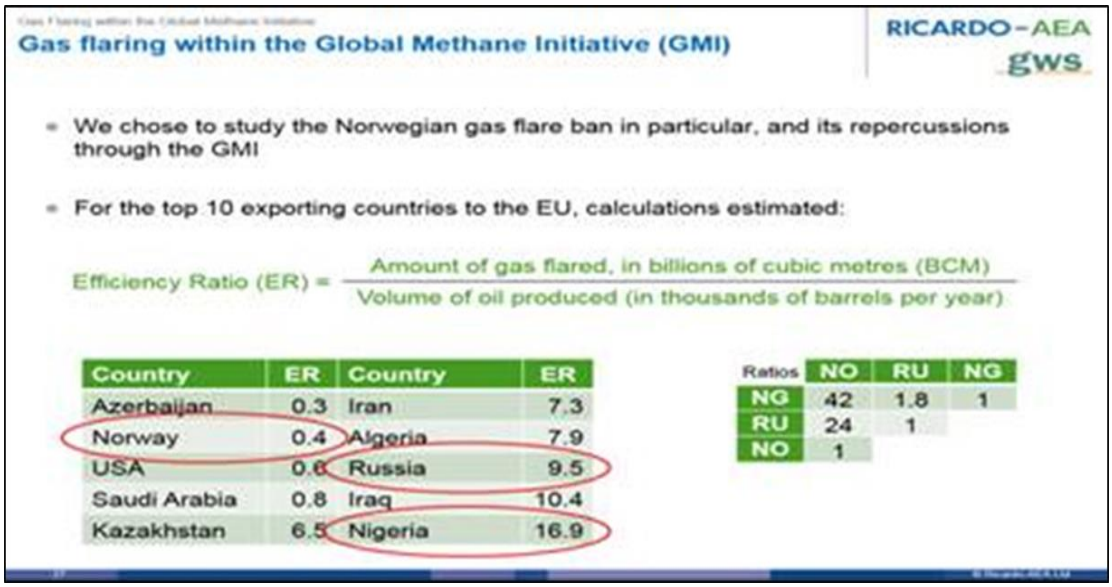
- Draft conception on gathering and underground storage of CO_2 released to the air from "Neft Dashlari" OGED (Oil-gas Extraction Department) of Azneft Production Union (PU)
- Draft Conception on Collection of associated gas in Chilov oil field of Azneft PU
- Draft conception on Collection of associated gas in Neft Dashlari field of Azneft PU

"Methodology on calculation of greenhouse gas emissions released from stationary sources of SOCAR during burning process" was prepared in 2014 by Environmental Department based on 2006 IPCC GLs. The internal system of data collection on annual basis was established to achieve more accurate assessment of emission impacts on environment and improve of Measurement, Reporting and Verification system of SOCAR. Main feature of methodology is that national calorific values of fuels were used to convert amount of fuels used to TJ. The information on NCV has been taken from the annual statistical yearbook of the State Statistical Committee. This methodology was approved by the Ministry of Ecology and Natural Resources.

Since 2008 SOCAR is a member of the World Bank's Global Gas Flaring Reduction Partnership (GGFR) paying annually $50,000 as a membership fee. During 2012-2015 over 2 billion m3 of associated gas was collected and handed over to end users within this partnership. For the implementation of these advanced projects, SOCAR has been awarded two "Excellence in Flaring reduction" certificates from the GGFR WB in 2012 and in 2015.

According to the Energy Balance of the Azerbaijan Republic, the decline in the volume of gas flared at the Azeri-Chirag-Guneshli fields during 2011-2017 has been observed. Thus, the volume of gas flared in the period 2011-2017 was reduced from 710.7 mln m^3 in 2011 to 167.7 mln m^3 in 2017.

According to the Consumer-Based Approaches to Mitigate Climate Change Impacts Survey conducted by "Ricardo-AEA" company and sponsored by the Directorate-General for Climate Operations (DG CLIMA) of the European Commission, Azerbaijan is ranked the first among the top ten oil exporters to the European Union per the efficiency of the flared associated gas (0.3 mln m^3 per year per thousand barrels of oil).



According to the European Commission Energy Directorate's report on "Import of crude oil from non-EU countries" (Registration of Crude Oil Imports and Deliveries in the European Union (EU28) (EXTRA EU)), Azerbaijan was ranked the 7th among 33 countries that exported crude oil to the EU in 2016.

Table 21. Ration of crude oil producer countries by efficiency of associated gas

Country	Volume (1000 bbl)	Total amount ($ 1000)	CIF price (2) ($/bbl)	Share in import %
Russian Federation	1 198 914	49 929 733	41.65	31.84%
Norway	453 324	20 199 798	44.56	12.04%
Irag	305996	11731872	38.34	8.13%
Saudi Arabia	298 286	12 597 854	42.23	7.92%
Kazakistan	269 368	11 487 858	42.65	7.15%
Nigeria	211 371	9 370 591	44.33	5.61%
Azerbaijan	**162 875**	**7 292 442**	**44.77**	**4.33%**
Algeria	108741	4860114	44.69	2.89%
Iran	106 400	4 566 537	42.92	2.83%
Angola	98 528	4 151 820	42.14	2.62%

In 2014 SOCAR voluntarily joined the World Bank's "Zero routine flaring by 2030" Initiative. In 2016 in order to fulfil voluntary commitments SOCAR has prepared a document titled "The associated gas reduction plan in SOCAR and SOCAR's joint projects for 2017-2022". According to the document, by 2022 it is planned to reduce of associated gas release to 95 mln. m^3 / year .

SOCAR has also achieved reduction of natural gas loss in main distribution networks. In fact, it was 1137.4 mln m^3 (8,1% from total volume of gas distributed) in 2015, while 794.9 mln m^3 (5,7%) in 2016 and 759.3 mln m^3 (5,3%) in 2017.

In recent years, SOCAR has implemented different energy efficiency projects:

- Compressor station collecting associated gas was constructed in Guneshli field and 310 mln.m^3 of associated gas released to atmosphere was collected and supplied to consumers;
- 70 numbers of vacuum compressors were installed under the Project on Collection of Associated Gas from "Neft Dashlari" OGED (total annual collection volume of associated gas was 280 mln.m^3 through the use of compressor facilities of local production);
- Old "Lancashire" boilers used for heating in some SOCAR offices were replaced with "Yetsan" boilers (as a result greenhouse gas emission was reduced up to 12%);
- As a result of replacement of Old cast iron boilers used in Ship Repair Facility with modern induction boiler, power efficiency has increased for more than 3.5 times. Old copper and aluminum melting furnaces operated with liquid fuel in the same facility was replaced with power efficient melting furnaces caused decrease of CO_2 for 6-7 times;
- New Nitrogen-Oxygen Complex constructed in Ethylene-Polyethylene factory of the Company helped to fully meet nitrogen and oxygen demand of the factory, as well as oxygen demand of repair-construction department. Power consumption in the new complex, which operates at its design capacity, has been reduced for 5 times comparing to the previous facility. According to the calculations, the emissions have decreased up to 750 ton of CO_2 - eq;
- Daily Power demand of New Water Cooling Facility which has been operated since 2013 is 120 thousand kW/hour, which means 55 thousand KW/hour power saving. Thus, annual CO_2 emission reduction is 39 thousand tons;
- New Power Station consisting of 6 gas turbine generators, each at 7.5 MVA capacity, was constructed in 2009 to provide oil and gas extraction managements in the sea with power supply (annual volume of reduction was 76 thousand ton of CO_2-eq;
- As a result of power saving measures, the consumption of 16.889 thousand kW/hour electric power reduced in 2016, comparing to 2015;
- Due to application of screw pump method in oil extraction, 68.543 kW of power energy was saved in 2016-2017. Electric Engine at 315 kW capacity was installed instead of oil supply pump at 500 kW capacity in new tanks park in "Complex Collection and Delivery Area", as a result 203 thousand 650 kW electric power was saved;
- Replacement of power engines at 22 kVa capacity with new engines at 18.5 kVa capacity in five operation wells of Oil and Gas Extraction Management of Azneft Production Union resulted in 17.406 thousand kW power saving;
- 4 units of wind generators and solar batteries are used in Eco-park.

Below listed measures were taken in Azerkimya PU, Siyazanneft Oil and Gas Extraction Management of Azneft Production Union, Waste Center of Environmental Department and Transportation Department in accordance with Nationally Appropriate Mitigation Actions which

ensures reduction of carbon emissions in Azerbaijan fuel consumption sector, co-executed by SOCAR and UNDP Azerbaijan Representation:

- Repair-installation and heat insulation works were carried out in the administrative building for Polyethylene production of Azerikimya production Union and solar generators were installed in chemist culture house.
- With participation of international experts, samples were taken and laboratory analysis was conducted to study the volume of associated gas, its methane composition and instrumental measurement in 63 wells of Siyazanneft Oil Gas Extraction Management of Azneft Production Union. Subsequently, a monitoring plan was prepared for regular verification of project execution.
- Heat insulation and installation of solar generators were completed in Administrative Building of Waste Disposal Center of Environmental Department of SOCAR "Eco-park" building. As a result of these measures, it is planned to achieve up to 40%evergy efficiency.
- International trainer held trainings for drivers on agitation for green transportation.
- 60 units of solar panels with 15.36 kW total capacity and 4 units of wind generators with 6.9 kW total capacities were installed in the area of Waste Disposal Center under the Project. It is planned to replace the existing wind generators with vertical wind generators with 16.8 kW total, while each at 2.8kW capacity in the future.

It is to note that, there is substantial improvement towards provision of gas supply in Azerbaijan. At present, the level of gas supply is 93% and targeted to be 95% in 2018. For this purpose, 100 million manat was allocated to SOCAR from the state budget.

3.2.1.2. Power engineering

According to the information as of 2016, total power production was 24.952,9 million kW hour in the Republic of Azerbaijan, 22.935,8 million kW hour (approximately 91.9%) of which was produced by CHP plants.

Based on the indicators as of the same year, specific weight of electricity obtained from renewable energy sources was 8.1% out of total electricity.

In 2016, electricity export appeared to be 1095,5 mln. kW, which is 4.1 times more than that in 2015, while its import was 114,4 mln. kW, that is, increased for 6%.

As a result of investments on power system in recent years, quality indicators of electricity have significantly improved, the loss level has reduced and collection percentage has increased. Meanwhile, this tendency has impacted the distribution. In fact, the loss was reduced from about 16.6 percent in 2010 up to 11.1% in 2016.

One of the main actions taken towards reduction of greenhouse gas emissions in the field of electricity of Azerbaijan is the saving in the amount of conditional fuel consumed on production of 1kW electric power in heating power stations. According to the reports submitted by "Azərenerji" JS, as a result of modernization works conducted in thermal power stations, specific fuel consumption for 1 kW power production in 2016 was reduced from 292,0 q/kW in 2015 up to 286,6 q/kW (5,4 grams), which shows 107,5 min ton saving in conditional fuel consumption.

Specific fuel consumption for 1 kW power production in 2017 was increased from 286,6 q/kW (10.5 gram) in 2016 up to 296,3 q/kW , which shows 107,5 min ton surplus in conditional fuel consumption. The main reason is power production in the thermal electric stations ("Azerbaijan" HES and Shirvan" HES) with conditional fuel consumption, as repair works are in the process in the stations "Janub" HES and "Sumgait" TPS, which are distinguished for their efficient operations due to modern technologies. Therefore, increase in the annual use of fuel oil (9520 kcal/kg) with higher heat-generating ability than that of natural gas (8000 kcal/kg) has been occurred.

In 2015, technological loss in the transmission was 668,8 mln. kW (3,1 %), while 518,1 mln. kW (2,4 %) in 2017. As a result of such technological loss reduction, 44.7 thousand ton of power was saved. It was achieved through implementation of reconstruction works (installation of power supply lines related to capacity increase) in transmission networks.

In 2015, technological loss in the distribution was 3232,5 mln. kW (16,4%), while 1934,0 mln. kW (10,0 %) in 2016, and 1831,4 mln. kW (9,9%) in 2017. As a result of such reduction of technological loss, 415,1 thousand ton of power was saved comparing to that between 2015 and 2017. It was achieved through implementation of reconstruction works (construction and reconstruction of distribution power centers with the capacity related to the increased power demand, installation of power supply lines and laying of self-carrying isolated wires, etc) in distribution networks.

It is to note that, due to the purposeful policy carried out, thermal power stations are now operated by using gas instead of fuel oil, which has caused significant decrease of greenhouse gas emissions. Use of gas instead of fuel oil in thermal power stations and as well as application of more modern technologies in this sector resulted in decrease of greenhouse gas emissions for 10 thousand ton between 2006-2016.

According to statistic data as of 2016, total amount of electric power produced in WPS was 1.959,0 mln. kW/hour, which means 19.7% increase comparing to that in 2015. Azerenergy JSC has launched several small WPS's with 12 MV total capacity during recent 2 years. They are:

- Chichekli WES, Goygol district, capacity-3 MV 08/17
- Balakan WES, Balakan district, capacity -1,5 MV 08/17
- Ismayilli WES, Ismayıllı district, capacity -3,2 MV 08/16
- Astara 1 WES, Astara district, capacity -0,3 MV 04/16
- Oghuz WES, Oghuz dstrict, capacity -3,6 MV 04/16

In addition to the above mentioned, Varvara WES was reconstructed and new, efficient turbines were installed there in April 2017. Accordingly, the capacity of the station was increased from 16,5 MV to 18 MV. "Shimal-2" Heating Electric Station with 400 MW capacity is planned to be launched in 2018.

«Azerishiq» OJSC, which purchases electric power from electric power consumers based on the contracts and provides the end-users with reliable, safe, effective and uninterrupted power supply has replaced old equipment and facilities with new ones in order to eliminate greenhouse gas emissions released during delivery and distribution of electricity, as well as due to possible loss caused by low power efficiency and other factors. In fact, 98 units of "Power Substations" have been constructed or reconstructed, 3481 units of "Complex Transformer Stations" and 24 units of "Transformer Stations" have been replaced, while 10.206,8 km low voltage power transmission air lines have been replaced with self-carrying isolated cables and 5263 km power transmission air cables have been replaced with underground cables.

Direct investments in electricity sector and private sector's participation will play significant role in establishing renewable energy system (mainly consisting of wind and solar photo elements) as the main goal for 2025 year and beyond. Certain measures are being taken to make necessary amendments in the regulation and establish attractive investment environment through allocation of mid-term finance. Subsequently, it is planned to take certain initiatives towards increasing the production of renewable energy which is less dependent on fuel type energy sources in the country.

As there is a certain level of inefficiency in the transmission and distribution system of electricity, measures will be taken to reduce energy losses in this area in Azerbaijan, as well as existing power stations will be upgraded to meet the modern requirements. Amendments to the service tariffs will be reviewed considering the performance assurance, as well as inclusion of costs in the prices, efficiency rates of production enterprises.

Based on feasibility studies and analysis, "Azerenerji" JSC will determine power stations which need increase in efficiency, as well as proper mechanisms for improving efficiency in these stations through comparison of standard indicators. Meanwhile, the issues on ensuring safe supply from new stations with high efficiency and suspension of operation of most inefficient stations will be reviewed. In order to eliminate possible negative impacts of actions taken towards increasing the efficiency on power production, the most proper milestones will be determined for improvement work, in accordance with time-phased Schedule on entry of power stations into operation.

Furthermore, it is necessary to prioritize, re-construct ad re-install 110 kV and 35 kV substations, electric supply lines, as well as 110 kV and 3520 kV air and cable lines which have expired service lives starting from the most inefficient ones. Therefore, it is planned to establish Smart Grid to supply electric energy to the consumers without any loss and efficiently through the use of modern information and communication Technologies. «Azerishiq» OJSC will review the establishment of Automated Management System on the digital map in order to set up unified information bank for transmission and distribution networks or select proper equipment for newly-installed lines or those to be reconstructed in accordance with climate map.

In addition, «Azerishiq» OJSC intends to carry out several works such as, construction or reconstruction of 188 units of "Power Substations", replacement of Complex Transformer Stations and Transformer Stations which are in the balance and already expired, replacement of all overhead low voltage electric transmission lines with self-carrying Isolated wires, of overhead high voltage electric transmission lines with underground cables in Baku and other cities, as well as installation of overhead electric transmission lines to be replaced or reconstructed by 2030 away from forest farms in order to prevent any environmental damages.

Above mentioned measures will result in uninterrupted and quality power supply for consumers, reduction of energy loss in the grid, effective operation and management of the grids. Thuswise, «Azerishiq» OJSC will complete the implementation of actions by determining the medium term finance sources to continue phased rehabilitation and reconstruction works of distribution grids.

3.2.1.3. Energy efficiency

Efficient use of energy resources is determined as one of the key areas of energy security by developed countries and international organizations. In fact, providing the population and the economy with energy resources, increasing the share of alternative and renewable energy sources in power production and ensuring the energy efficiency are the main principles of energy policies of the countries.

Energy efficiency is not only targeted to resource saving, but also to sustainable economic development, transition to green economy, protection of environment, production of competitive and cheap industrial and agricultural products, improvement in the provision of consumers with energy carriers, reduction of dissipation in utility services and surplus costs.

Several legislative acts and draft state programs have been developed to regulate the performance of the Ministry of Energy of the Republic of Azerbaijan in energy efficiency. The Ministry fulfilled its duties arising from the Law of the Republic of Azerbaijan on "Use of energy resources" and the regulations of the ministry to ensure efficient use of energy resources. Considering the above mentioned, "State Program on efficient use of energy resources and energy effectiveness of end-users (2016-2020 years)" was developed and submitted to the government for review.

This State Program includes reduction of energy volume in gross domestic product of the republic and some other actions, taking into account the establishment of state information system for energy security, energy effectiveness of the economy, ecological safety of power engineering, energy resources saving and efficient use of energy and other trends.

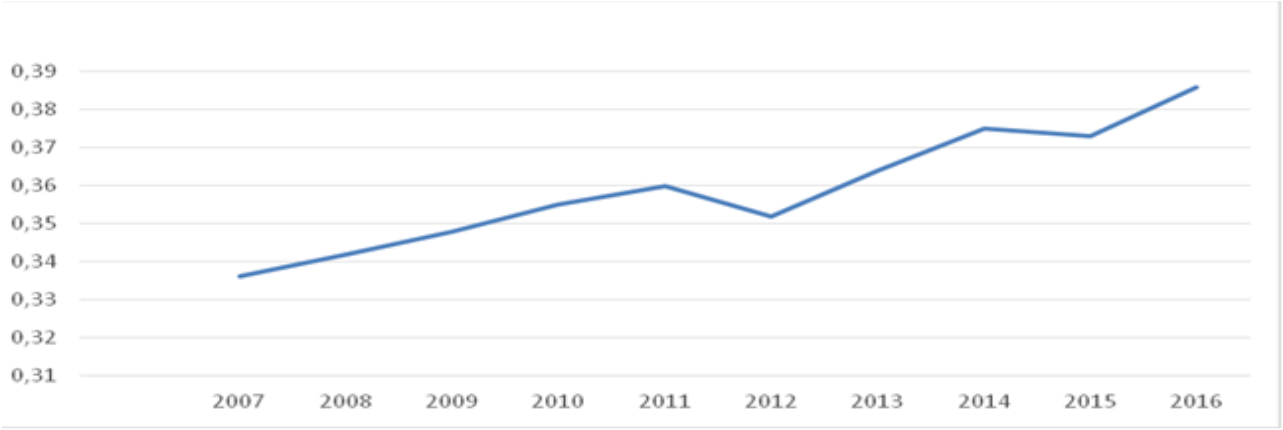
One of the actions taken towards energy efficiency is wide-scale application of self-carrying isolated wire system instead of bare wires in order to reduce the loss in energy distribution and consumption. In addition, modern technologies, remote control of new substations and modern relay protection in substations, and use of automated equipment are successfully applied for energy auditing. Major reconstruction works and improvement of audit system with modern technologies have resulted in substantial energy saving.

The application of economic technology in energy production shows reduction in the amount of conventional fuel consumed on 1 kW energy. Whereas, specific fuel consumption for the

production of 1 kW energy decreased in 2016 from 292,0 q/kW up to 286,6 q/kW (5,4 gram) comparing to 2015 and accordingly, 107.5 ton of conventional fuel was saved.

It is to note for comparison that, this indicator was 378.5 gr/kV in 2000 and this reduction has caused decrease in the amount of emissions. State Program targets to achieve 260 qr/kV conventional fuel consumption in heating electric stations for production of 1 kV energy, through definition of new generation powers and improvement of capacities of older energy blocks in energy sector.

Diagram 27: Energy efficiency indicators in 2007-2016 years, %



The researches show that, application of economic lighting and heating systems in commercial and residential sector of the country shows great opportunities for efficient energy use. In fact, replacement of existing bulbs with 5-10 Vt LED one might result in 15-30 mln.kVt/hour energy saving.

Reduction of loss in energy use might be achieved through application of measurement-control system. As an example, we might show installation of electric meters in the country in 2007-2008. In fact, the use of electric meters has resulted in reduction of energy production from 21.6 bln.kVt /hour in 2008 up to 18.9 bln.kVt/hour.

In addition, application of modern universal system technologies facilitates setting up modern energy control and audit system which excludes any loss during energy consumption. According to evaluation by local experts, it will result in 30% reduction of annual energy consumption. Application of this system will contribute to the decrease of annual amount of CO_2 wastes.

3.2.1.4. Alternative and renewable energy sources

Development of alternative and renewable energy sector is one of the priorities in the Republic of Azerbaijan, which is rich with such sources. It is to note that, "Strategic Plan of the State Agency for Alternative and Renewable Energy Sources for 2015-2018 years" was approved upon the Order dated December 10, 2014 by the State Agency for Alternative and Renewable Energy.

Wind Measurement Observation Stations with 18 units of 85 meter towers and 4 units of Solar Monitoring Stations were installed, 2 units of mobile laboratories were purchased and several observations were carried out in 2010-2012 years by State Agency of Alternative and Renewable Energy Sources in different regions to determine the capacity of alternative and renewable energy sources in the country. The Data obtained from such stations were integrated to the online servers of Monitoring Center of State Agency. Maps describing wind and solar energy potential were developed based on such data, as well as other hydro-meteorological and climate data and information obtained from satellites and of 30 year long-term meteorological re-analysis models. Consequently, it was determined that, Wind energy potential (including the sea aquatorium) of the Republic of Azerbaijan is more than 15000 MV, while solar energy potential is more than 8000 MV, Biomass and waste energy potential is more than 900 MV and energy potential of small rivers is more than 650 MV.

Short, medium and long-term horizon alternative energy supply atlas was developed for all the districts based on Alternative and renewable energy sources potential in 2014 to apply the above-mentioned potential and three phase "Energy development model" was prepared for its implementation:

- Small stations- energy supply of resident or non-resident buildings through application of alternative energy Technologies under "1 house -1 power station" principle;
- Medium stations – formation of energy supply in the cities and districts on the account of local energy sources under the hydride type energy stations principle;
- Large stations – increasing the energy safety through diversification of energy sources in the country.

Many Pilot Projects have been implemented in the framework of first component of Energy development model. Solar panels and thermal pumps have been installed in 24 various social entities in Baku and other regions. As a result, some social enterprises have been fully or others have been partly provided with power and heating service on the account of renewable energy sources.

Hybrid Power Stations were constructed in Gobustan and Samukh under the second component of the Model. Gobustan Experimental Polygon and Training Center is the first hybrid type power station composed of wind, solar and biogas stations. Three wind turbines, each at 0.9 MV capacity, solar station at 1.8 MV capacity and biogas station at 1MV capacity were installed in this center.

Samukh Agro Energy Residential Complex is a unique project under construction, which considers application of alternative and renewable energy in agricultural field. Main objectives of the project include provision of the district with power and thermal energy on the account of alternative energy, as well as prompt agricultural development, resolution of social problems, creation of new workplaces and provision of ecologically clean and sustainable energy. Solar Station at 1.5 Mt capacity is under operation in Samukh at present.

Yeni Yashma (50 MV capacity), Hokmali (8 MV capacity), Sitalchay (3.6 MV capacity), Shurabad (17 MV capacity) Wind Stations, Khalkhal Solar Station (20 MV capacity) In Nakhchivan AR, as

well as Sukhani, Pirallahi, Garadagh, Sumgayit Solar Station (each at 2.8 MV capacity), Baku municipal Solid Waste Incineration Plant (37 MV capacity), Fizuli Hydro Power Station (25 MV capacity), Ismayilli – 1 HPS (1.6 MV capacity), Takhtakorpu HPS (25 MV capacity), Arpachay -1 and Arpachay – 2 HPS's (21.9 MV total capacity), Shamkirchay HPS (25 MVt capacity) and second block of Shaki HPS (0.6 MV capacity) were constructed under the third component of the model.

In addition to the above mentioned, "Azguntex" solar panels plant (60MVt annual capacity) and the factory producing solar collectors were established under Sumgait Technologies Park.

Significant progress was achieved in the field of alternative energy within last two years. In fact, Pirallahi Solar Station at 2.8 MV total capacity and Nakhchivan Solar Station at 20 MV total capacity were constructed and launched

Thuswise, total installed capacity of renewable energy sources in the country is 263 MV (including 66 MV wind, 34 MV solar, 38 MV biomass and wastes, 125 MV hydropower stations).

2191.9 million kV/hour (or 8.8%) power energy (including large Hydropower Stations) out of 24952,9 million KV/hour energy from all the sources in country in 2016 was produced by renewable energy sources. Efficient use of alternative and renewable energy sources was resulted in 561.1 million cubic meter of natural gas saving and prevention of 998.8 thousand ton of carbon gas released (CO_2) to the atmosphere.

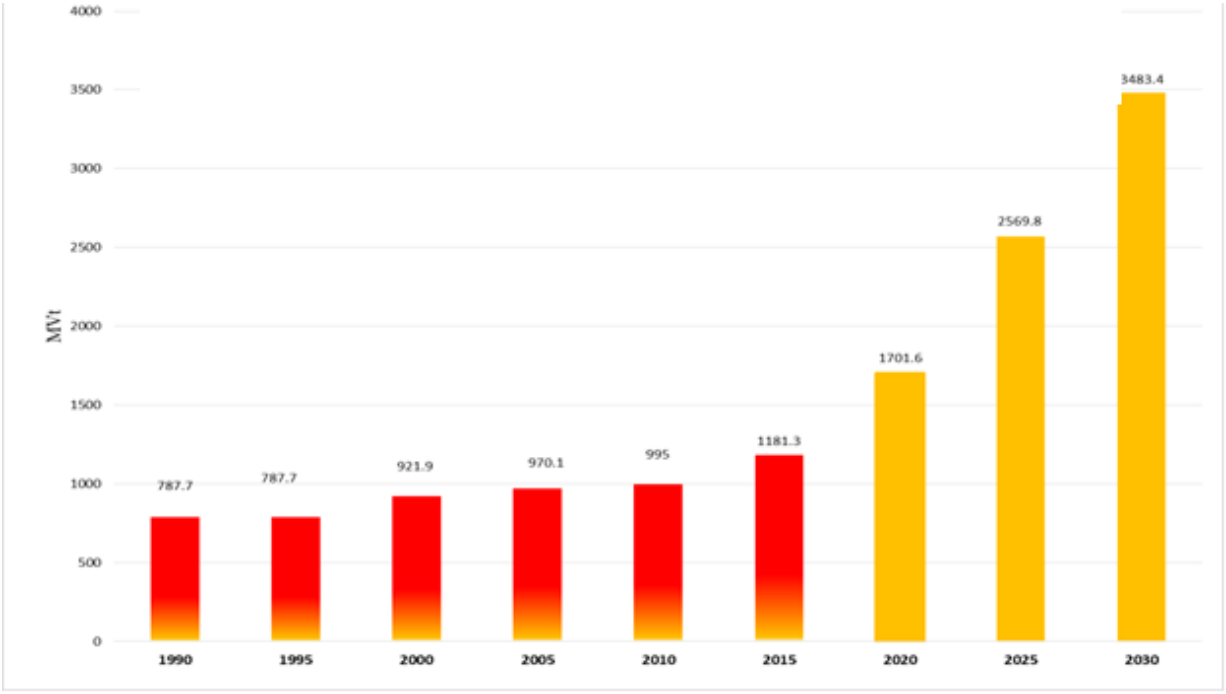
As a result of state investments, institutional measures and involvement of private sector, the share of alternative energy might reach 50% of energy balance of the country by 2050.

It is planned to establish new generation powers at 420 MV by 2020, which includes 350 MV wind, 50 MV solar and 20 MV bio energy on the account of alternative and renewable energy sources in order to expand energy portfolio in "Strategic Road Map for development of utilities (electric and heating energy, water and gas) in the Republic of Azerbaijan" approved by the Decree dated December 6, 2016 of the President of the Republic of Azerbaijan. The target is to establish hydride power stations in every city and district of the country by that period. Construction of such stations near residential areas will, first of all, prevent energy loss and allow the supply of consumers with energy in a cheaper way. Generally, 11 billion kilowatt/hour energy will be produced annually by power stations, with 2.500 megawatt installed capacity, by 2020 in order to ensure the development of alternative and renewable energy sources, which means up to annually 3 billion cubic meters saving of natural gas.

Design-research Works and different calculations were carried out for layout of 870 MV wind parks and other stations in 2021-2025. It is planned that, power installation for alternative energy will be more than 910 MV in the following 5 years.

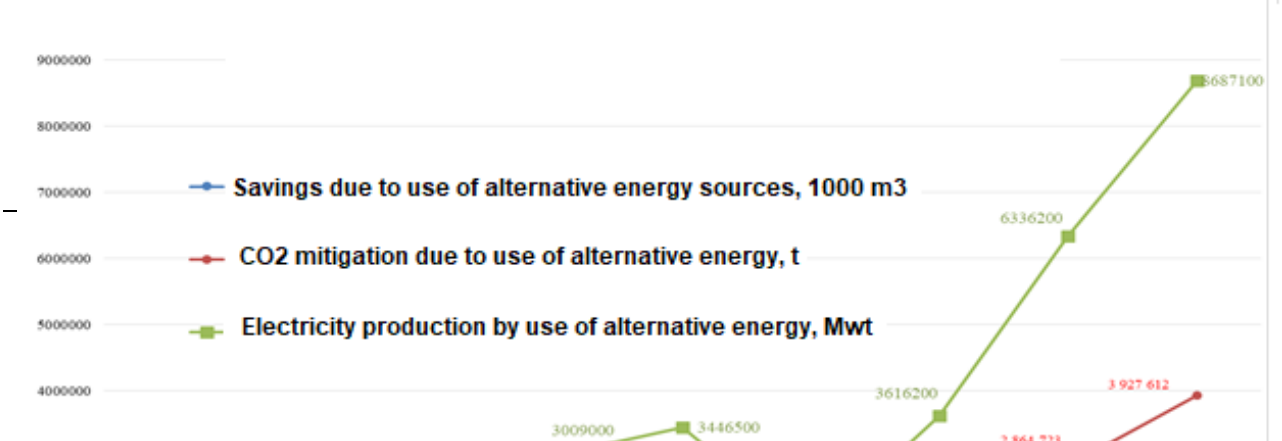
It is to note that, based on Decree dated December 22, 2017 by the President of the Republic of Azerbaijan on "Additional actions for the use of alternative and renewable energy sources in the Republic of Azerbaijan", Wind Power park located at 55th kilometer of Baku-Guba Road which was in the balance of State Agency for Alternative and Renewable Energy Sources of the Republic of Azerbaijan was removed to charter capital of «Azerishiq» OJSC for more efficient arrangement of Works in alternative energy sector.

Diagram 28: Existing and projected installed power for Alternative and Renewable Energy Sources in the Republic of Azerbaijan



The following diagram shows existing and perspective status for energy production on the account of alternative and renewable energy sources, natural gas saving and prevention of CO_2 emissions in that respect.

Diagram 29: Energy production by alternative and renewable energy sources, natural gas saving and prevented CO_2 emission by 2030



As shown in the diagram, it is planned to prevent approximately 3000 thousand tons of carbon dioxide as a result of more than 2200 MV power installation by using different alternative and renewable energy sources by 2030, which will facilitate implementation of volunteer obligations arising from Paris Climate Agreement.

3.2.1.5. Commercial/residential sector

Power and thermal energy, utility service which includes water and gas supply are the stimulating factors of economic growth and social welfare. Provision of consumers with utility services at high quality has a direct impact on effective performance of other economic sectors. Population growth and economic expansion causes increase of greenhouse gas emissions from this sector.

It is worth noting that, significant progress has been achieved towards increasing energy efficiency in energy supply through rehabilitation and expansion of old energy distribution grids in recent years by Azerenergy JSC which distributes energy to its consumers. At present, all the power engineering facilities, transmission wires, offices and supporting technical buildings owned by «Azerishiq» OJSC are under renovation in accordance with the modern standards. Construction-installation and repair-rehabilitation works in many new substations have been completed recently, both in Baku and in the regions. Thuswise, the works done will improve energy supply in Baku and the regions, increase the efficiency and quality of utility service and consequently, decrease the loss during energy distribution.

"Azeristiliktejhizat" JSC which carries out production, transmission, distribution, sale of thermal energy and provision of utility services and implements heat supply of residential houses and buildings, educational and healthcare enterprises and other social enterprises in Baku and other regions of the Republic continues taking actions towards application of modern systems. In fact, completion of necessary works for heating system, rehabilitation and modernization of relevant heating facilities and sources, construction of new boiler houses, reconstruction of heating systems and provision of consumers with reliable and high quality heating service were successfully implemented in 2014-2016 years in Baku and peripheral settlements.

Since the establishment of "Azeristiliktajhizat" JSC, 166 new heating sources have been set up. 108 old type boiler houses have been revamped with modern equipment, 57 heating points fed from regional heating boiler houses have been renovated into modern boiler houses, 271 gasification projects have been carried out, heating systems of 1828 residential buildings, more than 350 educational and healthcare enterprises have been reconstructed and rehabilitated in Baku and different regions of the republic as a result of state investments allocated on rehabilitation and reconstruction of heating systems. Modern boiler house and heating equipment which was manufactured in European countries and meets energy saving and ecological standards have been installed in newly constructed or revamped boiler houses. These boiler houses are better than the preceding for reliability and safety and are fully automated.

These measures have enabled increasing quality parameters of heating supply and improving the economic indicators significantly. Comparing to 2011, thermal energy production increased 1.9 times in 2015 and was 1235,0 thousand Gcal, heat loss decreased 4.5% and specific gas consumed for the production of 1 Gcal thermal energy decreased for 5,9 m3/Gcal, which conditionally resulted in 7.4 million m^3 gas saving.

"Strategic Road Map for development of utilities (electric and heating energy, water and gas) in the Republic of Azerbaijan" was adopted to determine future development priorities and trends of utility sector in the Republic of Azerbaijan and the named Strategic Road Map determined strategic view for this sector up to 2020, long-term view up to 2025 and target view for the period after 2025. Production of fully branched and ecologically clean uninterrupted power production, establishment of efficiency and quality standards in compliance with international indicators, launch of main stimulating mechanisms to realize the goals in power sector, provision of economic and effective gas distribution infrastructure, as well as high quality water management structure, ensuring efficiency in water consumption, elimination of current problems in heating supply and ensuring the efficiency of the system were determined as strategic goals.

The strategic target is to achieve improvement of normative-legal basis utility sector, increase of functional performance of regulating bodies, better performance in public utility enterprises and service quality, enrichment of investment environment, application of international norms and standards, enhancement of personnel base, optimization of tariffs and elaboration of stimulating mechanisms up to 2020.

Long-term targets up to the year 2025 include establishing improved institutional environment and prospective management systems, using modern technologies and specialized personnel potential, ensuring production on the account of investment opportunities, diversification in the distribution of each sector. Several achievements will be made in the Republic of Azerbaijan in utility service field and substantial reconstruction works will be implemented in energy production field through long term targets. The goal is to achieve efficiency in the energy sector through establishment of investment environment which involves wholesale market and private entities, especially the use of renewable energy and application of microelectric energy production. In addition, application of natural gas and water distribution networks which covers larger geographic area will be expanded through ensuring efficient and quality service.

End-users in the Republic of Azerbaijan will start micro electric energy production for self-supply during the period. The electric power obtained from photo power energy installed on the roofs of the buildings, especially in rural areas will be applied more widely since it is cheaper than the electric power produced in independent micro power facilities. This will mainly be more efficient for industrial fields which use different types of energy (electric or evaporation energy) in specific production fields such as manufacture of cellulose products or mining industry.

After the the modernized project is implemented, existing commercial and technical losses will be reduced in the distribution of natural gas in Baku. Since the level of natural gas supply of population is constantly improving, it is planned to increase the use of meters by that period in the Republic of Azerbaijan.

It is intended to continue investment allocation on improvement of potable, wastewater, heating, gas distribution systems in the Republic of Azerbaijan by 2025. Furthermore, actions towards provision of all end-users including new households and commercial entities with meters (especially completion of this action within the shortest period, considering that, meters for non-resident group will be installed on the account of the client) and improvement of old infrastructure for increasing efficiency will be implemented. All these efforts have been served in order to ensure performance efficiency in the sectors considered for the period after the year 2025.

3.2.1.6. Transport sector

In recent years, the Government of Azerbaijan has taken several actions towards developing and improving transportation system. In fact, some actions were carried out in the framework of "State Program for development of transportation system in the Republic of Azerbaijan (2006-2015)" and "State program for renovation and development of highways in the Republic of Azerbaijan (2006-2015)" towards developing transportation system in the country. Despite the fact that, implementation of such actions has not directly caused decrease of contaminations, they have indirectly contributed to decrease of emission releases. Numbers of highways were constructed, existing roads were enlarged, overpasses and underpasses, new parking stands were installed, which in its turn, caused reduction of traffic jams and ensured a speed-up in the movement of traffic, and resulted in decrease of emissions released from transportation sector to the atmosphere.

As for highways and transportation:

Considering the fact that, the amount of carbon emissions released during fuel use depends on speed of the means of transportation, plan and longitudinal profile for the design and construction of highways are developed to ensure movement of vehicles with the constant speed. Technical and economic indicators, as well as environmental impacts during highway construction are calculated, compliance of road with landscape is considered and design solution with minimum environmental impacts is preferred during the selection of direction and structure of highways.

In order to protect the lands covered by highways against negative natural, anthropogenic and technogeneous cases, trees and bushes are planted

in these areas, which in addition to its functional purpose, serve for decrease of harmful releases in the atmosphere. 549.000 trees and decorative bushes were planted in land plots of general use along highways from 2011 to 2016. 7 transplant nurseries covering 14.8 ha area were built up by road greening enterprises to plant green stripes along roads.

Use of industrial wastes which are located in the construction zone and useful for construction, as well as of asphalt-concrete wastes which are re-treated in the course of construction for the construction of highways allows saving raw materials and energy consumed for the production of new materials.

Development of highways plays special role in increasing the speed of passenger carriage and shipments by means of transportation. Several significant actions were taken towards improving transportation-operation indicators which directly meet the interests of consumers using highways and developing road infrastructure in 2011-2016. As a result of purposeful and systematic actions, the scope of construction, reconstruction and repair have increased year by year. In fact, the number of passage bridges under general use constructed, reconstructed and repaired within this period was 194, which in its turn served for decrease in the amount of release of harmful wastes into the atmosphere as well as the speed-up in the movement of traffic.

In recent years, rapid economic development, annual population growth and welfare improvement of Republic of Azerbaijan has resulted in rapid increase of parking vehicle lots. Based on the relevant decisions of the Cabinet of Ministers of the Republic of Azerbaijan, in order to ensure harmonization of requirements on harmful wastes released to the atmosphere from the means of transportation wheeled out in the Republic of Azerbaijan to European standards, since July 1, 2010 Euro-2 ecological norms, while since April 1, 2014 Euro-4 ecological norms have been applied in the territory of the Republic of Azerbaijan. These ecological norms have been introduced against harmful wastes released into the atmosphere from means of transportation wheeled out in the Republic of Azerbaijan (imported and manufactured in the Republic of Azerbaijan).

It should be noted that, passenger vehicles imported to the Republic of Azerbaijan are subject to excise tax rates depending on their engine size. According to the applicable legislation, low excise duty is applied to the motor-cars with low-capacity. Meanwhile, the policy towards application of low-level insurance premiums for motor cars with low-capacity engines under compulsory insurance of civil liability of vehicle owners has served for decrease of greenhouse gas emissions by stimulating the motor-vehicles with low-power engines.

Table 22. Information on excise tax applied on imported vehicles

Taxation item	Excise duty limit
When engine yield is up to 2000 cubic centimeter	0.20 AZN per each cubic centimeter of engine yield
When engine yield is up to 3000 cubic centimeter	400 manats+ 3 AZN per each cubic centimeter when engine yield is at 2011-3000 cubic centimeter
When engine yield is up to 4000 cubic	3400 manats+ 8 AZN per each cubic centimeter

centimeter	when engine yield is at 3001-4000 cubic centimeter
When engine yield is up to 5000 cubic centimeter	11400 manats+ 20 AZN per each cubic centimeter when engine yield is at 4001-5000 cubic centimeter
When engine yield is more than 5000 cubic centimeter	31400 manats+40 AZN per each cubic centimeter when engine yield is more than 5000 cubic centimeter

Some significant actions were taken in street-road network in Baku (the city where vehicles are most concentrated) in order to reduce traffic jams and speed-up the movement in the traffic. Under these actions, highways at 539.9 km length, 32 numbers of different overpasses and 48 numbers of overground and underground passages were constructed.

Since December 2011, based on the Intelligent Transportation System technology, Intelligent Transportation Management Center was established, which ensures security, comfort, effectiveness, promptness and environmental protection. This technology includes an integrated network of transportation information, advanced transportation monitoring and management, analysis and optimization of the current situation, crash & incident detection, notification and response and advanced crash avoidance.

Application of Intelligent Transportation System in Baku not only increased the average speed of traffic movement for 8-10 km/hour, but also eliminated several problems related to passenger carriage by town-service buses. As a result of high quality and comfortable service, the preference of public transportation to private vehicles by the citizens to meet their needs have stimulated the decrease of greenhouse gas emissions.

Substantial works have been and are being taken carried out towards modernization of vehicle parking lots, which are used for shipment and passenger carriage purposes, and improvement of production and technological processes. Minibuses used for passenger-carrying were replaced with large buses and passenger-carrying route plans were optimized.

300 of new buses manufactured in France and operated with Compressed Natural Gas (CNG) were purchased and put into operation by “BakuBus” LLC established to serve the passengers in Baku in the field of bus transportation in compliance to international standards, provide this field with modern means of transportation, ensure technological and ecological safety during passenger carriage. Considering that, carbon emission released during the use of compressed natural gas is less than compared to other fuel types, the use of such means of transportation in passenger carriage is one of the measures serving for decrease of greenhouse gas emissions.

Furthermore, several other engineering and administrative measures have been taken in the field of transportation in recent period which served for decrease of greenhouse gas emissions. According to Minutes no. 1 dated June 30, 2015 by Traffic Security Commission of Cabinet of Ministers of the

Republic of Azerbaijan, motion of lorries, having more than maximum allowed 5 tones weight was restricted to enter Baku city in the daytime (except for certain group of vehicles) and free parking lots with necessary convenience for means of transportation from towns and districts of the republic were set in operation at south and north entries to the city. Such progress might be assessed as positive actions towards reducing traffic density and traffic jams in Baku.

It is to note that, Draft "State Program for Traffic Security in the Republic of Azerbaijan for 2017-2021 years" have been developed jointly with relevant state agencies, based on the instruction by the Cabinet of Ministers of the Republic of Azerbaijan. This Draft includes the following actions towards decrease of greenhouse gas emissions:

- Improving and expanding the performance of Intelligent Transportation management System (ensuring more efficient use of opportunities under Intelligent Transportation Management System in administrative area of Baku city and expanding its coverage for Absheron as well as other main highways of the Republic);
- Optimizing speed limit allowed in highways;
- Improving road dividers in highways (taking relevant measures for unrestricted access);
- Increasing traffic potential of highways and reducing the traffic density;
- Constructing bicycle strips and parkings;
- Stimulating the use of ecologically clean means of transportation;
- Arranging the utilization of means of transportation

Subway

Since number of people and vehicles in Baku is constantly increasing, transport network development measures should be taken into account on a regular basis. It is also worth noting that the Ministry of Transportation prepared the Development scheme for Transportation infrastructure of Baku city as for 2030.

In April 19, 2016, "Avtovagzal" and "Memar Ajami" stations which were the first priority of prospective development plan of Baku Metropolitan were put into service and thuswise, the length of underground railway lines became 36.6 km, while the number of railway lines became 3 and number of railway stations became 25. At present, according to conceptual development programme, construction works are ongoing in Baku metropolitan. According to State program, total length of underground railway lines in the capital is 119.1 km, while in near future the number of stations will become 76.

Railway traffic

As a result of energy efficient projects implemented by "Azerbaijan Damir Yollari" Closed Joint Stock Company, timber sleepers were replaced with reinforced-concrete sleepers according to the repair plan of overground railway materials. Consequently the speed was increased and KISS ES-2

two-storied 5 electric trains which meet modern standards and consist of 4 cars were purchased and put into service. Meanwhile, structural repair of circular railway at 29.2 km in the direction of Baku Sarnishin-Pirshaghi-Sumqayit was commenced in November, 2016 and now is under completion. Structural repair of main railway roads at 317 km in the direction of Baku-Boyuk Kasik was commenced in 2010 and completed in 2015. Structural repair of 600 km of railway lines under Phase 2 of "Reconstruction of Azerbaijani Railroads" Project is ongoing and totally thorough repair of 850 km of railroads have been completed, are replaced with 800 meter long continuous rails and other necessary measures are taken. The timber sleepers are replaced with concrete sleepers during structural repair railroads. Replacement of power supply in the direction of Baku-Boyuk with traction system at 25kV alternating current is under completion. The Replacement of Automated Signalling System of railroads with Microprocessor-based management is under implementation.

Renovation of locomotive and rolling stock, modernization of diesel-powered locomotive to ensure transportation of incremental load, that is, replacement of old type engines with modern energy and ecologically efficient engines were commenced, 10 units of new TE33A «Evalution» type of diesel-powered locomotives to be used in transportation were purchased and put into service. These TE33A «Evalution» type diesel-powered locomotives are modern and supplied with asynchronized traction engines with 6 axles, 2 cabins which are economically efficient for diesel consumption and work with alternating current.

Necessary actions are being taken towards purchasing of 40 units of new freight electric locomotives with alternating current and 10 units of two system passenger electric locomotives, extending the operation lives of electric locomotives and diesel-powered locomotives in the existing locomotive park through modernization, ensuring safe operation and improving the material-technical base of locomotive facilities. Due to renovation of rolling stock in 2015-2016, 3101 wagons, including 401 closed wagons, 1000 high-sided wagons, 200 container carrying wagons, 600 vessel wagons, 300 wheat carrying wagons, 100 hopper-dosators, 400 universal platforms and 100 cement carrying wagons were purchased and put into service.

Suitable geographical position of the country opens large-scale opportunities to form a transportation system characterized with effective performance in both west-east and north-south directions. "Baku-Tbilisi–Kars new railroad" Project has been successfully implemented in the country, jointly with the Republic of Georgia and Turkey. Completion of this project which has great political and economic importance for the Republic of Azerbaijan, will enable establishing direct railway connection between Asian and European countries and increasing transit potential of the country by ensuring easy access of freight and passengers to Eurasia through Azerbaijan, Georgia and Turkey. "Baku-Tbilisi-Kars new railroad" was put into service after the opening ceremony on October 30, 2017, and 20 units of first class passenger wagons has started its operation on "Baku-Tbilisi-Kars new railway" with the capacity meeting European railway standards.

"Ecological Strategy of the Company up to 2030" was developed and approved to ensure arrangement of environmental protection work, observation of nature protection law, application

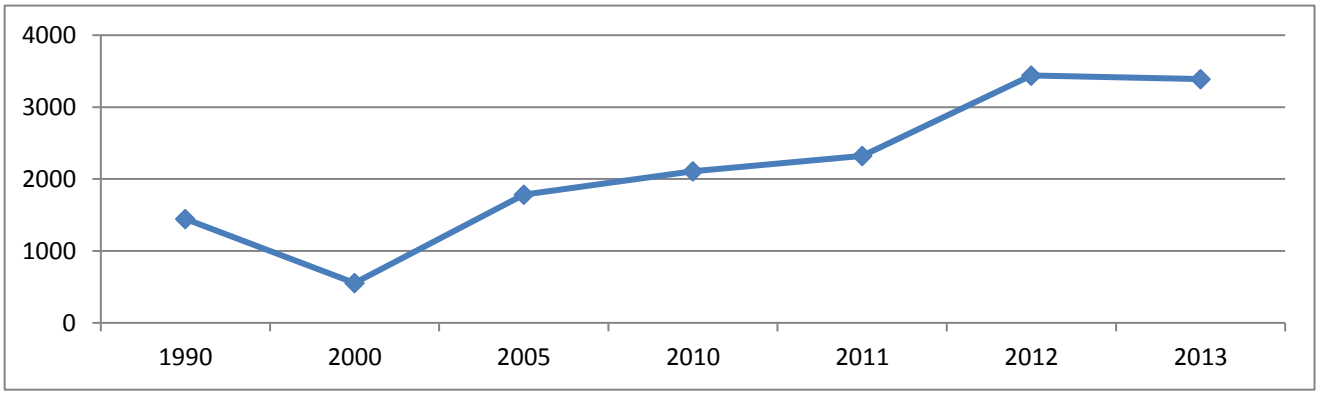
of ecological management and industrial security system in the field of ecology in order to enhance control over the limit of harmful substances released to the atmosphere and efficient use of fuel-energy resources by relevant enterprises and companies of Azerbaijan Railways Closed Joint Stock Company. Technical reforms aimed to mitigate negative impacts to the environment and cost saving and the following strategic targets and purposes in the field of environmental protection were determined herein:

- Reduction of harmful substances, as well as greenhouse gas emissions released from permanent sources to the atmosphere;
- Reduction of harmful substances, as well as greenhouse gas emissions released from portable sources to the atmosphere;
- Prevention or reduction of wastewater discharged into sewerage systems;
- Implementation of actions for prevention of negative impacts of production field on land and elimination of contamination results;
- Use of wastes in overproduction as an additional raw material source;
- Application of the most modern technologies for the use and neutralization of wastes;
- Increase in energy efficiency and decrease in material consumption in technological processes;
- application of single corporative principles and norms in ecological management;
- Application of ecological control in the production and improvement of ecological auditing practice;
- Increase of economic efficiency in nature protection.

3.2.2. Industry

According to results of inventory carried out under the current report for Greenhouse gas emissions, in 2013 5.4% of total emissions in the country was emitted by industrial category. The following diagram describes tendency of greenhouse gas emissions from 1990 up to date:

Diagram 30. Change of Greenhouse gas emissions in the category of industrial processes in 1990-2013 , thousand tons CO_2 ekv



It is to note that, most of the industrial enterprises were not supplied with emission control equipment in former Soviet Period. Whereas those supplied with equipment guaranteed only 50% reduction of necessary waste. This period might be characterized with decline due to collapse of former Soviet economic system. In 1990-2000 emissions were decreased for about three times. Main reasons of air pollution in this period were the use of old technologies and equipment in industrial enterprises, frequent errors in production network, misoperation of equipment discharging the emissions and negligence of ecological issues in the industrial enterprises.

Since 2000, success was achieved in the development of industry, as in all the fields of economy of the Republic of Azerbaijan. Total production volume of industrial products has increased for 3.1 times in 2015 compared to the production volume in 2000. Within this period, many projects aimed to establish modern competitive industrial fields, improve infrastructural provision of industry, open new workplaces, and thus the industry has entered the new development stage.

Since 2004 new industrial development period has started in Azerbaijan. Major part of income made from oil-gas sector have been directed to the development of different industrial fields, state programs for optimizing industrial structure in the regions have been developed, significant actions have been taken towards solution of energy supply, many projects have been implemented to improve the infrastructure and put new production facilities into service. Favorable business environment and regulation of interpreneurship have played ignificant role in the development of the industry. As a result of state support on the development of entrepreneurship in recent years, the share of private sector in GDP was 81.2% in 2015. The number of entrepreneurial entities became more than 661 thousand, while the number of legal entities became more than 84 thousand. As a subsequent continuation of such action, the year of 2014 was announced as “Industry year” in Azerbaijan and action plan on the development of industry was implemented in accordance with the Decree no 212 dated January 10, 2014 by the President of the Republic of Azerbaijan. In addition, “Strategic Road Map on development of heavy industry and machinery in the Republic of Azerbaijan” adopted in 2016 considers actions to be taken in the industry as for 2025 and the following period. Above-mentioned Strategic Road Map, Priority 1.2 targets achieving desirable efficiency in energy use.

Realization of state policy has allowed formation of sustainable financial resources and subsequently development of all the industrial fields. In fact, the volume of industry increased twice during last 10 years mainly owing to non-oil sector. Development rate of non-oil industry in recent years have prevailed that of general industry. In the year 2015, which was characterized by world economic crisis, non-oil industry demonstrated increase of 8.4%. Serious improvement has been observed in the last 10 years in the field of metal industry and machinery, which are included to non-oil industry. In fact, production rate in the field of machinery has increased for about 15 times and its share in non-oil processing industry has reached 21.5%.

Products and services manufactured by the fields of machinery in 2015 increased by 2 times. This increase covers installation and repair of machine and equipment, which is the important field of machinery, as well as production of electric equipment. Optimization process of industrial structure has occurred gradually during last years, the share of mining sector has decreased, while that of processing sector has increased. In 2015, total budget directed to main capital was 16 billion manats, 53.3% of which was allocated to the industry sector.

Significant actions have been taken towards entry of new production facilities into service in the fields of heavy industry and machinery from the point of expanding the structure and regional coverage of industry. Establishment of Sumgait Technologies Park, Sumgait Aluminum Factory, including Ganja Aluminum Complex, gold-copper refineries in Sumgait, Gadabay, Dashkasan, Garadagh Cement Factory, Sumgait Carbamide Factory, Ganja Agricultural Machinery Automobile factories, Nakhchivan Automobile Factory, ATEF Large scale Transformer Factory, "Norm" Cement Factory, Sumgait Plastic Processing Factory, Mingachevir Electronic Equipment Factory other factories producing steel pipes, solar panels and metal structures are very important measures taken towards the development of economy.

Actions towards establishment of other necessary infrastructural facilities were carried on for the installation of external and internal infrastructure in Sumgait Chemical Industrial Park, provision of different services such as Office, consulting, laboratory examination, business incubation, training and vocational training services and effective implementation of entrepreneurship. Implementation of "Polymer" Project by State Oil Company of Azerbaijan Republic within the park is considered as the largest Project carried out during last 40 years in Petro-chemical industry of Azerbaijan for its type and scale. Furthermore, different factories engaged in manufacture of large diameter corrugated polyethylene pipes, steel pipes, mechanical equipment and hydro-technical equipment, production of glass panels based on "Float" technology, and production of plant protection means – pesticides for the first time in the republic have started functioning under resident status.

Several facilities involved in retreatment were registered in Balakhani Industrial Park. Modern shipyard complex was put into operation in Garadagh Industrial Park. Works were carried out to involve scientific and innovative products in High Technologies Park. Actions towards Joint Automobile production with "Iran Khidro" company of Iran Islamic Republic have been commenced in Neftchala Industrial Site.

It is planned to construct relevant facilities for the production of pharmaceutical industry. Preparatory actions are carried out towards establishing necessary condition for local entrepreneurs involved in light industry and other fields and constructing the infrastructure in Mingechevir Industrial Park and Masallı, Sabirabad, Hajigabul, Neftchala Industrial Sites.

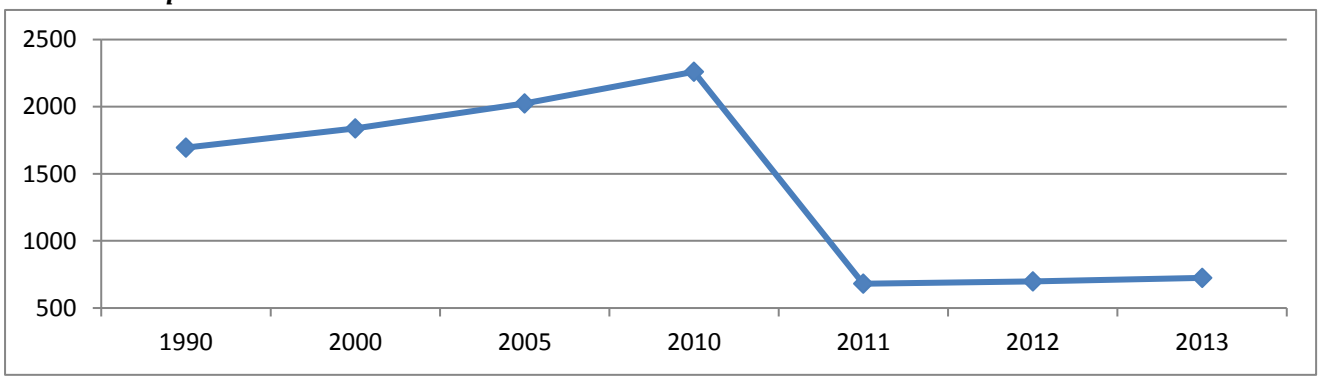
Despite the economic development, increase in emission level has not been so high due to closedown of several enterprises polluting the atmosphere and their replacement with new, modern and ecologically clean ones. It is to note that, increase in the number of enterprises and workforce is inevitable in current situation of economic development. However, it is worth noting that, most large enterprises located in Baku, especially oil and gas enterprises have started to apply modern low emission technologies, which prevents increase of emissions in its turn.

Considering the modern invitations and new initiatives in the current stage, it is necessary to take several actions with the view to modernizing the industry and expanding non-oil industry, as well as to involve natural and economical resources to the economic turnover, establish new prioritized production fields or industrial parks in addition to traditional industrial fields, enhance industrial potential in the regions setting up new opportunities ensuring industrial development based on innovations. In fact, in order to achieve improvement in heavy industry and machinery in the medium-term perspective, full operation of assets and natural resources in the industrial field will be ensured by 2025, application of effective work experience will be implemented to the fullest extent. Elimination of gaps in production of outputs is the main factor for effective use of natural resources of the country. Enterprises operating in the Republic of Azerbaijan will act as a model enterprise for the neighboring countries in terms of efficiency. Indeed, all the above listed actions will contribute to the achievement of reduction target by 2030 undertaken under Paris Agreement.

3.2.3. Waste sector

As a result of inventory carried out on Greenhouse gas emissions under this report, 1.2% of total emissions of the country is shared by waste sector. Tendency of greenhouse gas emissions in the sector since 1990 is shown in the following diagram:

Daigram 31. Change tendency of Greenhouse gas emissions from waste sector in 1990-2013, thousand tons CO2 eq.

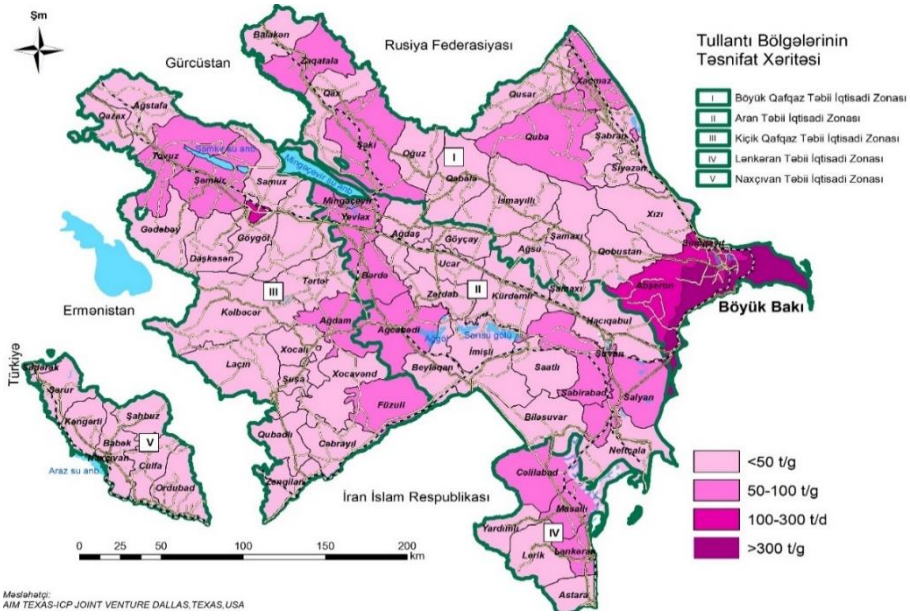


As shown in the diagram, in recent years reduction of greenhouse gas emissions from waste sector has been observed. Sharp reduction in 2011 can be explained with the application of IPCC methodology during the inventory of greenhouse gas emissions, because the calculation for the previous years was carried out with IPCC methodology updated in 1996. Greenhouse gas emissions of this sector since 1990 will be re-calculated through new methodology under the next National Communication report.

Solid wastes are generated by households, offices, hotels, shops, schools and other commercial facilities in the country. Main components of solid waste are food waste, paper, plastic, cloth, metal and glass. However, it also includes destruction and construction wastes, electric lamps, old and inoperable electronic devices, batteries, small amount of dangerous waste such as medicine, and other chemical products. According to the results of preliminary researches, 56% of total waste is generated from organic waste fractions, while 28% is generated from recyclable wastes.

It is worth noting that, the cities of the Republic of Azerbaijan are covered with 90% waste collection services. However, such service is almost not provided in rural areas.

The reduction of greenhouse gas emissions released from waste sector to the atmosphere is the prioritized problem of the country. In fact, modern methodologies for waste management have been applied in the Republic of Azerbaijan in recent years. As such, the construction of waste incineration factory was carried out under "Complex Action Plan on improving environmental situation in the Republic of Azerbaijan in 2006-2010" approved under the Decree dated September 28, 2006 by the President of the Republic of Azerbaijan. In addition, collection and transportation of all solid wastes regardless of the source of generation is being implemented by Baku City Executive Power. However based on Decree dated August 6, 2008 by the President of the Republic of Azerbaijan "On improving the municipal waste management in Baku", "Tamiz Shahar" Open Joint Stock Company carries out placement and disposal of household wastes in accordance with modern standards and improvement of environmental situation in Baku. "Tamiz Shahar" JSC also carries out acceptance and utilization of solid household wastes in Baku (about 700 thousand tons per year)



It is to note that, Balakhani solid waste landfill was rehabilitated in accordance with modern ecological sanitary norms under the "Integrated Solid Waste management Project" based on "Absheron Ecological Rehabilitation Project" jointly implemented by World Bank and the Republic of Azerbaijan. The Construction work aimed to develop Balakhani landfill into sanitary landfill meeting the highest international standards was commenced in early 2015 in order to ensure its operation in the next 20 years. Despite the fact that, the landfill is located on the coast of Boyukshor lake with rugged topography, rehabilitation and construction work is successfully carried out at present. As a result of rehabilitation Works, earth work have been completed on 60 ha area and 2.9 million m^2 area has been covered with special isolation layers. Generally, 26 special cells were constructed for neutralization of wastes in the polygon. 9.7 million ton of waste might be neutralized in the new area.

Meanwhile, the network which includes about 40 km of different size high density polyethylene (HDPE) pipes, 15 special manholes, two ponds (üith a capacity of 1500m and 400 m) for initil cleaning of wastewater, 3 km length trenches,

more than 400 gas ducts were installed in the landfill area to collect waste, rainwater and biogass. Wastewater within the landfill area is collected by drainage and treated by reverse osmosis method in the facility with 80 m^3 wastewater treatment capacity. Then, treated water is used as irrigation and technical water. Station which consists of plan generators at 2MVt capacity converts methane gas produced upon waste putrefaction to electric power. Methane gas produced from cells constructed for the placement of wastes is pumped to the station by special pumps and methane gas is converted to electric power by generators in the station.

Wastes are not sorted but incinerated in mixed form in the Baku municipal waste incineration factory (at 500 thousand tons annual capacity) which was constructed in 20 ha area located in Balakhani settlement. The Factory is considered to be operated by France "CNIM" S.A for 20 years. Power station at 37 MV capacity is under operation in factory (231.5 mln. KV/t hour electric power is produced per year) and 33 MV power is supplied to city power network. In general, generation of approximately 660 thousand tons of greenhouse gas emission (CO_2) will be prevented after 10 year operation of solid waste incineration factory.

Balakhani Industrial Park was established under the Decree no 1947 dated December 28, 2011 by the President of the Republic of Azerbaijan to develop recycling in the country. Opening ceremony of the park was held on September 22, 2017.

Above mentioned measures will enable solving the problem with household wastes, improving environmental situation in Baku and Absheron, eliminating the factors which cause hazards to potable water, environment and health of people.

Forecasts related to population growth and increase in development rate of industry affords ground to announce that greenhouse gas emissions released from waste sector will increase for about 60 thousand ton CO_2 equivalent per year. It is planned to construct waste processing factories in different regions and large cities of the country in future in order to reduce emissions from this sector.

It is worth noting that, the Ministry of Economy of the Republic of Azerbaijan developed and submitted draft "National Strategy on Solid Household Waste Management in the Republic of Azerbaijan" for waste management to the Cabinet of Ministers in July 2017.

Main goals of National Strategy is to establish landfills and transfer sites which will provide neutralization service to different groups, improve collection and neutralization processes in the districts of Azerbaijan, ensure efficient use of current resources in establishing investment and development schemes aimed to improve collection, re-processing and neutralization of solid wastes in all villages and cities of the country.

General objectives to achieve goals of National Strategy include:

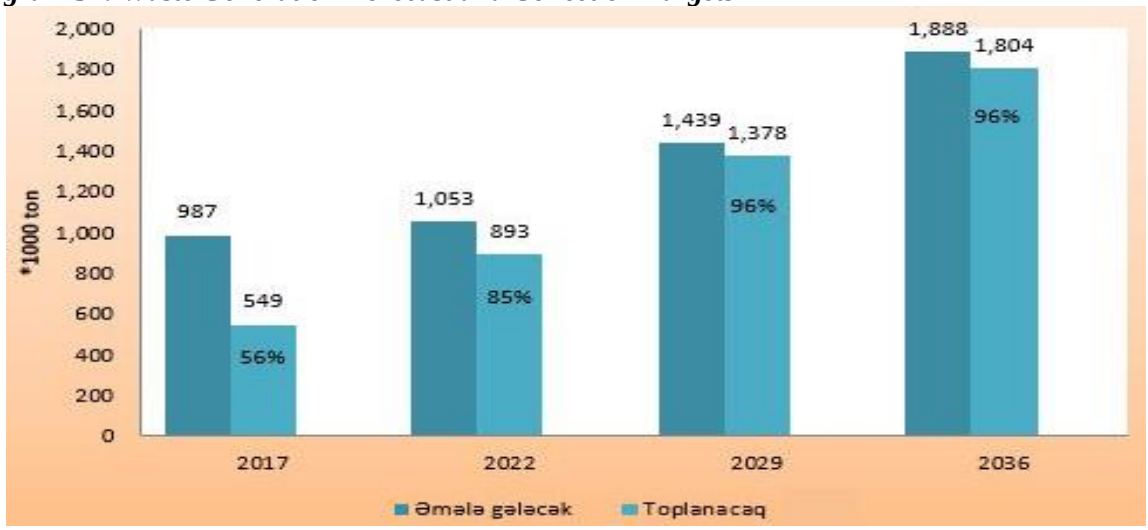
- Expand solid waste collection service towards all residential and non-residential enterprises of Azerbaijan;
- Ensure safe and efficient neutralization of all unproductive and untreatable wastes through cost-effective sorting;

- Improve sorting and recovery of resources through public awareness, efficient public enlightenment campaigns and by enhancing new solid waste systems and market;
- Sort potentially hazardous wastes for proper management in order to reduce threats against public health and environment;
- Shut down existing open landfills in an ecologically adequate manner to reduce negative impacts.

Above mentioned concept document considers expanding the coverage of solid waste collection and subsequently determines certain targets. In fact, it is targeted to collect 100% and 90% of wastes in urban and rural areas respectively by 2036.

Generally, Waste Generation Forecast and Collection Targets by 2036 based on concept document are shown in the following diagram:

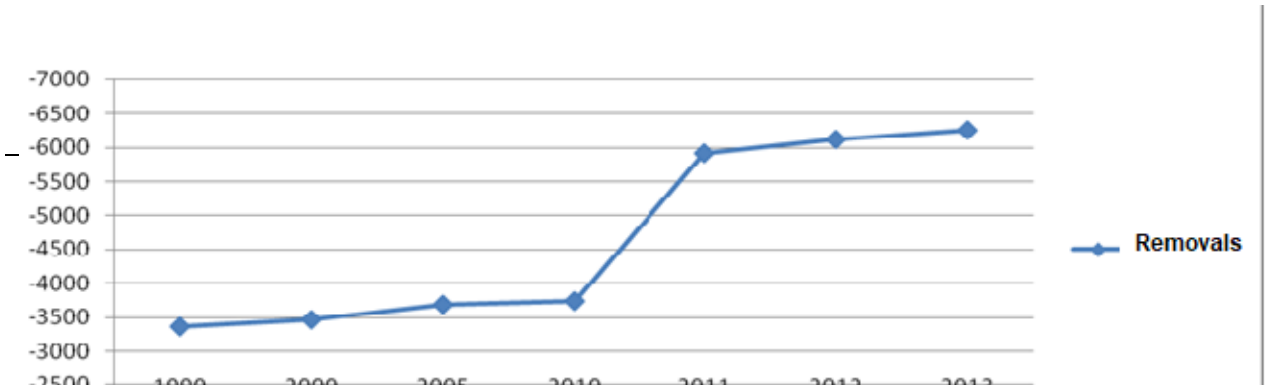
Diagram 32: Waste Generation Forecast and Collection Targets



3.2.4. Forestry

According to the results of inventory carried out on greenhouse gas emissions under this report, -6.248 thousnad ton CO_2 absorption occurred in forestry in 2013. Change tendency in the absorption of greenhouse gas emissions in this sector in 1990-2013 years is shown in the following diagram:

Diagram 33. Change of greenhouse gas removals in forest sector in 1990-2013 years, thousand t, CO2 eq.



It is to note that, absorption level reduced due to decrease of forest areas in the country in 1990-1995. However, forest restoration and rehabilitation works carried out in the country in recent years have caused increase in the level of carbon absorption. Forest Rehabilitation works have been carried out in 159.7 thousand ha area during last 16 years under the "National Program on Forest Rehabilitation and Restoration in the Republic of Azerbaijan (2003-2010)", while 53.9 thousand ha area has been reforested, and 102,7 millions of trees have been planted.

Generally, large scale landscaping projects based on modern methods have been implemented during recent years after the arid areas and low-quality lands were cleared and made suitable for tree-planting. 5 386196 numbers of trees were planted in 4 438 ha area, while nearly 11 thousand kilometer area was provided with modern drip irrigation systems.

In addition, in accordance with the execution of Decree by the President of the Republic of Azerbaijan on "Landscaping along right of way in the Republic of Azerbaijan", more than 3.000.000 evergreen and other trees and bushes have been planted along Alat-Hajigabul main highway, between Bayil hillside and 20th area, on Guneshli pass, the areas around International airport, along Alat-Astara highway in recent years.

In 2017, relevant works towards forest restoration, rehabilitation and afforestation were continued in non-forest lands, 504 003 numbers of different trees and plants were planted in Absheron peninsula and other arid zones adjacent to it, along highways, and all the areas were provided with drip irrigation system. In that year, 75 601 numbers and 18 200 numbers of trees and bushes of different types were planted along Zigh-Haydar Aliyev Airport Highway and Bayil hillside respectively. 41 710 trees and bushes were planted on Alat-Hajigabul section of Baku-Gazakh highway, while 143 227 trees were planted at Alat-Salyan section of Baku-Astara highway, 92 349 trees were planted along Baku-Shamakhi highway, and 88 470 trees were planted along Baku-Guba highway.

The Ministry of Ecology and Natural Resources have commenced the creation of agroforestry zones to support initiatives on development of agriculture in the country in recent years. Orchards have been created by planting totally, 1803400 numbers of young plants (202 thousand mulberry, 237

thousand walnut, 300 thousand hazel-nut, 517 thousand pomegranate, 154 thousand almond, 30 thousand chestnut, 63 thousand olive and other trees) up to date. 41 383.3 ha open areas out of forest fund considered to be replaced, open fields with relatively small area, meanwhile 687 ha area of non-forest lands have been determined and mapped out. Necessary materials for cultivation have been delivered to the site.

The Ministry of Ecology and Natural Resources plans to create agroforestry zones in total 24678 ha area by 2021. In fact, actions towards creation of agroforestry zones which include productive types of fruit trees (olive, almond, mulberry, common jujube, pistachio) suitable for local condition have been started in the country. Totally 2185.44 thousand young plants have been planted up-to date in 4902.2 ha area through determination of endemic tree types, nature of grounds, irrigation options and assessments made in different parts of the country. Earth building works for plantation of agroforestry areas, including citrus gardens and tea plantations were carried out in autumn, 2017 and such action is ongoing.

Considering that, silkworm breeding is one of the priorities and its development is directly connected to expansion of mulberry gardens, 948 850 numbers of young plants were distributed for free to different districts to companies, farmers, individual farms, executive powers and municipalities involved in development of silkworm breeding for growing mulberry gardens.

Totally, more than 2.1 million of trees were planted on the forest and non-forest land areas in 2017.

Public sector has supported landscaping and tree-planting campaigns in the country in recent years. It is worth noting that, IDEA (International Dialogue for Environmental Action) Public Union is more sensitive about expansion and protection of greenery. Since its establishment, IDEA Public Union has planted more than 5 million trees in the country.

Totally 1,493,891 pine, plane and oak trees were planted in 76 districts of the Republic of Azerbaijan under “Republic-wide Green Marathon” implemented in 2014 by IDEA Public Union in order to contribute environmental protection by preventing possible threats caused by decrease of green areas and encouraging towards tree-planting.

IDEA Public Union launched tree-planting actions in conjunction with the spring planting season, jointly with the Greenery Agriculture Association under the Executive Power of the city of Baku aimed at expanding green spaces of Baku and improving their quality. In the framework of the campaign, poplar trees, which are considered hazardous based on the assessment of the Examination Department of the Ministry of Ecology and Natural Resources, will be cut down and replaced with pine, cypress, olive, Japanese pagoda, ash, medlar, hackberry and other trees in accordance with soil and climate conditions of Baku and the Absheron peninsula.

Regional Development Public Union of the Heydar Aliyev Foundation, IDEA, Ministry of Ecology and Natural Resources of the Republic of Azerbaijan, United Nations Food and Agriculture Organization (FAO) and “Cavan” Youth Movement Public Union launched a joint project on establishing fruit gardens in April, 2017. A total of 10000 fruit trees such as hazel-nut, pomegranate, apricot, feykhoa, date trees were planted in 18.2 ha area of 9 districts under the project.

Social-economic importance of these projects is that establishment of such fruit-trees will not only contribute to improving welfare of people, reducing the dependency on agricultural import in the country, but also enable executing the target on reduction of carbon gas for 1 million ton by 2030 undertaken in accordance with Paris Agreement adopted by the Republic of Azerbaijan 2 years ago.

Below listed projects have been implemented to develop forestry farm in the Republic of Azerbaijan with the participation of several international donors in recent years:

- Management plans were developed based on modern methodology on sustainable forest management under "Sustainable Land and Forest Management in South Caucasus landscape" Project (2013-2018) financed by Global Ecology Fund, local guidelines were developed on greenhouse gas absorption by the forests based on IPCC 2006 guideline and forest restoration and rehabilitation work was carried out in 70 ha area;

- Assessment of climate change impacts on forest resources was carried out under "Forest Law Enforcement and Governance FLEG II Project (2013-2016) financed by European Neighborhood and Partnership Instrument (ENPI);

- Actions towards developing assessment and monitoring of forest resources were started under "the Project on monitoring and assessment of forest resources to strengthen knowledge about the forest fund of Azerbaijan" (2017-2019) financed by Global Ecology Fund and executed by the Ministry of Ecology and Natural Resources jointly with FAO. It is planned to carry out forest restoration and rehabilitation work in 600 ha area in following years under this Project.

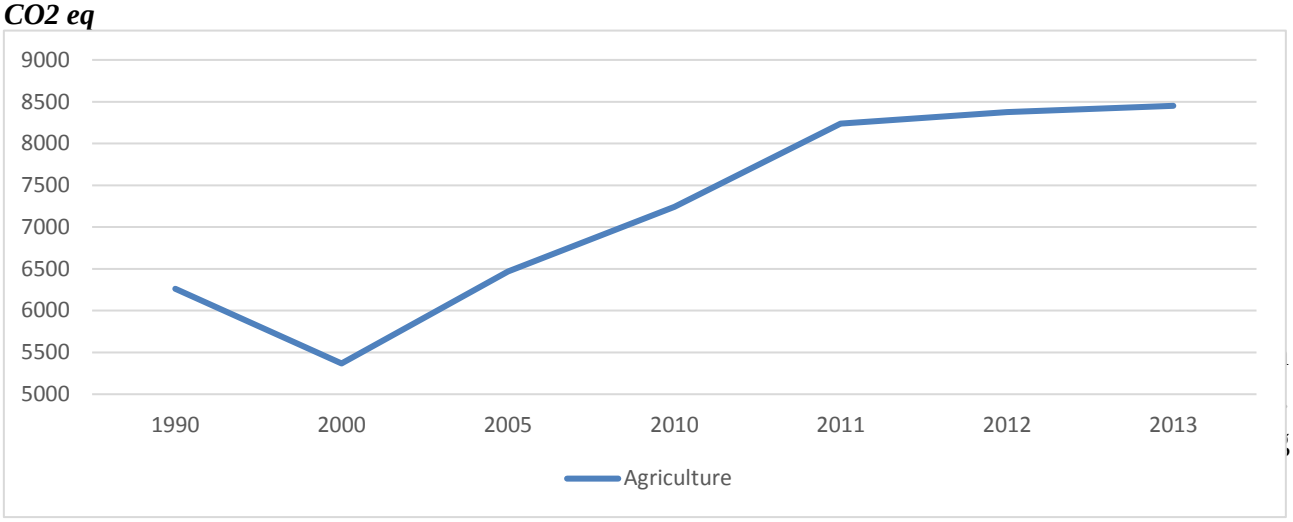
SOCAR has taken tree-planting actions in recent years and has planted 756.497 numbers of trees, bushes and flowers in 502.67 ha area of its enterprises. 48.869 different types of trees and bushes were distributed to enterprises and companies of SOCAR in 2016.

Policy elaborated towards development of forest sector in the Republic of Azerbaijan proves that, there will be increase in emission absorption by forest sector in future years. According to the information obtained from Forest Development Department, forest plantation will be carried out as shown in the below table, which will cause absorption of 840 thousand tone of additional emission within this period:

3.2.5. Agricultural sector

According to the inventory of greenhouse gas emissions carried out under this report, 14% of total emissions in the country in 2013 were released by agricultural sector. According to this indicator, agricultural sector is on the second place after energy category in total share of greenhouse gas emission in the country. Change tendency of greenhouse gas emissions from this category in recent 20 years is shown in the following diagram:

Diagram 34. Change of greenhouse gas emissions og agricultural sector in 1990-2013 years, thousand t, CO2 eq



After Azerbaijan gained its independence and started the transition process to market economy, fundamental structural changes occurred in agricultural sector. Despite the fact that, total area of arable lands had decreased until 2000 it was constantly expanded from 2000 due to development of private sector and extensive production method. Total area of arable lands increased for 8.4% in 2015 comparing to that in 1990. As a result of extensive expansion of cattle-breeding, total number of both bovine animals and small ruminants has constantly increased since 1995, while that of birds has increased since 2000. Consequently, total number of bovine animals and small ruminants increased for 47.9% and 60.1% respectively in 2015, comparing to that in 1990.

Thuswise, after Azerbaijan gained its independence and started transition to market economy in the country, main trend in the production of agricultural crops has been characterized with formation of production structure in this field which is fundamentally based on production of food-purpose agricultural crops. Meanwhile, there was serious increase in the production of food-purpose processing crops within the last period. In addition, relation of import volume of some products to local production of such crops is adequately high in order to meet both consumption demand in domestic market and demand of processing industry for raw material.

It is to note that, actions towards climate change mitigation in agricultural sector have been less than those taken in other sectors. Although private sector was involved in agricultural sector as a result of land reforms completed in 1997, there was not any knowledge and skills about the climate change mitigation actions. Pilot Project on the use of biogas facilities through the initiative of several organizations, including the Ministry of Ecology and Natural Resources, as well as enlightenment actions against burning agricultural crop residues in arable lands have caused relative decrease in the increase rate of emissions released from this field.

In accordance with the Decree No 152 of the President of the Azerbaijan Republic dated 16 April 2014, to ensure transparency, accountability and efficiency of the state support of the agrarian sector, as well as to exercise more progressive practices and approaches in the field of agriculture, the Ministry of Agriculture provided implementation of activities on creation of "Electronic Agriculture" Information System (**EAIS**) according to the principles and innovative technologies applied in the European Union

According to the developed project strategy documents, technical requirements for relevant projects, the policy of e-government expansion in our country, and the prepared action plan on the implementation of EAIS, the Ministry of Agriculture launched simultaneously several inter-connected projects as follows:

- Development and implementation of information systems (software, databases), provision of licenses for regular software
- Establishment and development of ICT infrastructure (central database, servers and computer equipment, network and communication systems)
- Development and use of new ortophoto maps of the country's relevant territories (base spatial information)
- Creation of single geographical data base for land plots, vegetation and agricultural resources
- Provision of advisory services for relevant components
- Capacity building of the Ministry's employees on EAIS use (arrangement of special training, transfer of new knowledge)

Over 1,300 automated workplaces equipped with the necessary facilities and ICT infrastructure have been created to ensure development and use of electronic databases.

According to the principles of the EU Integrated Administration and Control System (IACS), the "Subsidy and Policy Information" system, comprising several sub-subsystems (modules - "Farm Registry", "Land plots Identification", "Subsidy Requests Registration, Risk Analysis, Control, Payment, etc.), has been created and is currently used at the corporate level.

Information about more than 210,000 farms, farmers' land plots, livestock, machinery and other components has been collected in the system.

Simultaneously, based on aerospace and satellite images, new ortophoto maps for 69431 sq.km area, primary geographical database for agricultural lands have been created comprising borders of administrative territorial units, Ministry's enterprises and facilities, their lands, areas of changed designation, large farms, seed producers, hazelnuts, cotton, greenhouses, salinized areas, areas newly used in agriculture, land plots of agro-parks and other information.

These activities will also assist in the achievement of qualitative statistical information on agriculture, the application of environmental standards, environmental protection, biodiversity conservation, and, particularly, will support climate change related regulation, and provide opportunities for quality assessment to substantiate policy decisions in the agrarian sector.

Strategic Road Map was adopted "on production and processing agricultural products in Azerbaijan Republic" approved under the Decree no 1138 dated December 6, 2016 by the President of the Republic of Azerbaijan. Implementation of this Strategic Road map will form suitable business environment by increasing effectiveness of relevant regulation system and improving competitiveness in the market. In addition, complex actions will be taken towards development of competitive environment in production, sale and market of production means, facilitation of access to financial resources, improvement of market infrastructure, enhancement of access to markets, development of information-consultation services and so on. Consequently, it will establish suitable condition for efficient use of natural resources, enhancing performance in the farms, developing production fields of agriculture and food products in respect of value chain, subsequently will ensure sustainability of food security, achieve increase of export volume in non-oil sector and improve profit-making capacities of those involved in agricultural field.

In accordance with the execution of "Strategic Road Map on production and processing of agricultural products in the Republic of Azerbaijan", Action Plan, sub item no 7.1.1 "Assessment of climate change impacts on agriculture and preparation of adequate application plan", analysis of statistic data on climate change impacts on agriculture has been commenced and climate scenarios have been developed based on modern methods. Meanwhile, in line with execution of Action Plan, sub-item 7.2.2 "Reduction of carbon gas emission in agriculture", propaganda activities have been held towards collection and use of methane gas released from manure in the farms as renewable energy, jointly with representatives of farms involved in cattle-breeding in different districts, executive powers and agricultural departments as a result of carbon gas emission actions taken in plant-growing and cattle-breeding.

Promotion towards collection and use of methane gas released from manure in the farms as a renewable energy will be considered due to carbon gas emission reduction actions taken in plant-growing and cattle-breeding under the above mentioned Road Map. The actions to be implemented towards development of cattle-breeding in the country will be coordinated with those towards reduction of greenhouse gas emissions. Meanwhile, creation of layered field-protecting forest strips around the cultivation areas will be supported and action plan on expansion of field-protecting forest sites will be developed by 2025. Relevant actions will be taken towards creation of field-protecting, land-protecting and water-protecting forests and forest strips by involving international donors.

In general, one of the main strategic targets is the application of economic approach on protection of environment, that is, support on the use of economically viable plants (olive, almond, pistachio, pomegranate, mulberry, fig, etc.) in tree-planting. Different types of fruit trees and perennial grass will be planted in existing terraces to enhance combating against erosion in mountainous and foothill districts. Economically viable types of plants will be used for the creation of greenery in non-forest unsuitable for agriculture areas . The opportunities for application of dry-farming in sensitive areas subject to impacts of exogenous geological processes will be studied. Meanwhile, negative impacts of mass use of plastic bags on plants, animals, land and water resources will be assessed and relevant action plan will be prepared towards reduction of contamination in this field.

On the other hand, potential on transition to "green economy" in agriculture field will be assessed, preference to the use of composts manufactured from organic substances in greenhouses will be encouraged, opportunities on the use of solar collectors, biogas and thermal water resources in heating supply of greenhouses will be studied and application potential will be reviewed.

Thuswise, application of pollution-free production technologies in agricultural field will be expanded, compliance of agricultural production with ecological norms will be ensured, and carbon gas emission will be reduced in tree-planting and cattle-breeding through such actions. Application of chemical matters in agriculture will be reduced for 30% totally. Carbon gas emission will be reduced in tree-planting and cattle-breeding. Use of both field-protecting forest strips and economically viable types of plants in creation of greenery will be increased for 30%, while the use of alternative sources in heat supply in greenhouses will be increased for 20%.

It is to note that, creation of orchards in agricultural lands is widespread in recent years. In fact, more than 60 thousand ha of new orchards has been created in agricultural lands of the country durin 2010-2017 years. In addition, 2.500.000 young mulberry plants have been delivered and planted in different districts of the country to stimulate development of silkworm breeding.

Actions towards creation of modern agroparks have been commenced in the Republic of Azerbaijan in recent years. Agroparks, first of all, enables integration of agricultural production with nonagricultural sectors of economy and proper use of resources and creates opportunities for effective application of modern technical, information-communication technologies, minimization of expenses, environmental protection and efficient use of water and land resources. Generally, it is intended to establish 4 modern agroparks in 28 districts of the country, 27 out of which are tree-planting, while 16 are cattle-breeding agroparks. Totally 183 thousand ha area was allocated for agroparks. Main problems related to food security are to be solved as a result of such agroparks.

Such actions will cause to use more advanced methods in management of cattle-breeding, while expansion of biogas facilities used in remote rural areas will result in reduction of emissions released from agricultural sector in future.

3.2.6. Reduction of Hydrochlorfluorocarbons (HCHFC) regulated by Montreal protocol

Upon the prohibition on the use of chlorfluorocarbon regulated by Montreal protocol in heating and cooling systems, refrigerators, the hydrochlorfluorocarbon has been widely used in Azerbaijan. Despite the fact that, R-22 (CHF2Cl) which is included in HCHFC group and widely used in Azerbaijan has lower ozone depletion potential (0.055), its global heat capacity is 1810. This figure is considered to be too high.

According to the information obtained from relevant companies and firms in this sector, rejection of the substance use is not expceted in near future. The companies are satisfied with its cost and procedures of use. Forecasts on use of HCHFC (table 23) show that, emissions of such substances will be released to the atmosphere at least by 2020.

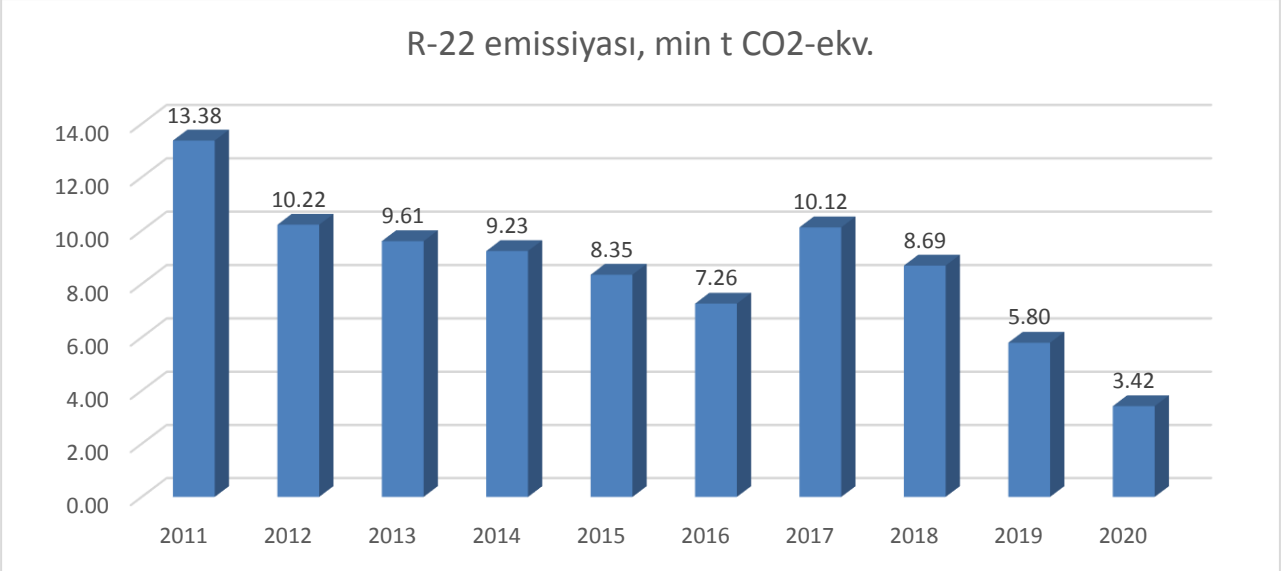
Table 23. Forecast on the use of R-22

Ozone depletion substance	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**

R-22 (CHF_2Cl), kg	7390	5647	5307	5102	4612	4013	5592	4801	3204	1888

Emissions will be released to the ambient air, in case this tendency remains (diagram 35).

Diagram 35. Forecast on R-22 emissions



According to Montreal protocol, the use of these substances will be suspended after 2030. The Project on replacing these substances with alternatives was implemented in relevant companies of Azerbaijan upon financial and technical support of GEF-UNIDO. As a result of this Project, the use of HCHFC will be suspended and their GHG emissions will become zero.

3.3. Works carried out under National Appropriate Mitigation Activities (NAMA) for Climate Change Mitigation

Some progress towards preparation of National Appropriate Mitigation Activities for climate change mitigation has been achieved in the Republic of Azerbaijan in recent years. "National activities to reduce carbon emissions in fuel consumption sector of Azerbaijan", is the only Project, which was registered in NAMA registration system of UN Framework Convention on Climate Change.

Main goal of "National activities to reduce carbon emissions in fuel consumption sector of Azerbaijan" Project which is jointly implemented by UN Development Program and SOCAR, is to support preparation of national actions towards climate change mitigation in low carbon fuel consumption.

This Project, generally, consists of 3 components (Each component includes one NAMA (National Appropriate Mitigation Activity)):

- Component 1 covers actions towards increasing energy efficiency in administrative and service buildings of SOCAR;
- Component 2 covers improvement of transportation system owned by SOCAR and introduction of transportation means with low emissions into service;
- Component 3 covers collection of low pressure associated gases released from oil wells into atmosphere and its delivery to consumers.

The following table describes the work to be carried out under the Project and summary of results to be achieved:

Table 24: Projects components and possible results

Project Component	**CO_2 per year, in ton**	**CO_2 in 5 year Project period, in ton**	**CO_2 In Technology operation period, in ton**	**Technology service life**
NAMA 1– Green Building Programme				
Direct reduction of emissions	420	2100	10500	25 il
Indirect reduction of emissions	86 124	430 618	1 291 855	
NAMA 2 – Sustainable transportation				
Direct reduction of emissions	162	808	1 616	10 il
Indirect reduction of emissions	1 611	8 055	9 666	
NAMA 3 – Collection of associated gases				
Direct reduction of emissions	21 962	109 809	549 044	25 il
Indirect reduction of emissions	329 426	1 647 132	4 941 395	
Direct reduction of total emissions	**22 543**	**112 717**	**561 160**	
Indirect reduction of total emissions	**417 161**	**2 085 805**	**6 242 916**	

Energy audit service carried out to assess the results of works under Component 1 of the Project during 3 year implementation period, have revealed the following conclusions:

- *Administrative building of Ecological park*

After energy efficiency measures were taken in the administrative Building of Ecological Park of SOCAR, **94 615 kW /year (56.6 %)** energy was saved and base energy demand was reduced from 167 309 kW /year to 72 694 kW /year. The amount of energy consumption per 1 m^2 of the building was reduced from 363.7 kW to 158 kW. As a result of energy efficiency actions, the amount of CO_2 emissions released into atmosphere was reduced for **20.9 ton/ year.**

- *Eco Center*

After energy efficiency measures were taken in the laboratory and canteen buildings of SOCAR, **56 851 kW /year (48 %)** energy was saved and base energy demand was reduced from 117 013 kW /year to 60 162 kW /year. The amount of energy consumption per 1 m^2 of the building was reduced from 233,6 kW to **159 kW** .

- *Administrative Building of Ethylene and Polyethylene Factory*

After energy efficiency measures were taken in the administrative building of Ethylene-Polyethylene Factory of Production Union of SOCAR, **125 802 kW /year (45,6 %)** energy was saved and base energy demand was reduced from 275 598 kW /year to 149 796 kW /year. The amount of energy consumption per 1 m^2 of the building was reduced from 236,6 kW to 140,1 kW . As a result of energy efficiency actions, the amount of CO_2 emissions released into atmosphere reduced for **35ton/ year.**

- *Waste Center administrative building*

After energy efficiency measures were taken in the laboratory and canteen buildings of Waste Center of SOCAR, **188 493 kW /year (40,5 %)** energy was saved and base energy demand was reduced from 465 955 kW /year to 277 462 kW /year. The amount of energy consumption per 1 m^2 of the building was reduced from 366,3 kW to 258,6 kW. As a result of energy efficiency actions, the amount of CO_2 emissions released into atmosphere has reduced for **68.3ton/ year.**

- *Domestic Building of Waste Center*

After energy efficiency measures were taken in the domestic building of Waste Center of SOCAR, **25 189 kW /year (39 %)** energy was saved and base energy demand was reduced from 64 540 kW/year to 22 215 kW /year. The amount of energy consumption per 1 m^2 of the building was reduced from 235,5kW to 143,6 kW. As a result of energy efficiency actions, the amount of CO_2 emissions released into atmosphere has reduced for **5,7 ton/year.**

The activities under Component 2 and Component 3 have started. Greenhouse gas emission reduction targets considered for all NAMA's will be achieved by the end of the Project.

It is to note that, one of the main results to be achieved under the above-mentioned Project is to establish Measurement, Reporting and Verification (MRV) system and national registry of the impact reduction measures. In fact, as a result of such actions, calculation procedure of relevant emission factors in the sector will be improved and the experience in this field will be expanded. Considering the existing inventory initiatives and data collection mechanisms, inventory of greenhouse gas emissions from main consumer sectors such as, energy production, buildings and transportation will be carried out at higher quality as a result of improvement of data collection mechanisms and methodology. In addition, national MRV guidelines will be elaborated through national registry of impact reduction measures and these guidelines will include main parameters to be measured during MRV implementation and MRV methodology.

3.4. Projects related to climate change mitigation

In addition to the national initiatives related to climate change and climate change mitigation, the Republic of Azerbaijan is implementing various projects upon cooperation with several international projects. International donor agencies mainly cooperated by Azerbaijan include Global Ecological Fund, Green Climate Fund, European Union, Asian Development Bank, KfW bank of Germany, German International Cooperation Organization (GIZ) and others.

Such projects not only cause reduction of greenhouse gas emissions, but also play important role in introducing effective international practice and improving the knowledge and skills of local specialists. Table 24 shows projects, which have been or are being carried out by international donor organizations related to climate change.

Table 25. Completed and ongoing projects related to climate change

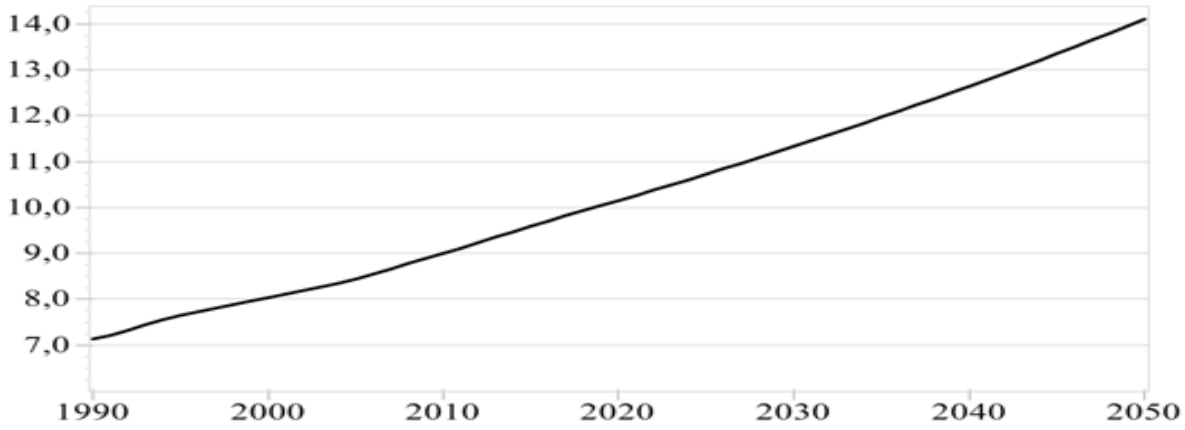
Project	Donor and executive body
Capacity Building Program of Clean Development Mechanism in Azerbaijan	Donor: Norway Government Executive body : UN Development Program
CDM as instrument for industrial development and poverty alleviation	Donor: Norway Government Executive body :ECON, NORSK Energy
Solid waste management improvement project	Donor: Norway Government Executive body : UN Development Program
Caspian Basin Greenhouse Gas Emissions Reduction Training Program (regional project)	Donor: Canada International Development Agency
Eastern Partnership countries Solid Waste management project (regional project)	Donor: European Union
Eastern Partnership countries East Countries Forest Law Enforcement and Governance (regional project)	Donor: European Union
Eastern Partnership countries ambient air management project (regional project)	Donor: European Union
Increasing the resilience of forest ecosystems against climate change in Southern Caucasus countries (regional project)	Donor: European Union
Energy Saving Initiative in the Building Sector in the Eastern European and Central Asian Countries	Donor: European Union
INOGATE Technical Secretariat and integrated programme in support of the Baku Initiative and the Eastern Partnership energy objectives	Donor: European Union
Improvement of legal basis in the field of alternative energy in Azerbaijan	Donor: European Union
Technical Assistance to the Caucasus Countries and Moldova on the. Fulfillment of Commitments on Global Climate Change	Donor: European Union TACIS programme
Capacity building for improving greenhouse gas inventory	Donor: GEF
Support to Development of National Forestry Program and Forestry Legislation	Donor: GEF
Renewable Energy Development (Biomass Cogeneration) Project	Donor: Asian Development Bank (ADB)
Economics of Climate Change in Central and West Asia	Donor: Asian Development Bank (ADB)

Project	Donor and executive body
Forestry activities aimed at preventing floods in Kish village of Sheki district	Donor: Asian Development Bank (ADB)
Integrated Solid Waste Management	Donor: World Bank
Training project for Nationally Appropriate Mitigation Actions (NAMA) (regional project)	Donor: German International Cooperation Organization
Support to Development of Usage of Renewable Energy in Azerbaijan	Donor: KfW
Improving solid waste management in Ganja	Donor: KfW
Forest expansion pilot Project in Ismayilli-Zagatala	Donor: KfW
Financing energy efficiency projects in Azerbaijan	Donor: International Finance Cooperation
Power system optimization in Azerbaijan	Donor: World Bank
Reconstruction and Modernization of AzDRES Thermal Power Plant	Donor: European Bank for Reconstruction and Development
Energy efficiency development in Azerbaijan as a component of South Caucasus Energy Efficiency Project	Donor: European Bank for Reconstruction and Development
Climate: Supporting Climate Change Mitigation and. Adaptation in Russia and eastern Neighborhood countries	Donor: European Union
Integrating Climate Change Risks into Water and Flood Management by Vulnerable Mountainous Communities in the Greater Caucasus Region	Donor: GEF Executive body : UN Development Program
sustainable land and forest management in the Greater Caucasus	Donor: GEF Executive body : UN Development Program
Nationally Appropriate Mitigation Actions (NAMAs) for low-carbon end-use sectors (NAMAs)	Donor: GEF Executive body : UN Development Program
Capacity building in improving forest monitoring and inventory system	Donor: GEF Executive body : FAO
GCF Readiness and Preparatory Support Programme	Donor: Green Climate Fund

3.5. Population growth dynamics

According to the information as of early 2017, the number of Population of the Republic of Azerbaijan is 9,810 million. The Figure 1 shows calculation of Population growth forecasts based on BAU scenario. According to the data obtained from State Statistics Committee, annual growth is 1.1%. The information as of 2017 was adopted for the base year. There is a constant growth in the number of population in Azerbaijan and the researches show that, this tendency will continue in future.

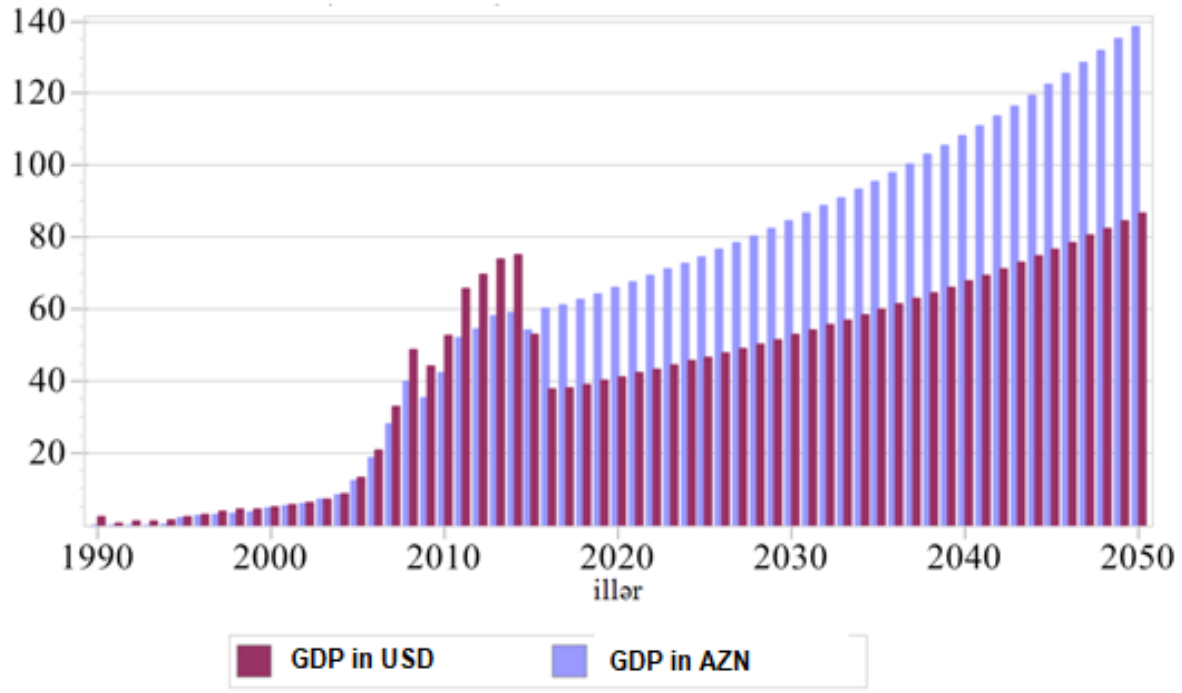
Diagram 36. Population growth forecast based on BAU scenario (1.1% annual growth in 2017-2050 years, million person)



3.6 Change dynamics of Gross Domestic Product

GDP Change Dynamics scenario of the Republic of Azerbaijan in 1990-2050 is described in Diagram 2, based on BAU scenario. The Strategic Road Maps, which identify main development trends of national economy, forecasts more than 3% average annual growth of GDP by 2025. International Currency Fund forecasts 2-3% annual growth of the economy in Azerbaijan by 2025. International Currency Fund announced 2.275% average annual growth of GDP in Azerbaijan as a forecast for 2017-2020 years in September, 2017. In this scenario, annual growth of GDP was taken 2,5%. The Exchange rate between US dollar and AZN was taken as 1$=1,7 for 2016-2050 years.

Diagram 37. Change Dynamics of GDP in the Republic of Azerbaijan in 1990-2050 years based on BAU scenario (2.5 annual growth for 2017-2050 years, in billions)



GDP growth in the Republic of Azerbaijan for last 25 years might be divided into 4 stages.

- *Decline period (1991–1994 years):*
- *Deep economic reforms, transition and rehabilitation period (1995–2003 years):*
- *Economic development and progress period (2004–2014 years):*
- *Low oil process economic diversification period:*

As shown in the figure above, substantial growth of GDP by 2050 is forecasted.

IV. Financial, technological and capacity needs assessment

In accordance with climate change mitigation within the framework of fulfilling commitments made by the Republic of Azerbaijan under Paris Agreement, it is necessary to determine demands for technologies, receive and apply such technologies, and increase relevant funding and capacities.

Climate change mitigation technologies include those which reduce greenhouse gas emissions in different sectors of economy, such as energy efficient technologies reducing greenhouse gas emissions in residential and commercial areas, including but not limited to technologies aimed to use renewable energy sources or water, land, forest and other natural resources. One of the most important factors during determination of actions in this field is to assess existing technologies, need for additional technologies, amount of necessary funding, financial sources (internal and external source), relevant capacities, need for new capacities and outsourcing.

As described in this report, in the section on climate change mitigation actions, Strategic Road Maps adopted on main directions of National Economy determines medium and long term targets in every sector and actions to achieve such targets.

These actions include those which will ensure low carbon sustainable development. The most modern technologies will be applied during implementation of such actions.

After the reconstruction and modernization works in Baku Oil Refinery named after Heydar Aliyev in the coming years the most modern and efficient facilities will be put into service to produce high quality motor fuels, diesel and petrol products meeting Euro-5 standard in oil-gas sector (main economic sector of the country). Modernization work will be continued up to 2021 and for this purpose 14 units of new facilities will be installed in the factory. First phase includes constructing and launching new bitumen facility and relevant in-factory facilities, as well as new liquid-gas filling stations, while second phase includes constructing or reconstructing new facilities by the end of 2020 to produce diesel fuel, which meets “Euro-5”quality standards. The last phase of the project considers constructing and reconstructing new facilities by the beginning of 2021 for the production of Aİ-92/95/98 petrol products, which meet Euro-5 standard. As a result, annual processing capacity of the factory will be increased from existing 6 mln. ton up to 7,5 mln. ton and the quality indicators of petrol and diesel fuel will meet Euro – 5 standards.

It has been targeted to consume 260 gr/kVt.s conventional fuel for the production of 1 kVt.s electric power in thermal power stations, subject to creating new generation powers and improving the characteristics of old energy blocks in energy engineering sector, which necessitates application of more modern technologies in the stations. In addition, it is intended to establish “Smart Grid” system for loss-free delivery and distribution of electric power to consumers by using modern information and communication technologies. Azerishiq JSC intends to establish Automated Grid Management System on electronic map in order to create Single Database for transmission and distribution grid and select equipment according to climate map in newly-constructed or reconstructed lines.

Photoelectric power equipment to be installed on the roofs of the buildings will be applied to encourage micro-electric power production for self-supply of end-users in the future in the field of

alternative and renewable energy. However, the application of this technology has been launched in the country. It is also intended to apply the most modern technologies during the construction of power stations on small rivers of the country with enough energy potential.

The production of LED lamps will be stimulated in the facilities located within Sumgait Technologies Park, in the framework of stimulation for the use of cost-effective LED lamps with regard to energy efficiency in utility sector.

Application of means of transport operating with compressed natural gas (CNG) in public transportation will continue in the coming years to ensure safety from technical and ecological point of view during passenger transportation.

Implementation of several actions such as establishment of new prioritized production fields and industrial parks, enhancement of industrial potential in the regions, application of options which will ensure industrial development based on innovations and modern technologies will be continued in the coming years for modernization of industry and expansion of non-oil industry.

Regional waste management centers will be established based on modern technologies to achieve 100% waste collection in urban areas, while 90% waste collection in rural areas of the country by 2036.

Initiatives on creation of modern agroparks in Agriculture will create new opportunities such as efficient use of modern technical, information-communication technologies by enabling proper use of resources, minimization of expenses, protection of environment, and efficient use of water and land resources. The most modern technologies will be applied in above named agroparks for methane collection and use.

It is to note that, after the Republic of Azerbaijan joined UN Framework Convention on Climate Change, it has taken several national actions towards fulfilling obligations taken under the Convention and has made significant achievements in recent years. Most actions towards climate change mitigation have been taken under state funds. However, such actions and application of most modern technologies through the use of existing financial mechanism for climate change on the back of current economic environment and new initiatives require billions of US dollars to be financed by foreign funds. Therefore, cooperation with Global Environment Fund, Green Climate Fund, Adaptation Fund and other financial funds will be enhanced in the coming years and the use of foreign financial resources will be considered as a priority.

It is still necessary to take some actions towards creating more advanced measures, methods and approaches considering the rapid change of existing mechanisms under UN Framework Convention on Climate Change and thus, to improve and update existing skills and capacities in the following fields:

- Studying more effective international practices in and improving the law and policy on climate change in accordance with specific features of the country;
- Establishing internal Measurement, Reporting and Verification system and evaluating future activities in this field;

- Elaborating Low carbon sustainable development strategies in national and local level and in relevant sectors as well;
- Establishing advanced signalization system to minimize possible losses;
- Developing, involving donors, and implementing National Appropriate Mitigation Actions on GHG reduction through the use of different mechanisms of convention;
- Applying IPCC 2006 methodology (at sector-wide level);
- Improving the capacities and awareness of local communities, private sectors, municipalities and authorized bodies in the field of climate change

Skills and capacities required for the implementation of intended climate change mitigation measures are one of the main factors as well. In fact, experts from relevant authorities who are responsible for the implementation of such measures shall have knowledge and capacities about new technologies.

It is necessary to build the capacities of personnel involved by the Ministry of Ecology and Natural Resources, including the Climate Change and Ozone Center, which is the coordinating agency of climate change convention in order to effectively coordinate the actions taken towards climate change mitigation in the country. It is intended to improve the knowledge and skills of the personnel of Forest Department under the Ministry.

It is also important to improve knowledge and skills of personnel involved in energy sector for efficient use of energy in different fields of economy and reduction of energy consumed on unit product. Thus, actions (round tables, trainings and workshops) enabling enlightenment of individual consumers, municipalities and local agencies shall be carried out to enhance their capacities.

In addition, it is necessary to enlighten people involved in agriculture, farming units about bioenergy sources, biogas facilities and impact of manure from such facilities on productivity.

Furthermore, it should be mentioned that, existing scientific-research institutes shall be actively involved in study of necessary technologies to take actions on climate change mitigation. Therefore, for this purpose, financial and logistic base shall be enhanced and capacities of experts shall be built.

V. Domestic MRV: current situation and perspectives

5.1. General information on MRV

Paris Agreement as adopted in Paris on 12th of December 2015, established a universal and harmonized measurement, reporting, and verification (MRV) provisions for climate change mitigation. A common system of transparency now applies to all countries. MRV is central to effectively implementing the NAMAs and also NDCs submitted under the Paris Agreement, which describe countries' mitigation goals and policies. Measurement is needed to identify emissions trends, determine where to focus greenhouse gas (GHG) reduction efforts, track mitigation-related support, assess whether mitigation actions planned under NDCs or otherwise are proving effective, evaluate the impact of support received, and monitor progress achieved in reducing emissions. Reporting and verification are important for ensuring transparency, good governance, accountability, and credibility of results, and for building confidence that resources are being utilized effectively.

5.1.1. MRV and its significance

MRV can be considered as a knowledge-management system for tracking GHG emissions, actions to reduce GHG emissions, and climate change mitigation support.

Recent decisions within the international climate negotiations demonstrate a growing global consensus on the need for a common forms of measuring, reporting and verifying information to track such knowledge.

MRV stands for Measurement, Reporting and Verification. This broad concept sheds light on a range of credibility assurance activities for combating against the climate change.

- The **measurement** of, for instance, CO2 and other GHG emissions using established standardized **measurement and calculation** methodologies and tools;
- The **reporting of information** to internal and external stakeholders by using standardized definitions, units and performance indicators;
- The **verification** of the adequate application of the methodologies by the reporting entity, with the purpose to provide assurance of the quality and reliability of the reported information.

Measurement, Reporting and Verification are key elements for ensuring greater transparency, accuracy and comparability of information with regard to climate change and the MRV conceptual frame can be thought of as a knowledge-management system for tracking greenhouse gas (GHG) emissions, actions to reduce GHG emissions, and climate change mitigation support.

5.1.2. Types of MRV

- **MRV of Emissions** - MRV of emissions is a concept to measure, report and verify quantifiable emissions data at national, regional, sectoral or installation levels.

- **MRV of NAMAs** - MRV of actions is a concept to measure, report and verify the impacts of mitigation policies and actions.
- **MRV of Support Received** - MRV of support can vary significantly depending on the type of support. (ie. financial flows, technology transfer, capacity building and their impacts

5.1.3. Benefits of effective MRV systems:

The creation of domestic MRV system will help to:

- Underpin national GHG data quality
- Identify national priorities (including NAMAs), as well as challenges and opportunities
- Policy planning, prioritization and improving policy coherence, to ensure continuous improvement of MRV systems and implementing actions for the reduction of GHG emissions
- Keep a record of NAMAs in place, tracking progress of the effectiveness of NAMAs (e.g. emission reductions and progress to achieving objectives)
- Assure data quality, which is important to access climate finance and participate in market mechanism (e.g. emission trading system)
- Demonstrate to the donors the emission reduction and impacts of the mitigation actions

Why is robust MRV so important?

- It is a precondition for creating an emission market, taxation scheme or any other carbon related instrument
- Measurement, reporting and verification of GHG emissions play a key role in the credibility
- Creates and maintains trust in the emissions market
- Transparent data, prevents fraud or cheating
- Gives reliable information to the regulator on emission situation of companies
- Gives information to companies – "*where are we in terms of GHG emissions?*"
- It is a precondition for access to different schemes (internationally, but also domestically

5.2. Current situation on MRV in Azerbaijan

Azerbaijan signed the Paris Agreement on 22nd of April 2016 and approved it on 28th of October 2016. Therefore, there is a need to follow the commitments made in the INDC submitted, provide control over the national emission sources. There is also need to establish and implement measures to reduce emissions significantly. To provide support, to confirm reduction and to verify the effectiveness of the policy measures, there is crucial requirement to develop domestic MRV system in Azerbaijan. The goal here is both to support the national development, and also to ensure compliance with the Paris Agreement.

Azerbaijan submitted the Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change (UNFCCC) to support the adoption of a new Global Agreement on climate change to be applied to all Parties in the 21st Conference of Parties held in Paris in 2015.

In the INDC document the country expresses the intention that: " By 2030 the Republic of Azerbaijan targets 35% reduction (25.666 thousand ton CO2 equivalent (excluding LULUCF) and 24.374 thousand ton CO_2 equivalent (including LULUCF)) in the level of greenhouse gas emissions compared to 1990/base year as its contribution to the global climate change efforts". By communicating its INDC to the UNFCCC, Azerbaijan confirmed the importance of a new agreement in the field of climate change and expressed its solidarity with the countries that are most vulnerable to climate change.

INDC document also mentions the sectors and foreseen corresponding mitigation actions in order to reduce the GHG emissions. There is clear emphasize on the fact that Azerbaijan is a developing country and the efforts will put extra financial burden on the economy and there will be need for support. There being global/regional incentives to support GHG emission reductions, these incentives will be more available once the country has a functioning MRV system, in order to provide credibility to the mitigation actions and the reduction that these actions provide.

5.2.1. Reporting of emissions

Azerbaijan has a system to monitor and report pollutant emissions into atmosphere and an administrative set-up with specific requirements to limit the pollution. However, there is still a need to improve the set-up and enforcement and the focus has not been GHGs. Measurement and reporting of emissions, including GHGs, is carried out annually by entities themselves. The Department of Environmental Protection and the regional Departments of Ecology and Natural Resources, on behalf of the Ministry of Ecology and Natural Resources analyze and verify the data provided by entities. The entities submit annual reports in this regard to the State Statistics Committee.

Table 26. Greenhouse Gas Section of Report developed by enterprises concerning pollutants emitted into the atmosphere

Code of Line	Emissions (Pollutant substances)	Emissions (tonnes)	
		hesabat ilində	əvvəlki ildə
A	B	1	2
201	Carbon dioxide (CO_2)		
202	Nitrogen oxide (N_2O)		
203	Methane (CH_4)		
204	Hydrofluorcarbons (HFCs)		
205	Sulfur Hexafluoride (SF_6)		
206	Perfluorcarbons (PFCs)		

5.2.2. Pilot application of MRV in Azerbaijan: SOCAR

SOCAR (The State Oil Company of Azerbaijan Republic) has established a company level measurement, reporting and verification system and has implemented activities to improve this system. Current MRV system has 3 steps:

- Structural units of SOCAR prepares reports on emissions to ambient air;
- Ecological Unit of SOCAR provides monitoring at those structural units and prepares its monitoring report;
- Then, external evaluator contracted by the SOCAR provides independent monitoring and prepares and submits summary report which then becomes a part of the Sustainable Development Report of the company.

5.2.3. Legal framework and economic instruments

Azerbaijan applies the "polluter pays" principle. This common practice envisages that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment.

The main document regulating the economic mechanism for the "Polluter pays" principle is the decision of the Cabinet of Ministers on “Application of fees for use of nature, fees for emission of pollutants into natural environment and rules of use of the amount collected from those fees” (the rules are approved by the Cabinet of Ministers Decision No.122 dated March 3, 1992, last updated in 2008). By this decision, the rules of payments for pollution, use of natural resources, as well as principles for use of collected amount from those payments were identified. Rules applied to 88 different pollutants. Main GHGs are not included in this list as pollutants, however, minor GHGs such as CO, NO and NO_2 are listed.

As the amount of payments are very little and therefore many entities are not interested in emission mitigation actions. For example, in normal conditions payment for 1 tonne of SO_2 is from 0.26 manats up to 1.32 manats (depending on location of entity). If the emission was due accident or more than permitted by emission permitǁ then the payment will be ten times more. (In case of SO_2 emissions from 2.6 manats up to 13.2 manats).

According to the law "On the Protection of Ambient air" each entity which has stationary sources of pollutant emissions (CO_2 is not included as a pollutant) has to obtain “emission permit” from the State Expertise Department under the Ministry of Ecology and Natural Resources. Special emission permit for businesses is a document, which specifies for entities the limits of emissions measured by ton/year or gr/sec. The validity period of emission permit is 3 years. 4 types of payment have been identified for emission permit: 99 manats, 189 manats, 297 manats and 396 manats. It depends on the mass emission and type of production of an enterprise.

The main supervisory authority of the Ministry of Ecology and Natural Resources of Azerbaijan Republic is the Department of Environmental Protection. The Department of Environmental Protection was established in 2001 in accordance with the relevant order of the Ministry of Ecology and Natural Resources. The Department is the competent authority for controlling of environmental legislation in local and foreign entities in the territory of Azerbaijan and the Azerbaijani section of the Caspian Sea.

In accordance with the Law about stopping inspections in entrepreneurship, all inspections including environmental inspections stopped from 2015 until 2021. This law was created in order to stimulate development of entrepreneurship. However, in practice, the mentioned law stimulates some irresponsible entities towards non-compliance with the environmental legislation and this may cause bigger problems with much higher costs to resolve.

In accordance with the national legislation of Azerbaijan, every entity that has stationary sources of emissions shall submit Official Statistical Report on Atmospheric Air Protection until 25 January of each year to the regional statistical authority (after approval by the Department of Environmental Protection and regional units) or shall submit in electronic form via internet in real-time mode. The second section of the report is about GHGs.

Monitoring and reporting of emissions, including GHGs is performed by entities themselves annually. Usually monitoring does not include actual measurement. The Department of Environmental Protection and regional units on behalf of the Ministry of Ecology and Natural Resources analyze and verify the data provided by entities. Regarding the reporting part, entities submit this information to the State Statistics Committee annually.

According to the Republic of Azerbaijan Administrative Code Article 239 officials who do not conduct monitoring of environment within the enterprise (production) or calculation and accounting of the impact caused by the economic activity on the environment, which may create an ecological threat shall be inflicted penalty at the rate of from two thousand five hundred to three thousand five hundred manats, legal persons— from eight thousand five hundred to ten thousand manats.

5.3. MRV in Azerbaijan: existing gaps and opportunities

Along with own mitigation contributions, Azerbaijan, as a developing country, is also interested in participation in different financial mechanisms, including NAMAs of the UNFCCC and NDCs of the Paris Agreement, in order to increase its contribution to global mitigation efforts.

Azerbaijan is fully aware of the need to set-up a proper and reliable MRV system to secure international confidence to national climate change mitigation actions. In Azerbaijan, there is a need to develop a robust institutional framework that encompasses the relevant institutional entities as well as the necessary staff, systems and processes, for an effective and nationally appropriate MRV system.

Azerbaijan, as many other countries, has limited experience with relatively new MRV systems of international standards and therefore there are some gaps and barriers which need to be addressed. This requires a significant effort to increase the awareness. The awareness shall be initial focus on the understanding at the installations and entities by training and making user friendly manuals. The confidence of the private sector to the UNFCCC process is limited due to earlier “not good” experience with CDM and lessons learned, as well also due to limited knowledge of NAMAs, NDCs and MRV systems. Furthermore the business opportunities of a reliable MRV are only understood well by private sector. All this will require a very significant training effort to change the mind-set and clarify the importance of the business opportunities.

Following main gaps and barriers to develop a MRV system were determined during case study:

Capacity - Limited awareness on economic and environmental benefits of technologies which will give difficulties when structuring a MRV. Very limited experience with CDM, NAMA and NDC, and thereby international MRV systems.

Social- The unfamiliarity with new technologies will be a barrier as the socially accepted use of traditional methods in energy consumption and so on will be preferred. Probably many stakeholders will consider MRV as solely a control and financing instrument from the central authorities. The potential positive drives will probably be overlooked.

Economic and financial- There are many barriers for implementation high investment costs, long payback period, inappropriate financial initiatives and low tariffs. Due to the already existing barriers it is important to establish a MRV with limited costs otherwise it will not be a priority.

Technological- Limited knowledge of new technologies, including also research institutions and suppliers in Azerbaijan. This will be a limiting factor when trying to structure and set-up a new innovative MRV system.

5.4. Plans for implementation of an installation level MRV system

Azerbaijan has plans to implement a robust installation level measurement, reporting and verification system in the following years. According to the state policy on the harmonization of legislation with European Union, EU's installation level measurement, reporting and verification system for the EU-ETS is proposed to be the basis for national system. Installation level MRV legislations of non-EU countries (ie. Turkey) will also be considered. Options for market based mechanisms that might be built upon this national MRV will also be considered.

Preliminary studies show that there are more than 60 installations that will operate under a MRV system. Sectoral breakdown of identified operators is presented in Table 27.

Table 27. Number of Installations for MRV Sectors

ACTIVITY CATEGORY	SUB ACTIVITIES	NUMBER OF INSTALLATIONS
Combustion of Fossil Fuels (>20 MW thermal capacity)	Powerplant (natural gas based)	13
	Production of sugar	1
	Production of beer	1
	Natural Gas Pipeline Compressor Stations	4
	Other (MSWaste Incinerator)	1
Refining of Mineral Oil	Mineral oil refinery	1
Metal Industry (>20 MW thermal capacity)	Secondary Iron/steel Production (electric arc furnace mills, hot/cold rolling, smelting, etc.)	1

	Secondary aluminum production	1
Mineral Industry	Production of Cement Clinker	3
	Production of glass/glass fiber	7
	Production of ceramics	1
	Production of bricks/roof tiles	23
	Production of gypsum products	6
Paper Industry	Production of paper or cardboard	2
Chemical Industry	Production of petrochemical and other bulk chemicals	1
Production of Acids	Production of nitric acid	1

5.4.1. Principles for a robust MRV system

- **Completeness**: Monitoring and reporting for an installation shall cover all process and combustion emissions from all emission sources and source streams
- **Consistency**: Monitored and reported emissions should be comparable over time, using the same monitoring methodologies and data set
- **Transparency**: Monitoring data, including assumptions, references, activity data, emission factors, oxidation factors and conversion factors should be obtained, recorded, compiled, analyzed and documented in a manner that enables the reproduction of the determination of emissions by the verifier and the competent authorities
- **Cost effectiveness**: Monitoring and reporting of emissions should aim for the highest achievable accuracy, unless this is technically not feasible or will lead to unreasonably high cost

However, there is a lack of experience and information to build and run such MRV scheme. The following gaps are identified for the development and implementation of Azerbaijan MRV:

- Lack of institutional capacity in relevant Ministries and Azerbaijan Accreditation Center
- Lack of experience and knowledge of the operators of installations
- Lack of experience and knowledge of the personnel that will be conducting verification activities
- Legislative gaps (including accreditation standards)
- Lack of templates, guidelines and exemplars

Based on the above information the following steps are identified to be taken in order to increase national capacity, prepare and implement legislation in coordination with related programmes and other donor activities in Azerbaijan.

Step 1. Survey on Stakeholder identification and determination of level of readiness

A survey is necessary to identify the sectors and stakeholders, including a sector based list of operators that will report GHG emissions. A survey should be designed and conducted to establish a list of stakeholders and contact details to effectively implement the following capacity building steps. A survey study is also important to conduct a needs assessment.

Step 2. Study on Legislative Gaps and Development of Legislation

Necessary activities should be taken to set up an appropriate national system for implementing a national installation level MRV system in line with the requirements of the international best practices and standards. Legislation related activities comprise a detailed legal, technical and institutional analysis of the current national situation, develop appropriate options for implementation, analyses of the options, and an implementation plan for selected preferred option, including costs, responsibilities and a time path for implementation, as well as the definition of associated legal provisions for implementing the national MRV system.

Step 3. Preparation of Guidelines and Templates

Measurement, reporting and verification templates, annual emission report templates, monitoring guidelines, reporting guidelines, verification guidelines, sectoral examples and other technical guidelines should be prepared for all stakeholders so that they can conduct their work standardized and smoothly. Guidelines for the recognition of the verification bodies should also be developed to enable accreditation process. A list of proposed guidelines is presented below:

- **General Guidance on Monitoring and Reporting:** An explanatory guidance focused on operator providing information on the compliance cycle, deadlines, roles and responsibilities, general concept and monitoring and reporting approaches, data flow and uncertainties, calculation and other means of monitoring and reporting GHG emissions.
- **Sectoral Calculation Examples:** Detailed explanatory guidance providing step by step examples on how each MRV sector should measure and report GHG emissions.
- **Guidance on Verification of GHG reports:** An explanatory guidance focused on third party verification bodies that will operate under the MRV system. Guidance will provide detailed information on the main steps of verification process covering pre-contractual stage, preparing for the verification (strategic and risk analysis and preparation of verification plan), detailed verification, addressing non conformities and misstatements, concluding on the findings of verification, independent review and issuance of verification report.
- **Guidance on the online MRV System:** Tis guidance will focus on the use of proposed online MRV system including step by step instructions for operators and verification bodies to prepare and submit monitoring plans, annual emissions reports, improvement reports and verification reports.

A list of proposed templates are listed below:

- Monitoring plan for operators
- Annual emission report
- Improvement report
- Verification report
- Information exchange

Step 4. Training and Capacity Development Activities for Relevant Stakeholders

Enabling the involvement of all actors to implement GHG emission measurement, reporting and verification processes is crucial. Capacity development activities, workshops and on-the job trainings must be conducted and aimed for government staff including Azerbaijan Accreditation Center, operators of installations that will measure and report GHG emissions, verifiers and other stakeholders, and training events will be organized for each sector and stakeholder.

Trainings should be focused on delivering practical information aiming to enable robust implementation of installation level MRV. International expertise and best practices should also be presented to national stakeholders. A list of proposed trainings are presented below:

- Sectoral Measurement and Reporting Trainings:
    - ✓ Electricity Sector
    - ✓ Combustion & Glass Sector
    - ✓ Refinery Sector
    - ✓ Cement Sector
    - ✓ Lime, Sugar Sector
    - ✓ Combustion, Automotive, Chemistry Sector
    - ✓ Ceramics, Gypsum Sector
    - ✓ Bricks (refractory), roof tiles Sector
    - ✓ Pulp & Paper Sector
    - ✓ Iron & Steel, Foundry Sector

- Verification of GHG Reports Training
- Training on metrology and uncertainty assessment
- Training on accreditation of verification bodies

Step 5. Development of Online MRV Data Management and Reporting Platform

An installation based online data management system should be developed within the scope of the MRV legislation.

Data regarding the greenhouse gas emissions, as well as other pollutants that require monitoring, can be processed via an environmental information management system. With such a platform, installations can manage their monitoring plans and reports electronically, and the system facilitates the evaluation process.

Following components for the online MRV system identified:

- Monitoring plan: this component will allow an operator to prepare and submit a monitoring plan
- Emission Reports: This component will allow operator to prepare and submit an emission report based on the approved monitoring plan
- Verification component: This component will allow the verification body to receive and verify the annual emission report, prepare and submit verification report.
- Administrative component: This component will allow the Component Authorityto approve monitoring plans, view, approve or reject submitted verified emissions reports, get statistical information (ie. Number of operators, amount of verified emissions, list of verification personnel, etc) and can monitor the increases or reductions in total emissions.

Step 6. Study on options for market based mechanisms

A roadmap for implementation of market based mechanisms (MBM) should be studied. Reports and workshops are needed to get a comprehensive overview of relevant design elements that need to be decided upon when establishing an MBM. Risks and opportunities of different types of MBMs or carbon pricing mechanisms should be considered during this study.

Main components of discussion and study are identified as below:

- Decision making prosed to adopt a carbon pricing instrument
- Preparatory work
- Using models to analyze technological and economic effects
- Defining the scope and dynamics
- Reduce or avoid unwanted effects
- Deciding on the use of government revenues
- Oversight and compliance
- Evaluating outcomes

Different design options for each of those elements should be discussed based on international experiences.

5.5. Implementation Timeframe

Proposed timeframe for the implementation of activities is presented below. Expertise and hands-on experience from national, regional and international practices need to be transferred to Azerbaijan to ensure robust and effective implementation of proposed actions in this chapter. Access to required funding is required for Azerbaijan's ability to develop and implement these actions.

	Year 1				**Year 2**				**Year 3**			
Activity	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Survey on Stakeholder												

identification and determination of level of readiness												
2. Study on Legislative Gaps and Development of Legislation												
3. Preparation of Guidelines and Templates												
4. Training and Capacity Development Activities for Relevant Stakeholders												
5. Development of Online MRV Data Management and Reporting Platform												
6. Study on options for market based mechanisms												

5.6. Task specification of relevant stakeholders including governmental, private and any other stakeholders

Azerbaijan is fully aware of the need to set-up a proper and reliable MRV system to secure international confidence to national climate change mitigation actions. In Azerbaijan, there is a need to develop a robust institutional framework that encompasses the relevant institutional entities as well as the necessary staff, systems and processes, for an effective and nationally appropriate MRV system.

While there is an existing system to monitor and report emissions, there is a need for the set-up and enforcement of the system with regard to new systems and mechanisms of UNFCCC. As seen in ***Table 28:*** below, the institutional structure shall be set in order to meet the basic MRV requirements. An overall competent authority must be empowered to provide the legal and operational support and ensure a smooth running of the whole system. While the private sector, namely the operators of the emission sources are supposed to monitor and report their emissions, there is need for verification parties, which in any situation have to be independent and third party. This is the most crucial part of the MRV system on which credibility of the system relies.

Table 28: MRV Institutional lay out

Possible organizational structure			
Accreditation Body **Natonal Accreditation Agency**	**Verification Body (Third Party)** **Independent verifiers**	**Competent Authority** **Ministry of Ecology and Natural Resources**	**Sanctioning body** **Ministry of Ecology and Natural Resources**

A national accreditation system may also be needed. There is already a national accreditation organization and a committee on standardization and metrology (and patenting). A sanctioning body should enforce the requirements of the MRV system designated by a legislation. The foreseen roles and functions of the main bodies are mentioned as in the following table:

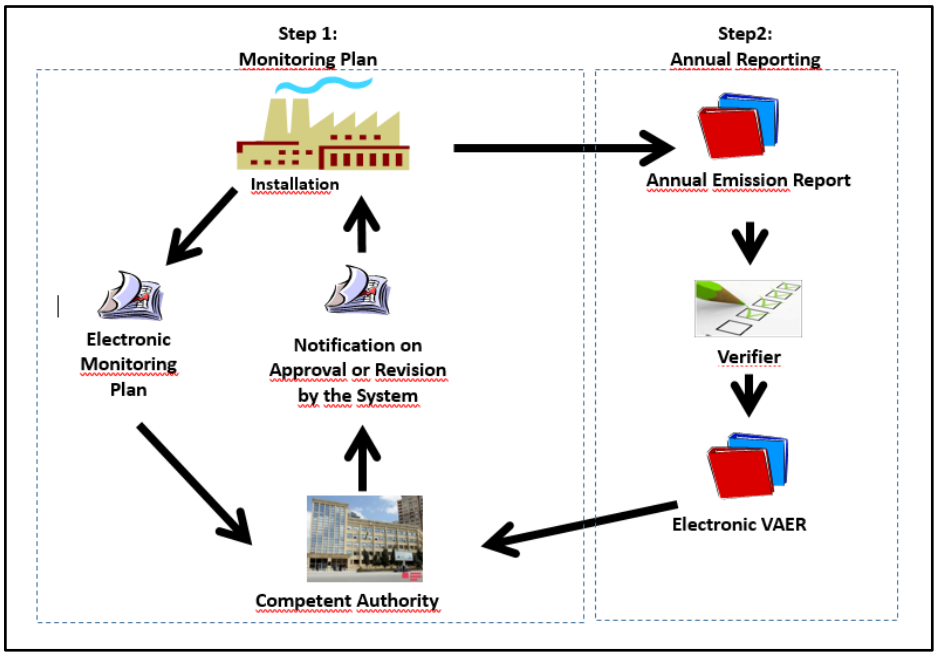
Table 29: Institutions and tasks

Accreditation body	▪ Assessment of verifiers' competence to carry out verifications ▪ Asesment if verifiers perform the verifications in accordance with the regulation
Independent verification body	▪ Verification that the emissions data report is free of misstatements ▪ Assessing compliance with the relevant regulation ▪ Initial licensing of verification body
Competent Authority	▪ Poviding guidance for enterprises ▪ Cross-check/approval of monitoring plan or emission reports
Sanctioning body	▪ Non-compliance with regulations ▪ Untimely/Incorrect submission of reports

Furthermore, as a future MRV system will have a national regulatory and enforcement system, it should also be considered to have an appeal system. This will secure a more smooth process and probably with a higher comfort level by the national stakeholders, like entities.

Below model demonstrates how an MRV system could be running. The model includes preparation and approval of GHG emissions monitoring plan besides annual reporting and verification of the GHG emissions according to the plan.

Model for flow scheme for MRV System



5.7. Financial and capacity needs for establishment of MRV

As mentioned above, there is need to develop a robust institutional framework that encompasses the relevant institutional entities as well as the necessary staff, systems and processes, for an effective and nationally appropriate MRV system. At present there are both emissions reporting at national level and a pilot MRV study at company level. However, in order to achieve an effective MRV system, a thorough analysis and assessment of the existing structure and gaps and requirements have to be carried out.

5.7.1. Financial needs

A rough assessment can be made depending on the international experiences and the information collected so far. According to such an assessment, financial needs can be figured out as in the following tables:

Cost Level	**Funding Range (USD)**
Low	<250.000
Medium	250.000 – 2.000.000
High	>2.000.000

Table 30. Financial needs and implementation time frame

Activity	Cost Level	Implementation Time
Survey on Stakeholder identification and determination of level of readiness	Low	3 months
Study on Legislative Gaps and Development of Legislation	Low	1 year
Preparation of Guidelines and Templates	Medium	1 year
Training and Capacity Development Activities for Relevant Stakeholders	High	1 year
Development of Online MRV Data Management and Reporting Platform	High	2 years
Study on options for market based mechanisms	Medium	9 months

Table 31. Cost level thresholds

Cost Level	Funding Range (USD)
Low	<250.000
Medium	250.000 – 2.000.000
High	>2.000.000

These costs include costs of the actions needed to be carried out as preparatory actions. Implementation of the MRV system will have further costs such as costs of institutional arrangements, accreditation/certification, upgrading of monitoring facilities by the operators (if necessary), human power needs, etc. There will be co-benefits such as improvement of emissions monitoring and data quality, awareness raised, increased credibility in funding of climate change mitigation projects. An accurate estimation of the costs and benefits can be carried out during the preparatory activities provided that sufficient data is supplied.

5.7.2. Capacity needs

Azerbaijan has a significant capacity on emissions measurement, reporting and emissions permit. A robust MRV system based on international standards requires significant technical and organizational capacity. Agencies may need to know how to prepare GHG emission reports and to how to upgrade the monitoring system and equipment. A national MRV system will need not only legal basis and institutional set up, but also professional staffing requirements. Establishment/improvement of the third party verification system will also necessitate time and human power. Quality and quantity of the capacity needs should be assessed through the more detailed assessment as financial needs mentioned above has been made.

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Annexes

Inventory Year: 2013

Table 1. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocola and greenhouse gas precursors

Greenhouse gas source and sink categories	CO2 emissions (Gg)	CO2 removals (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOCs (Gg)	SOx (Gg)
Total National Emissions and Removals	40983.1743	-7954.347	762.3316	8.9264	34.8	33.5	126.311	5.6
1 - Energy	37913.4476		532.1531	0.463	IE	IE	NE	IE
1A - Fuel Combustion Activities	32485.87606		4.304776	0.4397	IE	IE	NE	IE
1A1 - Energy Industries	16025.73445		0.383334	0.0475	IE	IE	NE	IE
1A2 - Manufacturing Industries and Construction (ISIC)	2420.68601		0.048894	0.0058	IE	IE	NE	IE
1A3 - Transport	7261.05313		2.060637	0.3516	NE	NE	NE	NE
1A4 - Other Sectors	6778.40247		1.811911	0.0347	IE	IE	NE	IE
1A5 - Other	NO		NO	NO	NO	NO	NO	NO
1B - Fugitive Emissions from Fuels	5427.571538		527.8483	0.0233	IE	IE	126.311	0
1B1 - Solid Fuels	NO		NO	NO	NO	NO	NO	NO
1B2 - Oil and Natural Gas	5427.571538		527.8483	0.0233	IE	IE	126.311	IE
2 - Industrial Processes	1293.633728		0.2355	0	0	0	0	0
2A - Mineral Products	729.7850945		NA	NA	IE	IE	NE	IE
2B - Chemical Industry	176.5465		0.2355	NA	IE	IE	NE	IE
2C - Metal Production	360.952		NA	NA	IE	IE	NE	IE
2D - Other Production	NO		NO		NO	NO	NO	NO
2E - Production of Halocarbons and Sulphur Hexafluoride					NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride					NO	NO	NO	NO
2G - Other (please specify)	26.35013333		NO	NO	NO	NO	NO	NO
3 - Solvent and Other Product Use		NO	NO	NO	NO	NO	NO	NO
4 - Agriculture			194.523	8.417	NE	NE	NE	NE
4A - Enteric Fermentation			176.8085		NE	NE	NE	NE

4B - Manure Management			16.96778	2.1797	NE	NE	NE	NE
4C - Rice Cultivation			0.746371		NE	NE	NE	NE
4D - Agricultural Soils				6.2372	NE	NE	NE	NE
4E - Prescribed Burning of Savannas			NA	NA	NE	NE	NE	NE
4F - Field Burning of Agricultural Residues			NA	NA	NE	NE	NE	NE
4G - Other (please specify)					NE	NE	NE	NE
5 - Land-Use Change & Forestry	1754.2801	-7954.3472	0.092925	NA	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks		-6248.4782			NE	NE	NE	NE
5B - Forest and Grassland Conversion		-1705.869	NA	NA	NE	NE	NE	NE
5C - Abandonment of Managed Lands		NA			NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	1732.793	NA		NA	NE	NE	NE	NE
5E - Other (please specify)	21.4871	NA	0.092925	NA	NE	NE	NE	NE
6 - Waste	21.8128768		34.88519	0.0465	NE	NE	NE	NE
6A - Solid Waste Disposal on Land			29.90049		NE	NE	NE	NE
6B - Wastewater Handling			2.174044	0.0305	NE	NE	NE	NE
6C - Waste Incineration	21.8128768		5.61E-05	0.014	NE	NE	NE	NE
6D - Other (please specify)	NA		2.8106	0.0019	NE	NE	NE	NE
7 - Other (please specify)		NO	NO	NO	NO	NO	NO	NO
Memo Items								
International Bunkers	1423.40952		0.03199	0.0396	NE	NE	NE	NE
1A3a1 - International Aviation	1171.49175		0.008192	0.0328	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	251.91777		0.023798	0.0068	NE	NE	NE	NE
Multilateral operations	NO		NO	NO				
CO2 emissions from biomass	435.1872							

Table 2. National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF6

Greenhouse gas source and sink categories	HFC			PFC			SF6
	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg-CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg-CO2)	SF6 (Gg)
Total National Emissions and Removals	NO	1.032	NO	0.0851	0.0213	NO	NO
1 - Energy							
1A - Fuel Combustion Activities							
1A1 - Energy Industries							
1A2 - Manufacturing Industries and Construction (ISIC)							
1A3 - Transport							
1A4 - Other Sectors							
1A5 - Other							
1B - Fugitive Emissions from Fuels							
1B1 - Solid Fuels							
1B2 - Oil and Natural Gas							
2 - Industrial Processes	NO	1.032	NO	0.0851	0.0213	NO	NO
2A - Mineral Products							
2B - Chemical Industry							
2C - Metal Production	NO	NO	NO	0.0851	0.0213	NO	NO
2D - Other Production							
2E - Production of Halocarbons and Sulphur Hexafluoride	NO	NO	NO	NO	NO	NO	NO
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NO	1.032	NO	NO	NO	NO	NO
2G - Other (please specify)							
3 - Solvent and Other Product Use							
4 - Agriculture							
4A - Enteric Fermentation							
4B - Manure Management							
4C - Rice Cultivation							
4D - Agricultural Soils							

4E - Prescribed Burning of Savannas							
4F - Field Burning of Agricultural Residues							
4G - Other (please specify)							
5 - Land-Use Change & Forestry							
5A - Changes in Forest and Other Woody Biomass Stocks							
5B - Forest and Grassland Conversion							
5C - Abandonment of Managed Lands							
5D - CO2 Emissions and Removals from Soil							
5E - Other (please specify)							
6 - Waste							
6A - Solid Waste Disposal on Land							
6B - Wastewater Handling							
6C - Waste Incineration							
6D - Other (please specify)							
7 - Other (please specify)							