



**Azerbaijan
National Report on the Project**

**Enhancing Synergies in CIS National Programmes on Energy
Efficiency and Energy Saving for Greater Energy Security**

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Abbreviations

ADB - Asian Development Bank
ACG- Azeri-Chirag-Guneshli
AzSRES-Azerbaijan State Regional Energy Station
BCM-billion cubic meters
BTC - Baku-Tbilisi-Ceyhan
CDM- Clean Development Mechanism
CFL - compact fluorescent lamps
CIS-Commonwealth of Independent States
CN&R(SNiP)- Construction Norms and Regulations (SNiP)
EBRD - European Bank for Reconstruction and Development
EC-European Council
EE-energy efficiency
ENSI-Energy Saving International
ERSP - Energy Reform Support Program
ESIP - Energy savings in the building sector
HPP-hydro power plant
GDP – Gross Domestic Product
GHG- Greenhouse Gases
GW- gigawatt
kWh – kilowatt-hour
ISO-international standardization organization
LPG-liquid petroleum gases
MENR –Ministry of Energy and Natural Resources
MEPS- minimum energy performance standards
mln. –million
MPC –maximum permissible concentration
MW- megawatt
NIP-National Indicative Programme
OSC-open joint-stock company
PCA-Partnership and Cooperation Agreement
PJ - Petajoules
PSA-production sharing agreement
RES-renewable energy sources
SOCAR - State Oil Company of Azerbaijan Republic
SPPRS - State Program on Poverty Reduction and Sustainable Development
sq. km. –square kilometer
thsd. – thousand
TOE – tonne of oil equivalent
TPP –thermal power plant
TWh- terawatt-hour
UNECE-United Nations Economic Commission for Europe
UNDP- United Nations Development Programme
UNEP –United Nations Environmental Programme
USAID –United States Agency International Development
USD- U. S. Dollar
VAT-value added tax
WG-working group

1. Introduction

There is large potential of energy resources in the Republic of Azerbaijan. Oil and gas is most valuable natural resources of the country. At present economic growth of the republic is based on the capital invested in oil and gas sector. Future perspective of oil-gas industry is connected with the development of oil-gas fields. However, it is a known fact that oil-gas industry is the main source of greenhouse emissions, particularly hydrocarbon emissions. Oil-gas production, transportation and refining are priority sources of emissions.

Transport emissions are contributing greatly to atmosphere pollution in the republic. The people of Azerbaijan use petroleum products as a fuel in their automobiles. Sometimes, as a result of the use of high octane petrol which contains tetra-ethyl-lead additions (with 0,5 g Pb/l petrol concentration) the quantity of harmful emissions (CO₂, CO, NO_x and many hydrocarbons) amounts to 2000 tons/year.

At the same time the reserves of fossil fuels are finite and according to experts, Azerbaijan's oil and gas reserves will only be exploitable for the next twenty or thirty years. Analysis of the present situation shows that in order to prevent consequent disasters the country must change the existing energy systems. Azerbaijan must seek new ways of generating energy, which do not sacrifice the natural environment, and which protect the health of the population and promote sustainable development of the region.

Studies have shown that the greatest opportunity for solution of existing energy and environmental problems in Azerbaijan lies in improving energy efficiency and using renewable energy sources.

The Azerbaijan government has recognized this challenge and launched new initiatives for the use of alternative energy. It is commonly acknowledged that these alternative energy sources can be funded with profits generated by the exploitation and sale of the country's rich oil reserves.

After collapse of the former Soviet Union, a number of measures have been implemented in sovereign Azerbaijan to promote energy efficiency and usage of alternative energy resources.

This National Report provides brief information about the present state of energy resources development and utilization and the related environmental situation in the republic. The existing barriers are discussed and potential for energy efficiency is considered with respect to industry, transport, agriculture and households, etc. In addition, the Report provides information about the policy statements, and implementation of international and national programmes in the field of energy efficiency and energy saving improvements.

2. General information

The Republic of Azerbaijan is the biggest country among other South Caucasus states according to its territory, number of population, rich fuel-energy and other resources.

Situated in the south-eastern part of the Caucasus, Azerbaijan occupies an area of 86,6000 km². It borders Russia to the north, Georgia to the north-west, Armenia to the west, and Turkey and Iran to the south. The Caspian Sea forms its eastern border.

The total length of the country's border comes to 2646 km including: 390 km with Russian Federation, 480 km with Georgia, 1007 km with Armenia, 756 km with Islamic Republic of Iran and 13 km with Turkey.

Azerbaijan has a population about 9 million. As a result of occupation of 20% of the republic territory by Armenia, more than 10% of population migrated to other regions, in particular, to the capital of Azerbaijan- Baku city.

The territory of Azerbaijan is distinguished by its unique nature, physico-geographical and climatic peculiarities. It has significant amount of natural resources including oil-gas fields, ore deposits, and mineral waters. Oil-gas production and refining, petrochemical, chemical and other industries have been developed. The primary agricultural activities are: cattle-breeding, grain-farming, gardening, cotton-growing, tea-growing and vegetable-growing.

Figure 1. Map of the Republic of Azerbaijan



Table 1. Energy resources of Azerbaijan

Traditional Energy Resources	Unit of measure	Quantity
Oil	Tonne	>1.2 billion
Gas	Meter ³	> 2 trillion
Coal	Tonne	20-25 billion
Alternative Energy Resources		
Wind	Billion kWh	> 2.5÷4 per year
Large Hydropower plant	Billion kWh	2.5÷3.0 per year
Small Hydropower plant	Billion kWh	2.5÷3.0 per year
Solar energy	TOE	Equivalent to 100 thsd. ton of oil
Thermal Waters	TOE	in a big quantity

Source: Ministry of Economic Development, 2010.

Findings of recent researches show that quantities of energy resources in the country exceed those figures indicated in Table 1.

Currently, Azerbaijan ranks among the world's fastest growing economies due to its gas and oil reserves. The international oil contract signed in September 1994 between the Azerbaijan State Oil Company and 11 foreign oil companies soon became a reality. A strong oil industry infrastructure has been created in Azerbaijan over the last decades. Since that time, the oil sector in the sovereign Azerbaijan has experienced heavy domestic and foreign investments. It provided the country with massive economic growth. The oil and gas fields are explored both onshore and in the Caspian shelf.

Azerbaijan also serves as an important gateway for oil and gas transportation. Construction of the Baku-Tbilisi-Ceyhan (BTC) oil pipeline in 2005 also contributed to the country's economic growth to some extent.

Azerbaijan's economy achieved the highest GDP growth in the world in 2006 and 2007. The growth was caused by the sharp increase in oil prices and the opening of the new Baku-Tbilisi-Ceyhan pipeline. In 2008, real economic growth slowed down to a still-impressive 10.8%. The decline of oil prices since the middle of 2008 was a key driver in this change. Growth slowed further to 4.1% in the first quarter of 2009, compared to 13.8% in the first quarter of 2008. The growth of oil prices helped to restore a high level of economic growth in 2009. The level of poverty in Azerbaijan has declined to some extent. This progress was achieved as a result of rapid economic growth and the successful implementation of the national poverty reduction program.

Worldwide, more than 60 countries are currently engaged in developing or strengthening poverty reduction strategies. Azerbaijan is one of these countries. A State Program on Poverty Reduction and Sustainable Development of the Republic of Azerbaijan for 2008-2015 was adopted in 2008.

From 2006 to 2008, oil's contribution to GDP exceeded 60%, demonstrating the fundamental structural problem of the economy - a high dependence on the energy sector.

Table 2 presents the change of indexes of main economic indicators for years 2005-2011.

	2005	2006	2007	2008	2009	2010	2011
Gross domestic product (GDP)	126.4	134.5	125.0	110.8	109.3	105.0	100.1
Industrial products	133.5	136.6	124.0	106.0	108.6	102.6	95.0
Agricultural products	107.5	100.9	104.0	106.1	103.5	97.8	105.8
Investment to fixed capital	117.2	108.1	119.8	131.8	81.6	121.2	127.3
Transportation of goods in transport sector	109.4	113.5	115.1	109.3	104.0	103.2	103.6
Conveyance of passengers in transport sector	104.8	106.3	108.0	108.2	106.9	104.5	107.5
Information and communication services	138.1	123.0	127.3	129.8	113.5	129.7	113.3
Retail turnover	113.0	113.2	114.9	115.5	108.7	108.8	110.2
Catering turnover	126.1	128.3	135.7	134.9	117.1	116.3	122.6
Paid services for population	126.1	142.1	133.8	129.7	112.5	110.8	107.8
Average monthly salary per one employee	124.3	120.6	144.8	127.2	108.6	111.2	109.9
Income of population	122.3	126.5	142.7	142.4	109.0	113.3	119.6
Expenditure of population	117.3	126.1	137.1	141.3	109.6	110.5	116.2
Real money incomes at disposal of population	123.4	125.1	143.1	145.2	111.3	114.2	120.5
GDP per capita	124.9	132.7	123.40	109.3	107.9	103.7	98.8
Consumer prices	109.6	108.3	116.7	120.8	101.5	105.7	107.9

Table 2. The index of main socio-economic indicators, in percent to the previous year
Source: State Statistical Committee of Azerbaijan, 2012.

The favorable business environment has been established throughout the country as a result of the successful implementation of “State Program of the Republic of Azerbaijan on Social-Economic Development of Regions 2003-2008”. In order to strengthen the gained achievements in regional development, the next State Programme was approved by President Ilham Aliyev in April 2009, with regard to economic development of the regions for years of 2009-2013. It included the following priorities:

- Further development of non-oil sector, based on the country’s natural and human potential;
- Strengthening the infrastructural provision of the planned activities/measures;
- Improvement of business environment and support to entrepreneurship;
- Speeding up the investments to the economic development of the regions;
- Upgrading the infrastructure, in line with the established international standards;
- Improving provision of the population with communal services;
- Furthering the work aimed at improving the employment rate of the population;
- Decreasing the poverty level in the country.

Whereas Azerbaijan was ranked close to countries such as Turkey, Armenia, Bulgaria, and Romania in earlier years, the reforms propelled Azerbaijan now very often in proximity of high-income countries. This positive development demonstrates the political commitment to improve the general business and investment climate. Azerbaijan hopes that these business reforms will attract more foreign investment which, outside of the energy sector, has been negligible.

Because of Azerbaijan’s economic growth, the demand for electricity was expected to increase by 4.7% each year until 2015.

Azerbaijan has serious environmental problems due to intensive development of the hydrocarbon resources, increasing amount of consumed fossil fuels and greenhouse gas emissions.

The disruption or outright disappearance of power supply to many towns and settlements in the post-1991 period has been an indirect cause of deforestation and forest degradation, as the population of rural regions turned to fuelwood.

The module of harmful emissions to atmosphere is determined according to the amount of pollutants per each sq. km. Based on this parameter the country's territory is divided into the following groups: less polluted (18 districts), polluted (25 districts), highly polluted (14 districts) and critically polluted ones that includes 14 districts and the cities of Baku, Sumgait, Ganja, Mingachevir and Nakhchevan.

Transport emissions are main pollutants of atmosphere air in Azerbaijan, especially in Baku city, where vehicles now outstrip industry as the major source of air discharges.

In respect of the Decree dated September 28th, 2006 by the president of Azerbaijan Ilham Aliyev, entitled "Comprehensive Action Plan for Improving the Ecological Situation in the Republic of Azerbaijan during 2006 – 2010" steps were undertaken for the removal of industrial uses to the edge of the city, decontamination of land, and improvements of the coastal boulevard. In accordance with the order of the Head of Baku Executive Power dated June 11, 2010, it was decided to restore and redevelop the Black City with an area of 221ha, which has played a major role in the oil industry for more than 100 years, performing activities of refining, storage and transportation of "black gold".

The Law "About Environment Protection" passed in August 1999 is one of the principal documents regulating rational use and protection of the environment in the Republic of Azerbaijan.

This law includes:

- Basic principles of environment protection, responsibilities of government, public entities and citizens in the field of environment protection;
- Responsibilities of nature users during conducting environmental control and monitoring;
- Issues of insurance of environmentally dangerous activities and performing voluntary and compulsory ecological audit of industrial processes;
- Basics of solution of the problems related to responsibilities for the violation of environment protection norms;
- Economic basis of environment protection and nature use regulation: observation of material interests' principles in rational use of nature, regular payments and compensations for environment pollution.

The Law confirms main regulations for ambient air quality and ecological requirements to economic activities.

Upon attaining independence, Azerbaijan started cooperation with world countries on environmental protection and ratified international conventions and agreements including:

- UN Framework Convention on Climate Change, 1992 Rio-de-Janeiro (ratified in 1995);
- Kyoto Protocol to the UN Framework Convention on Climate Change, 2000 (ratified in 2000);
- Convention on Environmental Impact Assessment in a Transboundary Context (ESPO Convention), 1991 (ratified in 1999);
- Convention on the protection of ozone layer (Vienna, 1985) and Protocol on Substances that Deplete the Ozone Layer. 1987, Montreal Protocol (ratified in 2000);
- Convention on the Control Transboundary Movements of Hazardous Wastes and their Disposal. 1989, Basel Convention (ratified in 2001);
- Convention on Organic Pollutants. 2001, Stockholm Convention (ratified in 2003).

UN Framework Convention on Climate Change and Kyoto Protocol to this Convention are important documents to be observed. Azerbaijan government pays great attention to the execution of the Kyoto Protocol terms.

The State Program of Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015 (SPPRSD) stipulated measures to establish a Carbon Fund to provide financial support to enterprises in reducing the amount of CO₂ and other atmosphere emissions. In order to prevent atmosphere pollution caused by transport emissions, installation of gas analyzers in the intense traffic sites of the large cities is planned. Industrial enterprises are committed to give annual reports on CO₂ and other GHG discharge. Table 3 and Table 4 present the level of atmosphere emissions in the republic for the recent years.

Table 3. Impact of the industry on air pollution

Years	Air pollutant emissions (thsd. ton), total	of which:					
		particulates	Liquid and gaseous matters	Sulphur dioxides	Carbon monoxides	Nitrogen dioxides	Carbohydrates (besides evaporated organic combinations)
All industry							
2006	320.2	22.1	298.2	12.2	14.9	28.8	233.3
2007	358.3	27.3	331.0	9.0	24.2	22.7	265.6
2008	269.5	30.6	238.9	7.8	36.2	33.1	147.9
2009	266.0	19.4	246.6	4.1	26.5	23.9	183.8
2010	181.3	18.8	162.5	2.0	25.8	19.2	104.3
2011	184.7	17.2	167.5	2.3	31.3	20.5	101.7
Mining industry							
2006	227.8	5.4	222.4	0.1	3.6	1.8	216.7
2007	253.5	6.5	247.0	0.1	4.2	1.7	240.8
2008	165.6	6.4	159.2	1.0	9.6	14.4	129.3
2009	186.1	6.6	179.5	0.6	10.1	8.0	158.0
2010	111.6	6.6	105.0	0.3	9.2	8.0	83.2
2011	104.9	4.0	100.9	0.4	8.9	7.3	81.5
Manufacturing industry							
2006	56.2	16.1	40.1	2.5	9.2	4.2	15.5
2007	64.0	20.3	43.7	2.4	9.9	3.6	19.0
2008	64.0	23.9	40.1	3.3	12.8	3.9	11.8
2009	42.2	12.5	29.7	1.8	3.1	2.5	17.4
2010	40.4	12.0	28.4	1.4	1.8	2.5	16.0
2011	41.8	11.9	29.9	1.3	2.2	3.3	14.3
Electricity, gas and steam production, distribution of supply							
2006	36.1	0.6	35.6	9.6	2.0	22.8	1.1
2007	40.6	0.5	40.1	6.5	10.0	17.4	5.8
2008	39.7	0.3	39.4	3.5	13.7	14.8	6.8
2009	37.1	0.3	36.8	1.7	13.0	13.3	8.3
2010	28.9	0.2	28.7	0.3	14.5	8.7	5.0
2011	37.1	1.3	35.9	0.6	19.7	9.8	5.7
Water supply; wastes treatment and disposal							
2006	0.1	0.0	0.1	0.0	0.05	0.0	0.03
2007	0.2	0.0	0.2	0.0	0.1	0.02	0.03
2008	0.2	0.0	0.2	0.01	0.1	0.02	0.03
2009	0.6	0.02	0.6	0.01	0.3	0.1	0.1
2010	0.4	0.01	0.4	0.002	0.3	0.04	0.07
2011	0.8	0.01	0.8	0.01	0.5	0.07	0.2

Source: State Statistical Committee of Azerbaijan, 2012.

Table 4. The level of GHG emissions from stationary sources for years 2006-2010 (thsd. ton)

Greenhouse gases	Years				
	2006	2007	2008	2009	2010
Carbon dioxide (CO ₂)	17664,4	14828,8	16013,3	15293,1	14399,6
Methane (CH ₄)	16,6	24,3	49,5	24,2	18,3
Nitric oxide (N ₂ O)	0,8	1,7	6,4	10,4	11,8
Hydrofluorocarbons	0,6	0,5	0,2	7,0	6,8
Sulphur hexafluoride (SF ₆)	0,1	0,1	0,2	0,8	0,3
Perfluorocarbons	0,9	0,6	0,3	6,4	5,6

Source: *State Statistical Committee of the Republic of Azerbaijan, 2011.*

3. National Energy Efficiency and Energy Saving Programmes

3.1 Principal Institutions and Organizations Responsible for Energy Efficiency and Energy Saving Policies and Programmes

State energy policy in the Republic of Azerbaijan is conducted by the Ministry of Industry and Energy established according to the Presidential Decree from 6 December 2004. The main functions and authorities of the Ministry are:

- preparation of the country's fuel and energy balance;
- implementation of measures to meet the country's demand for energy resources;
- implementation of measures aimed at efficient utilization of energy resources in fuel and energy complex, while reducing energy losses and technological consumption;
- preparation and realization of state programs on the development of energy industry, fuel and energy complex;
- participation in the preparation of income-expense budgets of large state companies operating under industry, and fuel and energy complex.

The Ministry is also authorized to conclude agreements and issue licenses on specific activities related to survey, exploration, production, processing, transportation and distribution of energy resources.

State-owned SOCAR, Azerenergy and Azerigas are the major energy operating companies that dominate extraction/production, transmission, distribution and supply in the energy sector.

At present, the gas sector is only partially reformed with SOCAR acting as the "single buyer" of natural gas for delivery into the market. Gas supplies currently come from three sources:

- SOCAR's own gas production (currently around 4 bcm, but declining), associated gas produced under the Azeri, Chirag, Guneshli (ACG) production sharing;
- agreement (PSA) that, under the terms of the agreement, accrues to the State at no cost (currently around 1 BCM);
- imports that are either sourced from Russia or transit from Central Asia through Russia (in 2006 around 4 BCM- although the decision was taken to reduce imports from 2007).

SOCAR is responsible for processing (at the Garadag Gas Processing Plant) the gas currently produced in Azerbaijan whether from its own production or supplied from ACG. SOCAR sells directly, at a wholesale price, to three primary customers:

- AzerChemia, the country's petrochemical facility which also obtains naphtha from SOCAR;
- Azerenergy the power generator which also obtains heavy oil from SOCAR;

- Azerigaz, the company responsible for domestic storage, transportation and distribution of natural gas.

Generation of electricity is managed by the State company Azerenergy. Azerenergy is an open joint-stock company wholly owned by government. Until 2002, Azerenergy acted as a vertically integrated monopoly in generation, transmission, distribution and sale of electricity. In 2002, two separate distribution companies were established, one covering the regions of Absheron-Baku and the northern regions, and the other the remainder of the country. Distribution companies purchased electricity at a commonly set price (by the Tariff Council) without cost differentiation and sell at regulated tariffs (set by the Tariff Council). Operational functions in 2 of the 3 distribution companies in Azerbaijan have been privatised, under, what is in effect, a concession management arrangement. The Baku and Sumgayit power distribution networks were managed by *Barmek Holding*, and the Ali-Bayramli and Gandja networks managed by the *Baku High Voltage Electrical Equipment Company* (albeit for a short time since the operators have defaulted and the 2 distribution companies are now under Azerenergy and the Ministry of Economic Development). Subsequently, the operational management was transferred to state owned company – “Bakuelektrikshebeke” OSC. Further unbundling within the sector, however, would be beneficial and would be consistent with the government’s stated objective of securing private sector involvement in the domestic electricity sector. The stimulation of private sector investment in power generation is on the Government’s agenda. There are plans for selling part of power plants and attracting private sector to invest in generation including renewable energy sources.

Azerigaz is a closed joint-stock company owned by government which was established in 1992 and is a vertically integrated company with full monopoly in transmission, distribution and supply. Azerigaz has 68 gas distribution subsidiaries (including 7 in Nakhichevan). The restructuring of Azerigaz is not first priority for the government of Azerbaijan, but is forthcoming. There could be the possibilities to involve private sector into the gas distribution and supply activities, as with the electricity sector.

3.2 Existing Energy Efficiency and Energy Saving Programmes

With the aim of development of the energy sector, the Government of Azerbaijan undertook the necessary structural reform of the sector in accordance with the State Programme for the development of the Fuel and Energy Complex in Azerbaijan for 2005-2015 and the State Programme for the Utilization of Alternative and Renewable Energy Sources.

The purpose of the State Program of the Development of Fuel and Energy Complex in the Republic of Azerbaijan for 2005-2015 is to develop the country’s fuel and energy complex to achieve more reliable supply of the requirements of population and economic sectors for electricity, gas and other energy carriers.

The basic tasks of the State Program are:

- establishment of main directions of development of Azerbaijan’s fuel and energy complex according to modern standards;
- implementation of necessary scientific-technical and organizational measures to increase efficiency of activities of industrial branches of fuel and energy complex ;
- promotion of advanced technological applications on the production, processing, transportation, registration and consumption of energy resources;
- establishment of a sound competitive conditions in fuel and energy sector;
- increase of the volume of investments involved into fuel and energy complex development;
- ensuring of ecological safety in fuel and energy complex;
- improving of payment system to ensure reliable payments for fuel and energy resource (electricity and gas) consumption;

The State Program envisages the construction of new heat and hydro-energy stations in the country's energy system, modernization of the existing energy blocks, and increasing and approximation of the present generation capacity to 6500-7000 MW till 2015 through utilization of renewable energy sources (small hydro, wind, solar, thermal waters and etc.).

A general state policy in the field of alternative and renewable energy source development is the State Program on the Use of Alternative and Renewable Energy Sources adopted in 2004.

The major objectives of this Program include:

- determine the potential of alternative (renewable) energy sources in electric power production;
- increase the efficiency of energy resources by attracting investment in renewable energy;
- ensure that additional new jobs are opened in the sector;
- and achieve growth in the overall energy generating capacity of Azerbaijan, thus increasing the country's energy security.

Two strategic documents, namely the State Program of Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015 and the State Program for Environmentally Sustainable Economic Development clearly state environmentally sustainable energy development concerns.

SPPRSD determined medium-term activities to ensure comprehensive developments in all spheres including non-oil sector. The provisions is made to efficient use of power resources, strengthen financial discipline and public awareness activities in energy sector. In order to increase efficiency in power sector and create more competitive environment, increase of the private sector's involvement in the area will be supported. These steps would help meet the investment needs of the non-oil sector, introduce new technologies and knowledge in the sector, and promote strategic cooperation with foreign companies.

The Program includes important measures on the protection of atmosphere air, such as reduction of GHG emissions, minimization of the negative impact of climate change on the ecosystem, people health and the country's economy.

3.3 Implementation of Existing Energy Efficiency and Energy Saving Programmes

SPPRSD stipulated the development of new generation capacity relying on alternative and renewable energy sources including solar stations, small hydropower plants and wind farms.

Several steps have already taken in the republic towards renewable energy infrastructure development (Figure 2).

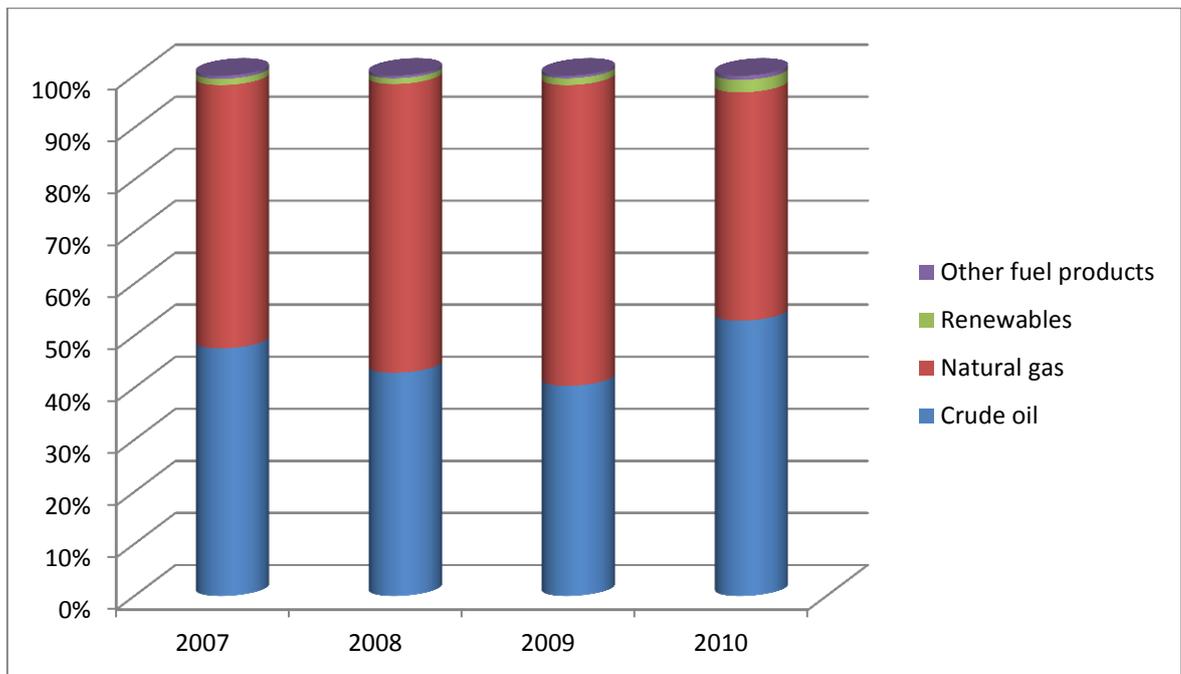


Figure 2. Total energy supply of primary energy products, in percent.

In April 2010, the Ministry of Industry and Energy identified the first major (wind park) projects within the framework of the State Programme on the Use of Alternative and Renewable Energy Sources, with an overall capacity of 250 MW.

Azerenergy studied the potential of 11 small hydropower plants with a total capacity of 17 MW. Out of these, the following have been constructed: Goychay (3 MW), Valaken-1 (1.6 MW), Gusar (0.8 MW), Lenkoran (0.2 MW), Ismayilli (2.2 MW) and Oguz (1.7 MW).

A program of measures on acceleration of socio-economic development of settlements of Baku city for 2006-2007 years approved by Presidential Decree № 1338 from 27 February 2006 provided important provisions for energy sector's improvement. According to this Program the following measures were implemented:

- During the period of 2006-2007 a new gas pipeline with 272,2 km length and appropriate gas equipment were constructed and put into operation;
- A part of 933 electrical motors were reconstructed and another part replaced with 491 water pumps;
- 21,3 km electrical cables were renewed;
- In order to improve centralized heat supply of buildings, 29 boilers were constructed in Baku city in 2007;
- Since 2006, a number of measures aimed at infrastructure rehabilitation and improving of people's electricity, gas and water supply systems have been implemented in Baku and its settlements.

State Program on socio-economic development of regions in the Republic of Azerbaijan for 2009-2013 approved by Presidential Decree 2009 stipulated important measures on reliable energy supply to Baku city and other regions. The following measures were planned under the Program on socio-economic development of Baku city and its settlements for 2011-2013 to continue works on sustainable energy use:

1. Implementation of projects aimed at the construction of modern electro-stations;
2. Rehabilitation of gas supply in the settlements of Baku city;
3. Reconstruction of substations and electricity transmission lines;
4. Rehabilitation, reconstruction and modernization of the existing heating systems;
5. Development of improved information and communication infrastructure;
6. Development of incentives to support the activities of private sector;
7. Improvement of environmental situation including reducing, accumulation and utilization of various wastes, etc.

In order to continuously supply Baku city and settlements with electricity, construction of new lines and two substations with 220 kWt capacity, and reconstruction and modernization of two substations were planned. In addition, the Program stipulates application of modern energy efficient and alternative energy technologies.

3.4 Envisaged Energy Efficiency and Energy Saving Programmes

Currently, projects are being developed to improve energy efficiency and use of alternative and renewable energy sources. The Government of Azerbaijan has in view an active energy saving policy and the introduction of efficient energy-saving technologies through a number of energy-saving measures such as:

- reconstruction of existing hydro and thermal power plants, which provide additional 111.7 billion kilowatt-hours of energy and will save approximately 740 PJ (Petajoules) of fossil fuels;
- use of alternative energy sources - wind, solar, geothermal, biogas and micro generator for hydropower plant installation – will give approximately 45-50 PJ of fossil fuel by 2025 with an investment of approximately US \$ 700-750 million;
- introduction of contemporary sources and lighting systems, which will save 14.5-17 PJ of fuel with the amount of investment predicted by level of US\$ 2.5-3 million;
- introduction of automated control system for energy consumption, which would require an investment of approximately US\$ 14-16 million. In this case, savings are guaranteed approximately 9.5-11.0 PJ to 2015 and approximately 13-15 PJ to 2025;
- implementation of special programs for all economic sectors to ensure fuel and energy resources by controlling instruments, which require an investment of US\$ 20-24 million;
- introduction of electronic power equipment (electric voltage control, efficient electric motors and transformers, compensation devices) will retain approximately 80-90 PJ of fuel from the predicted investment in US \$ 28-30 million;
- improvement of the heating system requires an investment of US\$180-210 million and which can save 31-35 PJ of fuel;
- increasing use of secondary energy resources saves fuel 38 - 45 PJ, and the necessary investment is about US\$ 145-165 million;
- optimization of power generation system of the country (the rehabilitation of existing and construction of new thermal and hydro power stations), power grids and upgrading of electrical equipment that will reduce fuel consumption by 1200-1300 PJ at investments US\$ 2,5-2,6 billion;
- increasing the efficiency of gas pumps with a decrease in fuel consumption of 20-30 PJ with the necessary investments of approximately US\$ 115-120 million;
- introduction of advanced technologies for the extraction and purification of oil from the fuel saving 2200-2400 PJ at investments of US \$ 42-45 million;

- introduction of technologies with low power consumption aiming at saving approximately 4300-4600 PJ of fossil fuels during the period up to year 2025 with an investment of US \$ 4.5-5 billion dollars;
- restructuring of the mining industry and mining (with the exception of open-hearth and oxygen convection processes with the transition to electric steel smelting and iron), the establishment of new processes with low energy consumption, upgrade the production structure and a reduction in energy intensity of final product. All this guarantees savings of approximately 45-50 PJ of fuel with the required investment of US \$ 35-40 million;
- using new power-saving technologies and high quality raw materials in machinery complex to reduce fuel consumption by 18-20 PJ of fuel with the required investment of US \$ 190-210 million;
- minimization of oil gas emission during oil production, its capture and use at high temperatures in power plants will provide approximately 60-62 billion m³ of petroleum gas by 2025. The necessary investment is US\$ 170-175 million.

The Ministry of Industry and Energy established the Coordination Council for the implementation of State Program for using renewable and alternative energy sources, aiming at achieving good results in this direction in a short time. A program of development, modernization and reconstruction of small hydroelectric plants, which are planned to be installed on mountain rivers in many regions of Azerbaijan. Technical capacity of these stations is 4.9 billion kWh. Table 5 shows the design parameters of smaller hydroelectric plants on the upcoming years.

Table 5 . Development Program of smaller hydroelectric plan

Name of HPP	Fixed capacity (MW)	Average productivity (millions of kW- hour)	Required investment \$ millions
1. Technical modernization of existing HPP's			
Varvary	16.5	90.0	16.5
Sheki	2.8	14.7	2.8
Gusar	1.2	2.6	1.2
Guba	1.15	6.3	1.15
Mugan	3.8	14.38	3.8
Zurnabad	2.76	12.76	2.76
2. Reconstruction of neglected HPP's			
Leninkend	0.8	2.99	1.2
Belokan	0.3	1.32	0.45
Nugedi	0.83	2.94	1.25
3. Construction of smaller HPP's on reservoirs and canals			
Tartarsu	31.0	155.0	46.5
On the Mil canal	30.0	150.0	45.0
On the Upper-Shirvan	10.7	55.0	16.1
On the Upper-Qarabakh	12.0	50.0	18.0
Arpachay	8.5	42.7	12.8
Vayhir	4.7	13.2	7.1
Jegamchay	3.3	14.6	4.95
Aqstafachay	2.8	13.8	4.2

Source: "Initial National Communication of Azerbaijan Republic on Climate Change"

3.5 Mutual Cooperation in Energy Efficiency and Energy Saving with Other CIS Countries

In order to support the development of energy co-operation between the EU, the littoral states of the Black & Caspian Seas and their neighbouring countries INOGATE programme was launched in 1992. The co-operation framework covers the areas of oil and gas, electricity, renewable energy and energy efficiency.

11 countries are members of INOGATE: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kirghizstan, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan. They are often designated as PARTNER COUNTRIES. Russia and Turkey are part of INOGATE in an observer capacity.

“INOGATE” originally stood for "Interstate Oil and Gas Transport to Europe", deriving from the predecessor project, 'Interstate Oil and Gas Pipeline Management', completed in 1997. The enlargement of INOGATE's scope of activities began with an Energy Ministerial Conference held in Baku, known as the “Baku Initiative” that culminated in the signing of the Astana Energy Ministerial Declaration in 2006.

At the Ministerial Conferences “Energy Cooperation between the EU, the Caspian Littoral States and their Neighbouring countries” held in Baku, November 2004 and in Astana, November 2006, the EU and twelve partner States agreed on their mutual interest in supporting the gradual development of regional energy markets and their regulation in the Caspian littoral states and neighbouring countries to facilitate the gradual integration in the future with the EU market and enhance capacity to attract funding for new energy infrastructure; to move regional energy cooperation beyond its traditional focus on the hydrocarbon sector to include discussions on electricity, energy efficiency and renewable energy sectors.

The Baku Initiative envelopes almost all crucial directions of Energy Conservation Policy, including:

- Strengthening the institutional and legislative support;
- Increasing the number of participants;
- Development and introduction of the minimum energy efficiency standards;
- Supporting the research and science enterprises, and commercial introduction of energy-efficient technologies and equipment;
- Dissemination of best practices with respect to energy efficient methods and technologies of fuel and energy resources use;
- Increasing public awareness on benefits and advantages of energy conservation.

The four defined areas of cooperation of the Baku Initiative were:

- harmonising the legal and technical standards with the aim to create a functioning integrated energy market in accordance with EU and International legal and regulatory framework;
- enhancing the safety and security of energy supplies extending and modernizing the existing infrastructure, substituting the old and dangerous power generation infrastructures with environmentally-friendly power generation infrastructures, developing of new infrastructures and implementing a modern monitoring system of their operation;
- improving energy supply and demand management through the integration of efficient and sustainable energy systems;
- promoting the financing of commercially and environmentally viable energy projects of common interest, which will be identified according to pre-defined criteria.

The agreed mechanism for implementing the Baku Initiative is through the working groups established at the Baku Conference with the INOGATE Technical Secretariat, to address each of the above areas, acting as coordination mechanism. This energy cooperation was given

new momentum in 2006 as the March 2006 European Council conclusions called for an Energy Policy for Europe, aiming at effective Community policy, coherence between Member States and consistency between actions in different policy areas and fulfilling in a balanced way the three objectives of security of supply, competitiveness and environmental sustainability.

Since one of the key issues faced by INOGATE partner countries are the energy losses, specifically those occurring in the building sector, European Commission and INOGATE Working Group 3 (WG3, Sustainable Development) decided to launch a dedicated project: Energy Savings in the building sector (ESIB).

ESIB is a EU funded project dedicated to the promotion of Energy Efficiency (EE) in partner countries of the INOGATE programme.

ESIB scope of activities covers all types of buildings: housing, public buildings, schools, hospitals, offices, shops, other tertiary buildings, etc.

ESIB main axes of action:

- Legal: analysis of the current state of EE legislation and policy advice for its further development;
- Financial: help to create stimulating conditions for EE financing, Technical assistance to demonstration/ pilot projects.
- Technical and professional: improving the regulations and technical norms to stimulate the use of EE solutions adapted to local conditions; capacity building.
- Public awareness: because raising awareness about EE is a major step towards changing the attitudes and practices, the program will provide the main actors with expertise on EE promotion.

The ESIB mission was organized from November 20 to December 1, 2012, for carrying out one trainings on energy audits in Azerbaijan, in Baku on November 28-29-30, 2012. The main goal of the mission were organization of energy audit of the Buzovna kindergarden of Khazar district and a training course on 28-30 November 2012.

The final objective of training was to require from the participant to perform by themselves, in small groups, the energy audit on the selected concrete case. The Excel model used for training in ESIB projects was fully filled with all the collected informations. Investment proposal of EE measures was duely included in this model. All pedagogical steps were filled.

The selected building (kindergarten in Buzovna) is supposed to be retrofitted, using some of the proposed solutions. This implementation of the energy efficiency measures should also be followed up by the trainees in order to bring a practical application that they can use again in their professional activities. It would be going along with the monitoring of the buildings before and after EE retrofitting.

Participation in the UNECE project “**Development of the Renewable Energy Sector in the Russian Federation and in CIS countries: Prospects for Interregional Cooperation**” promoted interregional cooperation to overcome the existing barriers to the development of renewable energy resources.

The International Workshops organized by UNECE under this project in Minsk (Belarus), Geneva (Switzerland) and Astana (Kazakhstan) became good opportunity for the exchange of information and discussions of national experts. These forums made important contribution to extending cooperation between Russia and CIS countries in the field of energy efficiency and renewable energy development.

3.6 Mutual Cooperation in Energy Efficiency and Energy Saving outside the CIS Region

As it mentioned above, the Republic of Azerbaijan has successfully identified political development, administrative reform and comprehensive economic development as national priorities in order to increase economic growth, alleviate poverty and unemployment. The EU has endorsed these national development plans of the Government of Azerbaijan and is currently supporting their implementation through the European Neighbourhood Policy. Azerbaijan’s

present agenda includes the Partnership and Cooperation Agreement (PCA) of 1999 to reinforce the cooperation between Azerbaijan and the European Community in several sectors. According to the National Indicative Programme (NIP) for 2007-2010, the assistance provided is supposed to concentrate on reforming energy legislation and on opening the energy market.

Relations with the European Union in the Energy Sector:

- A Memorandum of Understanding on a Strategic Partnership between the European Union and Azerbaijan in the field of Energy was signed in 2006.
- Regional energy cooperation between Azerbaijan and the EU takes place in the framework of the Baku Initiative, which provides for political dialogue between the EU and the countries of the littoral states of the Black & Caspian Seas and their neighbouring countries.
- Azerbaijan participates in the Eastern Partnership and its energy security platform.
- Bilateral cooperation between the EU and Azerbaijan takes place in the context of the European Neighbourhood Policy in line with the Partnership and Co-operation Agreement. This also covers energy cooperation.
- The EU and Azerbaijan launched negotiations in 2010 on a future Association Agreement, which will include provisions on energy security.
- In January 2011 President Barroso and President Ilham Aliyev signed a Joint Declaration on the development of the Southern Gas Corridor, for which Azerbaijan is a contributor and enabler.
- In September 2011 the European Commission was granted a mandate to negotiate the Trans-Caspian Pipeline system with Azerbaijan and Turkmenistan.

Memorandum of Understanding on a strategic partnership between the European Union (EU) and the Republic of Azerbaijan signed on 7 November 2006 by president of the European Council Matti Vanhanen, president of the Commission of the European Communities Jose Manuel Durao Barroso and president of the Republic of Azerbaijan Ilham Aliyev is one of the principal documents regulating cooperation of Azerbaijan and EU in the field of energy sector.

According to the Memorandum, both parties decided to cooperate in the four specific areas:

1. Establishment of a strategy and a programme for the gradual harmonization of Azerbaijani legislation with the Community legislation in the energy field leading to the convergence of the electricity and gas markets.
2. Enhancing the safety and security of energy supplies and transit systems from Azerbaijan and Caspian basin to the EU.
3. Development of a comprehensive energy demand management policy in Azerbaijan, including concrete energy saving measures, and measures to tackle climate change, making use also of the relevant mechanisms under the Kyoto protocol. In this context, the development of renewable energies should also be priority.
4. Technical cooperation and the exchange of expertise.

In the 2nd item of the Memorandum it is stated: “The EU and Azerbaijan face common energy policy challenges. The diversification and security of energy supplies, the deepening of energy market reforms, the development and modernization of energy infrastructures, energy efficiency, energy savings and the use of renewable energy sources are key concerns for both parties. An enhanced energy cooperation between Azerbaijan and the EU could boost the necessary reforms and, together with an enhanced investment climate, facilitate the attraction of further necessary investment.”

In the last year, several important measures were planned and implemented under the Norwegian ENSI (Energy Saving International AS) project “Energy efficiency in Azerbaijan buildings; Program on capacity building and technical support” and the German project “Training in Energy Efficiency - TrEff 2012/2013; Energy management systems: ISO 50001:2011”.

The main task of the ENSI project is to increase personnel potentiality and skills on complex energy audit and certification of buildings in Azerbaijan and use of renewable energy sources in buildings. The main directions of the project activities are:

- Initial phase;
- Development of the potential of local experts in building energy performance;
- Capacity building and technical support to the State Agency/company for Alternative and Renewable Energy Sources;
- Awareness raising activities.

The project also aims at including corresponding educational programs in universities and other educational institutions of Azerbaijan.

Cooperation with foreign specialists and international organizations have greatly contributed to energy reforms in Azerbaijan. Important results were achieved from implementation of the EU TACIS project “Support to the Ministry of Industry and Energy” in 2006. A number of projects were implemented with support from international donors such as World Bank, ADB, UNDP, USAID, EBRD and others.

A good deal of works has been implemented within the framework of the Energy Sector Reform Program (ESRP) in Azerbaijan supported by the European Union. One of the conditions of the Energy Reform Program was draft legislation on use of RES and EE.

In 2010-2011, under the EU ERSF the International Ecoenergy Academy implemented a project “Improvement of Azerbaijan’s legislation relating to Renewable Energy Sources and Energy Efficiency and its bringing in conformity to the EU legislation”. A number of experts and specialists from all over the world were involved in the project implementation including USA, Germany, Russia, Spain, Italy and Switzerland.

Draft laws and standards regulating development of non-traditional renewable energy sources and energy saving were developed. Among them there are draft laws “On Energy Saving and Increasing Energy Efficiency” and “On utilization of Renewable Energy Sources” and 21 secondary legislation documents needed to ensure the implementation of these laws. In addition, a package of proposals on the amendments in 17 of the existing laws were prepared and submitted to Azerbaijan government. At present they are at the stage of approval by the Cabinet of Ministers of the Republic of Azerbaijan.

The Law on Utilization of Renewable Energy Sources is developed to regulate relations in the fields of renewable energy source utilization for electric and heat energy generation, its transmission and consumption, and also determine the basic principles of governmental support to electric and heat energy generation from renewable sources in the Republic of Azerbaijan.

The main purpose of the Law on Energy Saving and Increasing Energy Efficiency is to regulate relations for efficient use of energy sources, electricity and heat energy while avoiding waste and protecting the environment. The law provides basic principles of state regulation in the field of energy efficiency increasing and effective use of energy sources in all spheres including state control and expertise, financial and economic mechanisms of energy efficiency, personnel training and people awareness raising, etc.

Most of the secondary legislation documents provide the principles of regulation of rational use of energy resources in buildings and were developed according to European standards, especially Directives 2002/91/EC and 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings (the EPBD). Among these draft regulations and standards there are:

1. Regulations proposed for energy performance of buildings
2. Rulebook for performing state energy expertise
3. Building automated management system standards
4. Heat consumption calculation for existing residential buildings
5. Calculation of smoke protection systems for residential and commercial buildings
6. Standards for apartment heating units in multicompartment buildings

7. Standards for complex intelligent systems for low-rise buildings and cottages
8. Guidelines for the rating of economic efficiency of heat supply investment project
9. Air change norms for residential and public buildings
10. Regulations for increasing energy efficiency and energy resource saving
11. Methods proposed for energy consumption calculation of buildings (BEC –Az)
12. Regulations on the methods and rules of energy efficiency increasing in transport
13. Urban development model regulations for solar energy use
14. Automated single house water heating and hot water supply nodes in exchange for the centralized nodes and others.

4. Potential and Drivers for Energy Efficiency and Energy Saving Improvements

4.1 Potential for Energy Efficiency and Energy Saving Improvements in Energy Supply:

4.1.1 Energy Production

The main indicators of energy efficiency development potential in Azerbaijan are:

- increased energy consumption by GDP and high economic growth;
- excessive consumption of fossil fuels by all sectors;
- increase of GHG emissions and aggravation of environmental situation;
- high proportion of obsolete facilities in energy sector;
- losses of energy resources during production, transportation and utilization of energy resources;
- insufficient application of energy efficient and renewable energy technologies.

Preliminary estimations show that the use of renewable energy sources will significantly increase the potential to reduce greenhouse gas emissions. The technical potential of energy savings and reduction of CO₂ emission measures planned by 2025 will amount to 873,000 tons.

Production of energy is managed by “Azerenergy” OSC, the state-owned enterprise. Azerbaijan's power sector has an installed generating capacity of approximately 6 (GW). Eight thermal power plants (TPPs), six hydropower plants (HPPs) and seven module type power plants operate in Azerbaijan. Azerenergy is preparing a plan for restoration of several small power plants whose operation was previously suspended. Much work is done and in the construction of new plants. It was expected that after putting into operation Janub power station with installed capacity of 780 MW in the city of Shirvan amount of fuel savings will be about 700,000 tons per year.

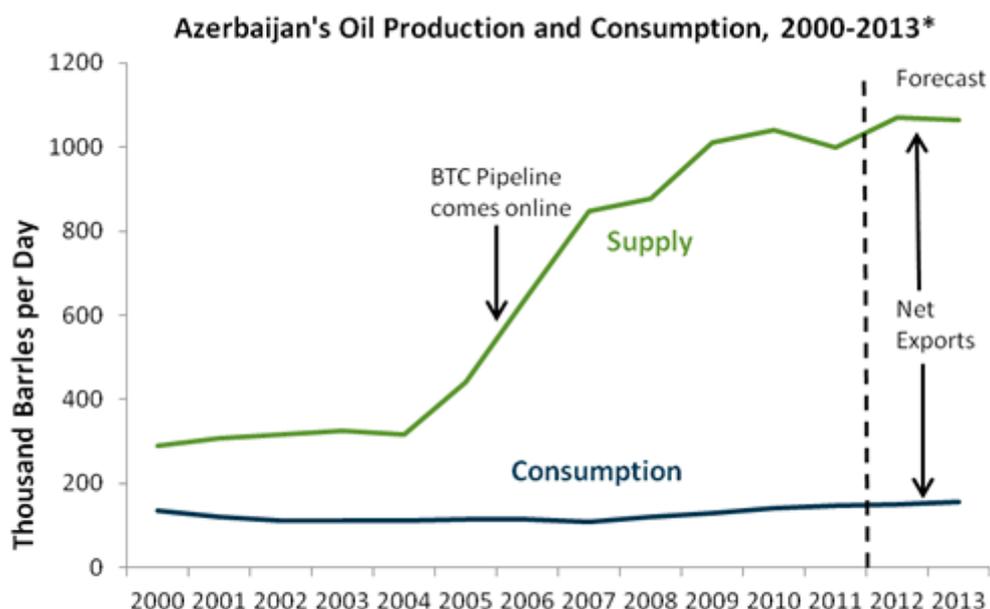
A 10 years historical summary of installed electricity generating capacity in Azerbaijan is shown in the table below.

Table 6. Power generation in Azerbaijan for years 2001-2010

Years	Power generation, <i>million kWh</i>					
	Total generation	from its:				
		Generation in heat station	Generation in hydro station	Production by non-power enterprises	Production by generator	Wind energy
2001	18969	17521	1301	131.2	15.9	-
2002	18701	16558	2020	103.8	18.8	-
2003	21286	18681	2470	104.9	30.4	-
2004	21744	18589	2755	365.4	33.8	-
2005	22872	19344	3009	430.5	88.0	-
2006	24543	21407	2518	475.9	141.8	-
2007	21847	19051	2364	432.0	-	-

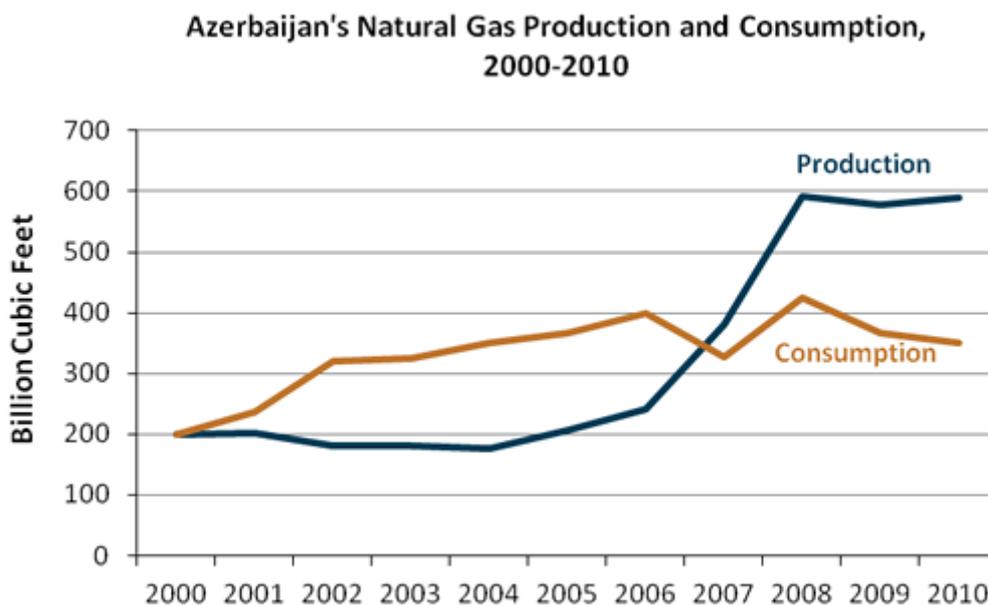
2008	21642	19090	2232	319.6	-	-
2009	18869	16289	2308	269.2	-	2.1
2010	18710	15003	3446	259.7	-	0.5

Source: State Statistical Committee, 2011.



Source: U.S. Energy Information Administration, Short-Term Energy Outlook
 * 2012-2013 data are EIA forecasts

Figure 3. Azerbaijan’s oil production and consumption for 2000-2013years.



Source: U.S. Energy Information Administration

Figure 4. Azerbaijan’s natural gas production and consumption for 2000-2010 years.

Available generation capacity in Azerbaijan is substantially less than installed capacity and is not sufficient to meet peak winter domestic demand. Options to meet peak demand include (i) expanding and upgrading existing generation facilities; (ii) increasing regional trade;

(iii) improving the performance of existing facilities; and (iv) demand side management. It is estimated that savings of 962,000 tons of conventional fuel could be achieved in the power engineering sector by:

- the decommissioning of obsolete equipment and replacement by new high-efficient equipment,
- construction and commissioning of high- and small capacity power plants,
- construction of new substations and power transmission lines and
- improvement in the overall efficiency of this sector.

Considerable part of energy efficiency potential is concentrated in the electrical and thermal power generation. Introduction of the combined production of electric power and thermal energy and upgrading the existing power plants will result in saving of energy losses to some extent.

One of the measures aimed at improving the efficiency of power stations is reducing the fuel and financial costs of electricity and thermal energy production.

The main activities seen necessary to improve the efficiency of power generation by thermal power plants are optimization of operating modes of all thermal power stations in the country and measures to improve the efficiency of the equipment based on modern technologies. The efficiency of electricity generation shall vary depending on the equipment life and, in some cases, on the possibility to use local types of fuel, etc.

The most important technological measures include the introduction of the combined cycle technology, steam-gas and gas turbines, waste heat utilization technology and introduction of automated control systems, while reducing power consumption for own needs.

4.1.2 Energy Transportation

Energy transfers in the region have been diversified, through seven hydrocarbon transport systems (oil and gas pipelines).

Azerbaijan is part of the Trans-Caucasian Power Pool and the regional interconnection infrastructure is presented in Table 7.

Table 7. Interconnection voltage levels

Country	Available interconnection voltage levels
Georgia	500 kV, 330 kV, 35 kV, and 10 kV
Turkey	154 kV and 34.5 kV
Iran	230 kV, 132 kV, and 10.5 kV

Source: *Ministry of Industry and Energy, 2010.*

In the electricity sector, transmission and distribution services are provided by Azerenergy OSC. There is also a presidential decree which established Baku Electric Distribution Grid SC (Bakielektrikshebeke) as distributor for the Baku region. The vertically integrated companies Azerenergy and Baku Electric Distribution Grid suffer important technical losses (up to 20% in distribution, although under 10% in high voltage lines).

In the gas sector, transmission and distribution activities are carried out by the state-owned Azerigaz, a subsidiary of SOCAR. Technical gas losses in the production and supply chain have been reduced greatly over the past 10 years and do not exceed 9-10%. Most losses occur during the replacement of pipeline sections where a leakage is identified. Modern technical equipment and processes are needed to remedy this. Gas losses are identified during regular field visits by the technicians who use special detection equipment. However, there is a need to implement additional measures and the state needs to provide the required technical and financial assistance.

According to experts estimates, introduction of new energy efficient technologies in the gas transportation system of Azerbaijan will result in saving of 44,4bcm of natural gas and reducing 590 mln. of tons of CO₂ after 25 years.

The transmission grid represents a major risk of systemic, catastrophic failure. Overloading and protective relay operations have been major contributors to winter blackouts.

There is a high risk that availability could be further reduced due to the suboptimal location of generation compared to demand and the consequent reliance on long transmission lines. The World Bank, in cooperation with Azerenergy, is preparing a power transmission project to improve system control and complete some upgrades.

Security assessment studies have also revealed the need for the improvement of capacity availability in the Baku-Absheron area and in the autonomous region of Nakhichevan.

Except for the Baku-1 power plant, most thermoelectric power plants in Azerbaijan are relatively old and in need of modernization.

The Asian Development Bank is working to improve the aging transmission system, including rehabilitation of existing lines, as well as building new lines and subsystems.

4.1.3 Energy Storage

According the information of the Azerbaijan Ministry and Energy, the production of electricity from alternative and renewable energy sources in Azerbaijan could reach 2.6 billion kilowatt / hours per year by 2015, that means the fuel saved will amount to one million tons. Most power losses occur in power plants and work on their reduction is currently underway. The construction of storage plants which will prevent the loss of electricity at night is planned in Azerbaijan as part of increasing energy efficiency and reducing losses during electricity generation.

Designing of electricity networks as smarter systems capable of integrating intermittent renewable generation such as wind and solar, and supplying new loads, such as electric vehicles and heat pumps would greatly contribute to energy saving. Significant increase in renewable generation will maximize CO₂-free power generation, and deliver cost-effective, environmentally attractive, high-quality services to existing power networks.

Energy storage system can receive and store power from wind turbines, as well as surplus power from the grid. It can take power delivered on a sunny day from photovoltaic panels and store it in a high-capacity battery bank.

Besides, power quality management technologies can be introduced to keep a more precise balance between electric supply and demand. These technologies can fill the gaps between actual electric demand. Electric power system operators must match electric supply to demand in real time, as demand changes over the course of the day.

Unpredictable changes on the supply side, such as variable (or intermittent) generation from solar or wind generators or unplanned outages, can further complicate the balancing function. Fast-response capability is a distinct advantage of power quality management storage applications for ramping and regulation purposes. A battery system at a wind farm, for example, can potentially be used to ensure the wind project delivers its forecast level of power until the grid can accommodate a change.

Currently, facilities at the oil production plant include separators, coalescers, three new crude oil storage tanks, export pumps, gas turbine power generators and a central control room. The Sangachal Oil Terminal has a processing capacity of 1.2 million barrels per day ($190 \times 10^3 \text{ m}^3/\text{d}$) and 1.25 billion cubic feet ($35 \times 10^6 \text{ m}^3$) of gas per day. The three new crude oil storage tanks added during the terminal expansion project have a capacity of 880 thousand barrels ($140 \times 10^3 \text{ m}^3$) each. The overall storage capacity at the terminal is 3 million barrels ($480 \times 10^3 \text{ m}^3$).

From the Sangachal Terminal four oil and gas pipelines carry crude oil and natural gas to the Black Sea, Turkey and the Mediterranean Sea. The terminal receives oil from the Azeri-Chirag-Guneshli field and natural gas from the Shah Deniz gas field. The oil is exported via the

Baku-Tbilisi-Ceyhan pipeline to Turkey's Mediterranean coast and via the Baku-Supsa Pipeline and the Baku-Novorossiysk Pipeline to the Black Sea coast. The terminal has been expanded to include the ACG Phase 1, Phase 2, Phase 3 Oil Trains, BTC's main pumping station and the Shah Deniz gas plant.

Azerbaijan has two underground gas storage facilities, located southwest of Baku at Garadag and Galmaz. Both are derived from depleted gas wells and both are in need of upgrades to increase their storage capacities. Garadag has a current capacity of about 1 billion cubic meters, but it could hold about 5 billion cubic meters if upgraded. Galmaz also has a current capacity of about 1 billion cubic meters, but it could be upgraded to about 2.5 billion cubic meters capacity. Integrated plans exist for installation of additional gas pipelines and refurbishment of underground gas storage. This would enhance the countrywide gas collection, transportation and the distribution system. Construction of several pipelines has been completed in the past several years. SOCAR has an ongoing underground gas storage programme; a major 3 bcm facility is presently under construction.

On 19 October 2011, the European Commission (EC) adopted the proposal for a Regulation on "Guidelines for trans-European energy infrastructure". It aims at ensuring that strategic energy networks and storage facilities are completed by 2020. To this end, the EC has identified 12 priority corridors and areas covering electricity, gas, oil and carbon dioxide transport networks. It proposes a regime of "common interest" for projects contributing to implementing these priorities and having obtained this label.

4.1.4 Energy Distribution

Significant losses are being observed during the transmission and distribution of electricity. The losses are much higher in Azerbaijan than in Europe. In particular, losses amount to 4.4 per cent during transmission and to 16 per cent in distribution.

In total, the volume of losses in transmission and distribution of electric power reaches 20-21 per cent.

The high percentage of losses in power and district heating networks due to the significant level of their wear stipulates the need for modernization of networks. At least 50% of transformer substations, which have reached the end of their service life, should also be replaced. In order to reduce losses in distribution networks and at consumer inputs, it will be useful to:

- redesign the existing power lines for the redistribution of energy flows;
- optimize the capacity of installed transformers in cases when the actual load is lower than the designed load;
- use automated control and management systems to reduce energy and heat losses and atmosphere emissions;
- introduce automated single house water heating and hot water supply nodes in exchange for the centralized systems;
- equip all consumers with electricity and gas meters.

According to expert estimations, as a result of installation of control and measuring equipment in the distribution of natural gas in residential and commercial sectors the volume of CO₂ emissions reduced will amount to 590 millions of tons after 25 years.

Azerigaz (and its subsidiaries) operates over 4000 km of transmission pipelines and 40,000 km of distribution pipelines. The old pipeline structure (largely pre-1986) has now been significantly modernized, with new compressor stations and other secondary infrastructure. Ongoing technical maintenance, including long-term and annual programmes, are financed by the company from its revenues.

4.2 Potential for Energy Efficiency and Energy Saving Improvements in Energy Consumption:

4.2.1 Industry

In order to increase energy efficiency it is important to implement measures to control consumers' demand.

Significant energy efficiency potential has been accumulated in all economic sectors of the republic. Table 8 shows consumption of energy products by key energy consumers.

Table 8. Consumption of energy products by types of economic activity for 2010
(thsd. ton oil equivalent)

Energy products	Industry	Construction	Transport	Agriculture, forestry and fishing	Commerce and public services	Households
Crude oil	6352,5	-	-	-	-	-
Natural bitum and asphalt	-	0,7	-	-	-	-
Refinery gas	266,3	-	-	-	-	-
LPG	7,0	5,5	15,8	0,1	0,8	65,9
Motor gasoline	-	-	1062,1	-	-	1,2
Kerosene type jet fuel	5,9	0,1	92,6	-	-	-
Other kerosene	0,1	-	-	-	-	1,5
Diesel fuel	11,1	26,2	456,8	342,8	3,3	12,6
Fuel oil-low sulfur	68,4	5,8	1,3	1,1	2,4	-
Fuel oil-high sulfur	-	0,8	-	-	-	-
Naphtha	212,5	-	-	-	-	-
Petroleum coke	5,0	-	-	-	-	-
Oil bitum	0,8	207,0	-	-	-	-
Other petroleum products	144,0	-	29,5	-	-	-
Natural gas	4900,6	21,5	-	24,3	32,8	2685,1
Heat	307,7	0,6	-	0,3	40,5	32,7
Electricity	275,3	41,3	46,8	57,2	322,0	495,0
Other fuel products	4,1	-	4,3	1,3	16,0	72,7

Source: State Statistical Committee of the Republic of Azerbaijan, 2011.

As can be seen from Figure 5, notable reduction was observed in the energy consumption of some consumer types during 2007-2010 years.

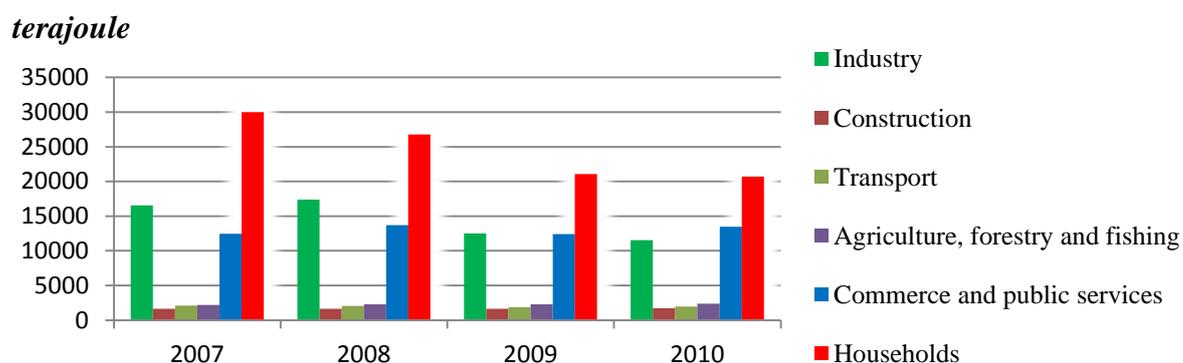


Figure 5. Consumption of electricity by economic sectors from 2007 to 2010 years.

One of the ways of energy efficiency increasing is reducing of energy intensity of GDP through the increase of productivity in some industrial branches including agriculture. The main purpose will be to increase the GDP without increasing energy consumption. GDP energy intensity should be reduced significantly.

It is essential to increase the share of less energy and material-intensive productions in the structure of manufacturing industry. Industrial processes have to be modernized, especially the energy-intensive ones. Local raw materials and industrial wastes should be used for the production of plastics and synthetic fibers, which reduces the need for energy-intensive metal products. Waste products should be utilized for the production of secondary energy resources.

Establishment of enterprises to develop the production of energy efficient equipment and materials, and the application of modern technologies are important measures in achieving energy efficiency and energy saving improvements.

The greatest reserves of savings are concentrated in the improvement of production technology, upgrading of furnaces, recovery of heat of exhaust process gases, production of electricity by utilizing pressure differences, the use of insulating materials.

Significant energy savings can be achieved through the improvement of combustion thermal and heating furnaces in machinery manufacturing and other industries, through improvement of designs, introduction of modern automated burners, systems of automated combustion and heat treatment control.

Taking into account the above mentioned, energy efficiency of industrial sector can be achieved through:

- introduction of energy management systems at industrial enterprises;
- implementation of energy audits for all sectors of industry;
- providing enterprises with modern facilities to control at all stages of production, transmission and consumption of energy;
- introduction of automated energy control systems in industrial enterprises;

- calculation and regulation of the fuel and energy balances for all types of energy resources;
- specialization of the enterprises to produce high-tech, competitive and less energy-intensive products;
- introduction of advanced technologies and equipment with high economic effect, and energy-saving and environmentally friendly technologies etc.;
- improvement of technological processes in existing enterprises through the introduction of advanced scientific and technologic achievements;
- certification of energy consuming appliances and equipment;
- use of waste products as alternative energy sources;
- use of energy efficient heating, lighting, ventilation and hot water systems.

In Azerbaijan metering is already implemented in a wide scale and in Baku it has been modernised with the introduction of electronic billing. In the electricity sector at present about 90% of electricity end-users (industry and households) have electricity meters installed.

A new metering system based on smartcard technology has been introduced in Ganja city and the installation of these new meters continues in other cities and villages.

4.2.2 Commercial and Public Services

As can be seen from Table 7 electricity consumption of commercial and public services is significantly high compared to other energy products. Energy efficiency in commerce and public services can be achieved through:

- improving the efficiency of electrical networks and boilers;
- modernization of heating systems;
- improving the efficiency of energy resources use in budget-supported public buildings;
- introduction of control devices;
- implementation of energy audits in the sector;
- designing and application of energy passports;
- introduction of automated energy management and controlling systems;
- expanding the use of energy efficient construction materials;
- wide-scale application of renewable energy technologies to supply electricity, hot-water and heat demand.

Recently, Azerbaijan has made important steps at the national level aimed at creating conditions for an extensive development of energy saving. It's worth mentioning that in September 2012 the "City Planning and Construction Code of Azerbaijan" was adopted, incorporating the issues of energy saving and energy efficiency at the stage of designing and constructing new facilities. The government was given a task to develop the relevant norms and regulations on this subject within a 5-month period.

Thus, the foundation was laid for creating a legal framework required for implementation of energy saving measures.

4.2.3 Agriculture

The activities to improve energy efficiency and energy saving in agriculture should be focused on:

- introduction of modern energy efficient technologies in all spheres of agriculture;
- upgrading of pumps and electrical equipment on irrigation and drainage systems;
- application of renewable energy technologies to use waste material (biomass) to supply electricity and gas demand of local population;
- introduction of hybrid energy (solar –biomass, solar-wind and wind-biomass modules) systems to supply local electricity demand;
- priority equipping of consumers with modern and affordable energy-saving equipment;
- equipping absolutely all electricity consumers with electricity meters;
- increasing the employment and utilization of capacities of in the introduction of renewable energy technologies;
- attraction of local funds to purchase energy efficient equipment, materials and technologies.

The biomass resources represent a significant energy potential in the rural regions. In the agricultural regions of Azerbaijan, there are large amounts of waste from agricultural crops, mainly in sunflower, potato and corn (Table 9). Currently the remains of these crops are left or burned in the fields. However, these can serve a source of obtaining biogas in the regions.

Table 9. Azerbaijan biomass resource data

Biomass resource type	Total production	Production density
Total land area covered by	(avg. 2006-2007, km ²)	(avg. 2006-2007, %)
Arable Land	18,477	21
Permanent Crops	2,229	3
Permanent Meadows and Pastures	26,857	31
Forest Area	9,360	11
Other Land	25,711	30
Inland Water	3,967	5
Primary crop production	(avg. 2006-2007, tonne)	(tonne /100 km ²)
Total primary crops (rank among COO)	5,687,438 (17)	6,581 (16)
Top 10 primary crops		
Wheat	1,397,114	1,617
Potatoes	1,161,170	1,344
Tomatoes	444,085	514
Barley	439,434	509
Watermelons	386,460	447
Vegetables fresh nes	219,982	255
Onions, dry	187,545	217
Apples	179,014	207
Cucumbers and gherkins	177,052	205
Maize	152,054	176
Animal units, number	(avg. 2006-2007, number)	(number / 100 km ²)
Cattle	7,068,475	8,179

Poultry	6,355,281	7,354
Pigs	14,922	17
Equivalent animal units	2,286,861	2,646
Annual roundwood production	(2006-2007, m3)	(m3 / 1000 km2)
Total	6,510	7.5
Fuel	3,200	3.7
Industrial	3,300	3.8
Wood-based panels	20	0
	(2006-2007, tonne)	(tonne / 1000 km2)
Paper and paperboard	1,600	1.9

The provinces and districts, where there is a relative abundance of electricity and the relative lack of heat, have an advantage of installing heat pumps. Heat pumps use the renewable low-potential energy of the environment and increase its potential to the level required for heat supply, thus spending 3 - 7 times less primary energy than is used when burning fuel.

4.2.4 Transportation

Transport sector has great potentiality for energy saving and energy efficiency increase.

Energy efficiency in transport system can be achieved through:

- use of alternative motor fuels in transportation system;
- improving the systems of diagnostics and maintenance of vehicles to improve their reliability and energy efficiency;
- improving the traffic management systems;
- improving the quality of road maintenance to avoid fuel losses;
- introduction of modern fuel monitoring systems.

4.2.5 Residential Sector

In the promotion of renewable energy, energy efficiency and GHG abatement study, the energy saving potential in the residential sector was estimated to be about 6,732kWh.

One of the important measures aimed at achieving energy efficiency and energy saving improvement in residential sector is the establishment of the regulatory framework for energy efficiency and resource saving that will include clearly defined and technically feasible energy efficiency requirements for newly commissioned buildings, and in particular, the indicators of specific consumption of energy resources in this building or structure (including energy intensity, thermal conductivity of walls, windows).

The design documentation on residential buildings should include a separate section on energy efficiency, which shall contain a list of measures ensuring compliance with the energy efficiency requirements and with the requirements to equipment of buildings with energy-consumption metering devices. Introduction of effective thermal insulation building materials, certification and standardization of electrical household appliances are essential factors determining energy efficiency in residential buildings. The use of local renewable energy sources (wind, solar and thermal water, etc.) for heating, electricity and hot water supply purposes will significantly promote energy efficiency in residential sector. As part of efforts to improve energy efficiency the following activities should be implemented:

- development of the local manufacture of energy saving equipment and materials;
- production and use of compact fluorescent lamps;
- development of manufacture of renewable energy facilities (wind turbines, solar panels, PV modules and others) and other types of energy saving equipment;

- organization of seminars and training courses aimed at people awareness raising on energy efficiency and energy saving improvement;
- training of energy managers of all sectors including industrial, housing and utilities;
- development of economically justified energy tariffs;
- improvement of legislative and regulatory framework of energy efficiency according to world standards.

4.3 Existing Political, Regulatory, Institutional and Financial Drivers for Energy Efficiency and Energy Saving Improvements

The major initial energy related laws and secondary legislative acts of Azerbaijan (such as, Presidential Decrees and Resolutions; Regulations and Resolutions of the Cabinet of Ministers; the Legal Normative Acts - Rules, Orders, Instructions, Norms and Normative Acts of the Central and Local Executive Power Bodies of Azerbaijan) were established approximately 5-8 years after adoption of the Constitutional Act of Azerbaijan on State Independence of 1991. However, there are still some old legal-normative acts in force at present in the energy sector of Azerbaijan.

The main policy statements and decrees concerning energy sector's development were:

The Law on the Utilization of Energy Resources (1996); Law on Power Engineering (1999); Presidential Decree on Establishment of Ministry of Fuel and Energy (2001); Ordinance of President on measures for Strengthening Financial Discipline in Energy and Water Sectors (2002); Presidential Decree on measures for Acceleration of Social and Economic development in the Republic of Azerbaijan (2003); State Program on Socio-Economic Development of Regions of Azerbaijan Republic for 2004-2008; State Program on Use of Alternative and Renewable Energy Sources in Azerbaijan Republic (2004); State Program for Development of Fuel and Energy Sector of Azerbaijan Republic (2004); State Program on Poverty Reduction and Sustainable Development of the Republic of Azerbaijan (2008); Presidential Decree on Establishment of the State Agency of Alternative and Renewable Energy Resources at the Ministry of Industry and Energy (2009) and Presidential Decree on Establishment of the State Company of Alternative and Renewable Energy Resources (2012).

This Law on the Utilization of Energy Resources determines legal, economic and social bases of the state policy on energy resources' utilization and the main directions of realization of this policy, regulates relations between the state, legal and natural person in this area.

According to the Law, the main principles of state policy on energy resources utilization are based on:

- state regulation of the activities of legal and natural persons in the area of energy efficiency through economic and administrative measures;
- effectiveness of energy saving requirements during the implementation of the activities related to production (extraction), processing, transportation, storage and utilization of energy resources, application of economic and legal stimulatory mechanisms;
- determination and application of advanced norms of energy resources' utilization;
- state control over efficient utilization of energy resources by organizations and enterprises;
- regulation and standardization in the field of energy saving and efficient utilization of energy resources, necessity of the observation of energy norms and standards;
- coordination of the interests of energy resource producers, suppliers and consumers;
- compulsory calculation of energy resources used by each enterprise and organization not depending on the property kinds;
- obligatory energy expertise of newly constructed and reconstructed objects;

- application of economic sanctions against inefficient use of energy resources;
- propagation about economic, ecological and social advantages of energy efficiency;
- international cooperation in resolution of energy efficiency problems of the republic;
- wide scale application of energy efficient technologies.

Despite the fact that, majority of the laws regulating energy sector in Azerbaijan, such as, Law “On Power Engineering” dated April 03 1998; Law “On Gas Supply” dated June 30, 1998; Law “On Energy” dated November 24, 1998 Law “On Thermal and Heat Power Plants” dated March 06, 2000 were prepared by the participation of EU Experts Group under the relevant TACIS project funded by EC by taking into consideration the appropriate energy laws of the European countries they require changes to be harmonized with the EU legislation and relevant Directives to promote sustainable utilization of energy resources.

Provisions of the energy legislation of Azerbaijan concerning the issues on energy efficiency and usage of renewable energy sources have also a general character and are not duly applied in practice. With respect to alternative and renewable energies the State program of 21 October 2004 has set the frame which will have to be filled by corresponding measures and activities. In addition to the requirements on energy efficiency and usage of renewable energy sources, the issues on ecology and protection of environment in respect to implementation of the requirements provided by the Kyoto Protocol should be brought in compliance with the EU Energy Directives.

One of the measures aimed at energy saving was the application of gas counters in buildings. According to long term forecasts, significant successes in CO₂ reduction can be achieved through application of gas counters, and a new automated system controlling and management technology (Figure 6 and Figure 7).

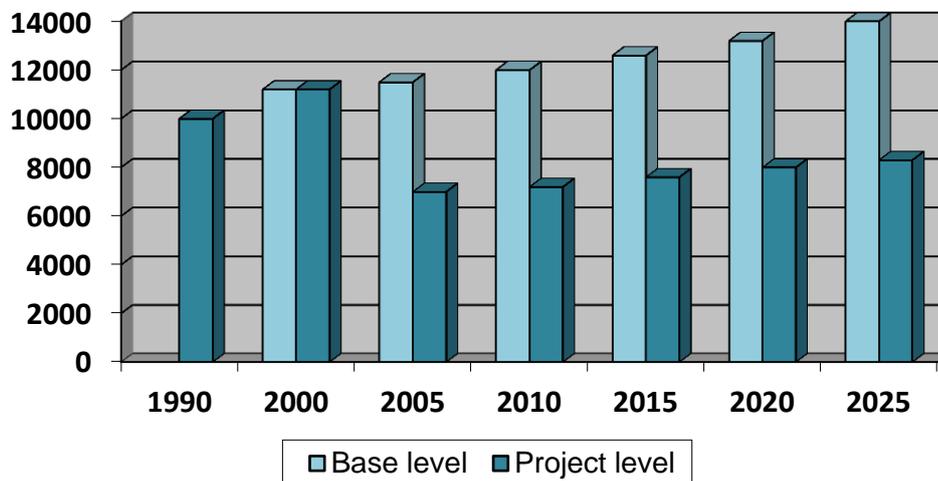


Figure 6. Forecast of CO₂ reduction by 2025 through application of gas counters.

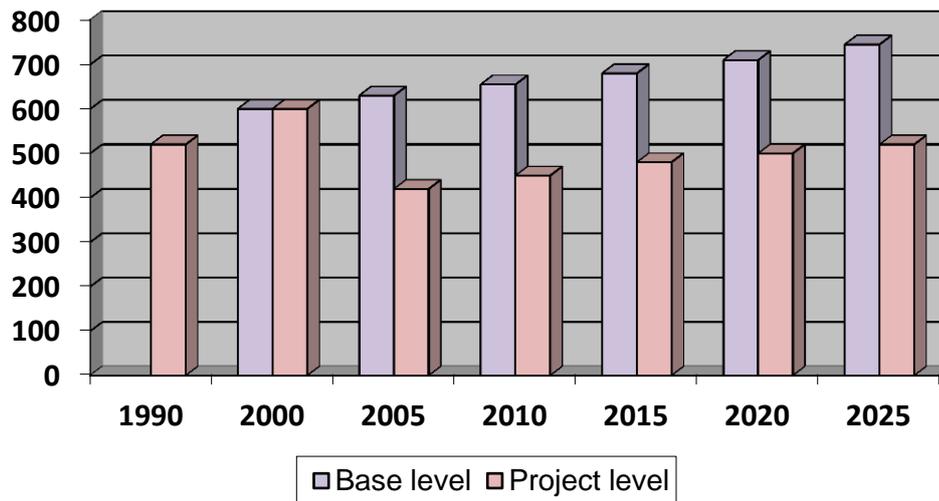


Figure 7. Forecast of CO₂ reduction by 2025 through application of an automated system controlling and management technology

The rates for electricity were last increased in 2007. According to the Order No 03 on the Regulation of Electric Power Tariffs, dated January 6, 2007 the following electric power prices are approved at present:

Table 9. Current power prices in Azerbaijan

Item No	Description	Tariffs per 1 kWh (with VAT) in gapikcs
1	Wholesale price	
1.2	“Azerenerji” OJSC production	4.1
1.3	Production of private small hydropower plants	2.5
1.4	Production of wind power plants	4.5

Note: 100 gapiks = 1 manat (the manat currently exchanges at 1: 0.80 \$US)

The greatest single problem in the tariff area is the lack of comprehensive tariff methodology reflecting a clearly stated strategy on the nature of energy production. Tariffs also contain significant cross subsidies from industry to residential, in both electricity and gas.

Energy efficiency investments are a great opportunity for the Azerbaijan, which is already making some strides.

A thermal power plant in Azerbaijan, AzSRES, will become the first in the world to be able to sell carbon credits earned thanks to an energy efficiency modernisation project. The project was financed by the EBRD in 2006; the \$207 million loan allowed the plant to rehabilitate old and inefficient turbines and boilers, modernise command and control systems, repair chimneys and water cooling systems and make a number of other improvements.

The project, “AzSRES Energy Efficiency Improvement”, has been registered under the Kyoto Protocols' Clean Development Mechanism (CDM) by the CDM Executive Board. The project on rehabilitation of seven dual fuel, gas and heavy fuel oil units of 300 MW each is estimated to generate over 10 million carbon credits over the ten-year crediting period. These credits can now be sold on global carbon markets, including the EU's Emissions Trading Scheme.

The energy efficiency improvement of the AzSRES thermal power plant is the first power plant rehabilitation project registered under the CDM and the second CDM project in Azerbaijan. It is also the largest CDM-registered project in the Caucasus. Owned by the national energy operator Azerenerji, the AzSRES TPP is the largest power plant in Azerbaijan, generating half of the country's electricity (Figure 8). The rehabilitation project significantly increased efficiency and capacity at the plant, which is now better able to meet the increasing demand of a rapidly growing economy. Moreover, the project has improved Azerbaijan's energy security and increased reliability of its energy infrastructure.



Figure 8. AzSRES reconstructed thermal power plant

Azerenergy has noted a small decline in consumption recently due to its efforts to improve efficiency. Improvements in natural gas supply and the introduction of electricity meters across the Azerbaijan have improved efficiency while also addressing access and security.

Azerbaijan has begun to promote energy efficient lighting. Namely, a proposal for the Parliament is considering MEPS for lamps and the National Standard Agency is preparing mandatory labels for lamps. Energy efficiency awareness raising campaigns through media and school educational programmes have been conducted in some cities. Baku is planning to establish CFL collection points and to build a recycling facility for electronic waste.

Most of these activities have yet to be implemented and most are not planned on a national level. Azerbaijan still needs to define the absolute levels of the lamp MEPS and make sure that these standards incorporate global best practices. A thorough transition to efficient lighting in the residential, commercial/industrial and outdoor sectors would yield environmental benefits of 454.6 kilotons of CO₂ annually. Electricity consumption would be reduced by 1.1 TWh annually (approximately 8% of total national electricity consumption). Lighting electricity consumption would be reduced by 50%. Annual cost savings would be approximately 55.8 million USD. The phase out of inefficient incandescent lamps would result in reductions of approximately 380 kilotonnes of CO₂ annually, electricity consumption would be reduced by 0.92 TWh and costs savings would be 53 million USD.

5. Barriers and Challenges to Energy Efficiency and Energy Saving Improvements and to Mutual Cooperation

Like other former soviet countries, Azerbaijan has serious institutional, legislative, financial, economic, scientific-technical, informational, and market barriers to energy efficiency.

The main barriers are:

1. *Economic and financial*

- The lack of local and foreign investment: the local companies interested in energy efficiency have limited financial resources and insufficient access to funds intended for energy saving technologies. Sometimes, participation of foreign capitals is delayed for the lack of appropriate regulations and legislative basis;
- The lack of long-term credits: commercial banks issue credits unwillingly, because repayment of long-term credits has risk aspects. In addition, financial entities have not enough experience for analyzing financial aspects of investments in this field. Long-term foreign credits are expensive due to high risk, which foreign commercial banks feel;
- The lack of interest and governmental support of renewable energy development due to the dominance of the oil and gas industry;
- The lack of financial schemes and mechanisms of investment into energy efficient projects, well-reputed in many foreign countries, including third party financing, leasing, etc. There is no extra-budgetary energy conservation funds so far. The long payback period for energy-saving projects are not attractive to potential investors.
- The lack of funding and low investment attractiveness are largely due to the limited scale and long-term commercial deployment of advanced energy-saving equipment and technologies.
- High cost of state-of-the-art equipment;
- The lack of governmental financing mechanisms that is necessary taking into account technical complexity, high risk level and long-term realization of projects aimed at renewable and alternative energy resource development. The situation is also complicated due to the fact that generation of energy from traditional fossil fuels is considerably subsidized.

2. *Institutional*

- Insufficiency of legislative basis in the field of energy efficiency: ineffective system of obligatory measures on ecological legislation fulfillment, promoting interests (incentives) in the development of more environmental friendly technologies including renewable and alternative energy technologies;
- Unwillingness of local self-government institutions to support projects dealing with energy efficiency and renewable energy development, since it is difficult to derive benefit from long-term projects in short-term perspective (difference between returns and benefits);
- The lack of a comprehensive tariff methodology reflecting a clearly stated strategy on the nature of energy production;
- The lack of effective coordination among governmental entities in the field of energy efficiency and renewable energy resource development;
- The lack of an institutional body governing the processes related to energy efficiency, and fuel and energy resources' saving;

- Reservation of the former administrative approach to energy saving, there is no governmental entity directly implementing energy efficiency policy.

The legislative barriers to the development of energy efficiency include:

- insufficient elaborateness of the regulatory framework on energy efficiency: legislative acts adopted in the country, are acts of indirect action and require further development and adoption of a significant number of secondary legislation documents;
- insufficient development and application of progressive standards, regulation documents concerning the utilization of alternative energy resources.
- limited scope of development and implementation of new energy efficiency standards for energy consuming equipment and appliances, and lack of activities with respect to application of the existing standards and control over their observance;
- lack of systematic development and application of State Standards, SNIPs and other regulations designed to ensure the level of quality of energy efficiency projects;
- inefficient organization of accounting and control over the consumption of energy resources.

3. Informational

- Lack of information about technologies and their use: there is no available information about technologies applicable for transformation of existing large equipment working on fossil fuels to the use of various renewable energy kinds;
- The lack of information about advantages (financial, social and environmental) and profitability of energy efficient technologies;
- Insufficient information and education in the field of rational and efficient use of energy resources. Industrial consumers and the public were not informed about the opportunities and benefits of energy efficiency, the existence of the internal market of energy efficient technologies, equipment and materials;
- The lack of reliable information about the reserves of renewable energy resources. There are only preliminary evaluations of potentially useful reserves of renewable energy sources for the present time;
- Insufficient provision of information to the energy users and decision-makers in charge of making the strategic, including investment, decisions in the energy sector and other sectors about the opportunities and benefits of energy efficiency;
- Limited use of information with respect to the search for manufacturers of energy efficient equipment, energy consulting and auditing companies, creation of databases;
- Low level of training activities in the field of energy efficiency: a significant number of training programs do not meet modern requirements set to the curriculum on energy saving;
- Insufficient use of mass media to promote the benefits of energy management for various categories of consumers.

4. Scientific and technical

- Limited scope of scientific-research works due to the lack of financial resources;
- Insufficient implementation of the results of scientific-researches and projects aimed at energy efficiency and energy resource saving;
- The lack of local firms manufacturing energy efficient equipment;

- High price of modern environmental friendly and energy efficient technologies;
- Limited financing of scientific and technological basis for energy saving and introduction of energy efficient technologies meeting the world standards;

6. *Market barriers*

- Absence of sufficient experience in conducting marketing researches, business planning and management of projects related to energy efficiency;
- The actual costs associated with inefficient use of energy are covered by public, rather than the enterprises that consume energy beyond the prescribed norms;
- Non-payment of additional costs associated with environmental pollution caused by production, transmission or ineffective consumption of energy resources by enterprises, which contaminate the environment.

In the recent years, Azerbaijan has made serious progress in overcoming the above barriers: the energy sector has received significant investment, control over energy resources utilization has been strengthened, a series of educational programs has been developed and implemented.

Azerbaijan has established close relationship with CIS and other foreign countries, international organizations and companies in the field of energy efficiency and renewable energy resource development. A number of projects have been implemented with support of international donors such as USAID, World Bank, European Bank for Research and Development and Asian Development Bank, etc.

Cooperation between Azerbaijan and the United Nations was established soon after the collapse of the former Soviet Union. Azerbaijan maintains cooperation with a wide range of specialized UN agencies and bodies in a very active and effective manner including UNDP, UNECE, UNEP and others that gives great opportunities for energy efficiency and environmentally sustainable energy development in the country. .

Many international organizations are working in Azerbaijan to inform and educate interested parties in energy conservation. The Norwegian ENSI program gave priority to raising awareness of specialists on energy efficiency.

Implementation of projects under INOGATE program played an important role in capacity building, promoting energy efficiency and raising awareness of industrial users and the public in the effective use of energy in Azerbaijan.

A number of laws and secondary legislation documents have been developed under EU Energy Sector Reform Program and TACIS project funded by EC.

6. Recommendations and Proposals on Creating a More Favorable Climate for Energy Efficiency and Energy Saving Improvements, on Enhancing Sub-Regional Cooperation between the CIS Countries to Foster Synergies

The main shortcoming in the republic with respect to energy efficiency is the lack of a specialized entity in this field. Therefore, it is necessary to establish an Energy Efficiency Council (or center), which would be responsible for the implementation of the state energy efficiency policy.

The primary functions of Energy Efficiency Council should be:

- support the government in the development and implementation of national energy efficiency policy;
- identification of priorities of energy efficiency policy;
- preparation of proposals for improving the efficiency of the use of fuel and energy resources;
- preparation of proposals for the implementation of measures aimed at energy saving and energy resources use efficiency;
- preparation of proposals for the utilization of the country's alternative and renewable energy sources;
- preparation of proposals for the development and implementation of state programs on energy saving and energy efficiency improvement;
- reviewing and evaluating proposals for the implementation of modern environmental friendly and energy efficient technologies, while involving local and international funds into the implementation of projects on energy saving and efficiency of energy resources utilization;
- coordination of activities of the related governmental entities and NGOs in promoting development of energy efficiency and energy saving improvement;
- organization of national and international conferences and seminars to discuss and disseminate the latest knowledge on energy efficiency and the use of energy-efficient technologies, introduction of energy saving devices and materials;
- organization of seminars involving local and foreign specialists to exchange information and train personnel in various areas of energy efficiency energy resources saving;
- development of educational programs for awareness rising of various categories of consumers;
- analysis and evaluation of the works of scientific-research institutes engaged in energy conservation and efficient use of energy resources, development of proposals on introduction of the results of their researches and innovation technologies in practice;
- preparation of proposals on wide-scale application of alternative and renewable energy technologies throughout the republic territory, while involving local and foreign investors, private companies, small- and medium-size enterprises, etc;
- preparation of proposals on improving existing legislation and regulatory framework to promote energy efficiency in all economic sectors;
- preparation of proposals on the improvement of environmental situation through implementation of energy efficient measures;

- preparation of proposals for the implementation of energy audits in industrial enterprises, households and public utilities, etc.;
- preparation of proposals for the manufacture of energy efficient equipment and materials, use of local mineral raw and various waste materials for this purpose;
- development of programs and business plans for energy efficiency projects;
- expanding and strengthening of scientific relationship with advanced world centers in the field of energy efficiency;
- development of programs on the implementation of projects with foreign specialists (including USA, European and CIS countries) and international organizations to use their practice in application of energy efficient technologies in the republic;
- development of proposals to establish energy management systems for all economic sectors, including transport, building industry and agriculture;
- development of educational programs to train energy managers at various levels;
- preparation of proposals on various kinds of incentives to promote the implementation of energy efficiency measures.

One of the ways of energy efficiency improvement would be establishment of energy efficiency centers in regions (the branches of Energy Efficiency Council). The responsibilities of these centers should include:

- coordination and management of the implementation of state programs and projects related to energy efficiency under executive power;
- management and analysis of the results of energy audits of enterprises, evaluation of the efficiency of the use of fuel and energy resources;
- analysis of energy efficiency of each economic sector;
- controlling of distribution of the funds intended for energy efficiency improvement;
- study of operation modes of equipment and making proposals for their optimization;
- analysis and evaluation of the level of environmental pollution of caused by inefficient use of fossil;
- management the improvement of environmental situation through implementation of energy efficient measures;
- identification of energy efficiency potential of local enterprises;
- identification of fuel and energy balances of local enterprises;
- analysis and evaluation of economic, social and ecological effect of introduced energy efficiency measures;
- creation of conditions for the use of energy efficient materials in construction;
- promoting the introduction of alternative and renewable energy technologies to supply hot water, heating and electricity to local enterprises and people;
- organization of the use of agricultural waste (biomass) to supply local electricity and gas demand;
- development of business plans to involve private sector to the projects intended for energy efficiency improvement;

- participation in national and international conferences and seminars to gain information about energy-efficient technologies, introduction of energy saving devices and materials;
- organization of training courses to train local specialists in the field of energy systems optimization and management, energy audit and application of renewable energy technologies;
- implementation of public awareness programs to improve the knowledge of local people about economic, social and environmental advantages of energy efficiency;
- attracting the extra-budgetary resources to finance the energy conservation measures;
- preparation of reports on the measures implemented to submit to Energy Efficiency Council.

Priority areas on enhancing sub-regional cooperation between the CIS countries would be:

- joint development and implementation of energy saving projects under mutually beneficial conditions;
- implementation of joint awareness rising courses to increase people knowledge in energy efficiency;
- organization of conferences and exhibitions to discuss and disseminate the latest researches on energy efficiency, to demonstrate new environmental friendly and energy saving technologies;
- development of programs to implement joint scientific-researches aimed at energy saving and efficient use of energy resources;
- development and implementation of joint educational programs to train specialists, including M.Sc. and Ph.D. students, in the field of energy efficiency
- establishment of joint ventures to manufacture energy efficient equipment, devices and construction materials;
- cooperation on the improvement of the existing legislation and regulatory framework on energy efficiency and renewable energy development, exchange of practice on the introduction of new standards;
- establishment of regional sites to demonstrate and test energy efficient technologies;
- development and implementation of projects with EU and other world countries under the support from local, regional and international donors.

7. Conclusion

Azerbaijan has significant amount of oil-gas resources. Since the signing of Contract of the Century between the SOCAR and 11 leading world companies the oil sector of Azerbaijan have experienced heavy domestic and foreign investment. Currently, Azerbaijan ranks among the world's fastest growing economies. Because of economic growth, the demand for energy in the republic is continuously increasing. Azerbaijan uses energy resources rather inefficiently, like other former soviet countries. It has serious environmental problems due to intensive development of the hydrocarbon resources, increasing amount of consumed fossil fuels and greenhouse gas emissions.

Two problems - energy saving and environment protection are current concern in Azerbaijan. Significant energy efficiency potential is concentrated in industry, agriculture, transport and construction sectors.

There are a number of institutional, legislative, financial, economic, scientific-technical, informational and market barriers to energy efficiency in Azerbaijan.

One of the key barriers hindering energy efficiency development is the lack of legislation and regulatory framework, insufficient development and application of progressive standards, regulation documents related to energy efficiency as well as insufficient control over the consumption of energy resources.

Despite the fact that majority of the laws regulating energy sector in Azerbaijan were prepared by the participation of EU Experts Group under the relevant TACIS project funded by EC by taking into consideration the appropriate energy laws of the European countries they required changes to be harmonized with the EU legislation and relevant Directives to promote sustainable utilization of energy resources. Provisions of the energy legislation of Azerbaijan concerning the issues on energy efficiency and usage of renewable energy sources have a general character and are not duly applied in practice.

In the recent years, Azerbaijan government has taken important measures to overcome the abovementioned barriers. Within the framework of the Energy Sector Reform Program (ERSP) in Azerbaijan supported by the European Union a project "Improvement of Azerbaijan's legislation relating to Renewable Energy Sources and Energy Efficiency and bringing it in conformity to the EU legislation" was implemented by the International Ecoenergy Academy.

Draft laws and standards regulating development of renewable energy sources and energy efficiency were developed. Among them there are draft laws "On Energy Saving and Increasing Energy Efficiency" and "On utilization of Renewable Energy Sources" and 21 secondary legislation documents needed to ensure the implementation of these laws.

The "City Planning and Construction Code of Azerbaijan" adopted by Azerbaijan government in September 2012, incorporate the issues of energy saving and energy efficiency at the stage of designing and constructing new facilities.

Insufficient information and education in the field of rational and efficient use of energy resources is among the barriers to energy efficiency.

Several important measures have been implemented under INOGATE programme. On 28-30 November, 2012 a training course on energy audit, and in particular collect data about the building and about the available technologies concerning energy efficiency in buildings in Azerbaijan was held in the frame of INOGATE's ESIB project.

The Norwegian ENSI project "Energy efficiency in Azerbaijan buildings; Program on capacity building and technical support" and the German project "Training in Energy Efficiency - TrEff 2012/2013; Energy management systems: ISO 50001:2011" have considerably promoted the activities of local specialists in this field.

The main task of the ENSI project is to increase personnel potentiality and skills on complex energy audit and certification of buildings in Azerbaijan and use of renewable energy sources in buildings.

Energy efficiency investments played important role in making some strides.

A thermal power plant in Azerbaijan, AzSRES, will become the first in the world to be able to sell carbon credits earned thanks to an energy efficiency modernisation project. The project was financed by the EBRD in 2006; the \$207 million loan allowed the plant to rehabilitate old and inefficient turbines and boilers, modernise command and control systems, repair chimneys and water cooling systems and make a number of other improvements.

The project, “AzSRES Energy Efficiency Improvement”, has been registered under the Kyoto Protocols' Clean Development Mechanism (CDM) by the CDM Executive Board. The project on rehabilitation of seven dual fuel, gas and heavy fuel oil units of 300 MW each is estimated to generate over 10 million carbon credits over the ten-year crediting period. These credits can now be sold on global carbon markets, including the EU's Emissions Trading Scheme.

Azerbaijan intends to expand and strengthen relationship with CIS and other countries worldwide to resolve the above stated issues.

Azerbaijan maintains cooperation with a wide range of specialized UN agencies and bodies in a very active and effective manner including UNDP, UNECE, UNEP and others that gives great opportunities for energy efficiency and environmentally sustainable energy development in the country.

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