

AZERBAIJAN

SUSTAINABLE DEVELOPMENT OF ENERGY IN AZERBAIJAN: GAPS IN ENERGY EFFICIENCY AND WAYS TO ELIMINATE THEM

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List of abbreviations

BPP	Bio power plant
CO ₂	Carbon dioxide
EU	European Union
GDP	Gross domestic product
GW	Gigawatt
HPP	Hydro power plant
H&PP	Heat-and-power plant
Km	Kilometer
kW	Kilowatt
kWh	Kilowatt hour
MMBTU	Million British Thermal Unit
MWh	Megawatt hour
OJSC	Open joint-stock company
PP	Power plant
RES	Renewable energy sources
SCADA	Supervisory Control And Data Acquisition
SHPP	Small hydro power plant
SPP	Solar power plant
USA	United States of America
US doll	United States Dollar
WPP	Wind power plant

Executive Summary

At the moment Azerbaijan's entire energy consumption needs are met with domestic production, based primarily on the use of its own oil and natural gas. Azerbaijan is a net exporter of oil and natural gas. In 2017 the total crude oil production in Azerbaijan amounted to 38.8 million toe, while natural gas touched 17 million toe. (18.2 billion m³). There are a number of promising fields in Azerbaijan that are being developed. An increase in gas production is expected due to the commissioning of the large Shah Deniz-2 gas field.

Ensuring long-term energy independence is defined as a policy objective for stimulating economic growth. However, since the country has already achieved energy independence and is a net exporter of energy, the driving force for developing renewable energy sources (RES) is apparently the possibility of increasing the volume of energy supplies to global markets.

The ideological basis for the short, medium and long-term development of the Republic of Azerbaijan is laid in the strategic road maps for the national economy and main sectors of the economy. There are 13 documents in total that were approved on December 6, 2016 by the President of the Republic of Azerbaijan.

Strategic roadmaps for the national economy and the main sectors of the economy are designed to ensure the competitiveness of the economy and to assist the social welfare of the population using a sustainable economic developmental model in Azerbaijan.

The strategic roadmap for economic prospects covers the short, medium and long-term, and consists of an economic development strategy and action plan until 2020, a long-term vision for the period until 2025, and a targeted vision for the period after 2025.

The strategic roadmap envisages that public investment will act as a catalyst, and the private sector will be the engine of economic development.

The strategic vision for the development of the national economy by 2020, in the short term focuses on the recovery of Azerbaijan's economy after the negative impact of external shocks. In the medium term the goal is to achieve diversification, applying new driving forces. And by the end of the period - to improve competitiveness through further integration into the global economy.

The strategic review up to 2020 aims to promote the development of fundamentals in building the economy for 2025 and beyond. Along with the preservation of the important role of Azerbaijan in energy security and the development of transport and logistics corridors in Europe, the progressive development of the economy will be ensured in the areas stipulated in the strategic roadmap.

The long-term forecast until 2025 sees the achievement of enhanced competitive potential through the creation of values, under conditions of mutually beneficial cooperation between all participants of the Azerbaijani economy.

The development of a favorable environment for free competition, accompanied by the support of the private sector, will lead to an increase in investment in the national economy and increased access to markets. The growth of the national economy will be ensured by taking into account the main factors in the global and regional context. The basis for development will be integration into global and regional value chains. The fundamental growth strategy for the development of Azerbaijan until 2025 will comprise of ensuring

macroeconomic stability, improving business conditions, encouraging investment by the private sector and supporting the public sector.

The review for the period after 2025 envisages the formation of a strong competitive economy based on the development of high technologies and the optimal structure of the economy, ensuring a high level of social security and achieving a high level of human development.

A strong middle class, effective integration into the world economy, national economic security and a developed infrastructure will be the basis of the strategic vision for the period after 2025. Azerbaijan will be committed to taking urgent, decisive and transforming measures that will make it sustainable and strong in line with the United Nations Sustainable Development Goals.

Introduction (State of the national energy sector)

The Republic of Azerbaijan is an energy independent country, with all its needs for basic energy resources being provided from domestic sources. The situation will remain the same in the foreseeable future, and therefore it can be stated with confidence that, in general, the energy security of the Republic of Azerbaijan regarding energy availability is fully ensured.

Currently, of all energy resources existing in the Republic of Azerbaijan, oil and oil products, natural gas and the energy of large rivers (hydroelectric power stations - HPS) have been developed the most. Energy resources such as wind, sun and other renewable energy sources, which Azerbaijan is rich in, will continue to develop, and it is expected that in the next decade there will be a sharp increase in the share of alternative and renewable energy sources in the overall balance of energy consumption due to their universal use.

Background

Azerbaijan, officially the Republic of Azerbaijan, is a country in the South Caucasus region of Eurasia at the crossroads of Eastern Europe and Western Asia. It is bounded by the Caspian Sea to the east, Russia to the north, Georgia to the northwest, Armenia to the west and Iran to the south. The exclave of Nakhchivan is bound by Armenia to the north and east, Iran to the south and west, and has an 11 km long border with Turkey in the northwest.

The population, according to estimates for March 2018, is more than 9.9 million, the territory amounts to 86,600 km². (By both these indicators Azerbaijan is the largest country in Transcaucasia). Its capital is Baku. The official language is Azerbaijani.

After the restoration of its independence in 1991, the Republic of Azerbaijan began to realize its sovereign rights in the economic field and implemented an independent policy. The main areas of this policy are the organization of the economic system based on different sectors, transition to market economy and integration into the global economy.

Azerbaijan is currently involved in the implementation of huge energy projects. Oil and gas projects are successfully implemented in the Azeri Caspian sector. Azerbaijan is a country, which plays an extremely important role in the Caspian and Caucasian regions, particularly in the development of transport infrastructure in the Caucasus and the

implementation of energy projects. It was the first country in the region to explore its huge energy potential, to form an absolutely new economic model in regional development, and to expand political and economic relations between Europe and Asia.

In the beginning of the economic recovery period, the country lacked oil-exporting infrastructure. In order to fill this gap, in 1996 Azerbaijan signed an agreement that allowed it to export oil via the Baku-Novorossiysk pipeline. In 1999 the new Baku-Supsa pipeline was put into use. Additionally, an agreement was reached on the construction of the Baku-Tbilisi-Ceyhan pipeline, which is currently the major oil-exporting pipeline.

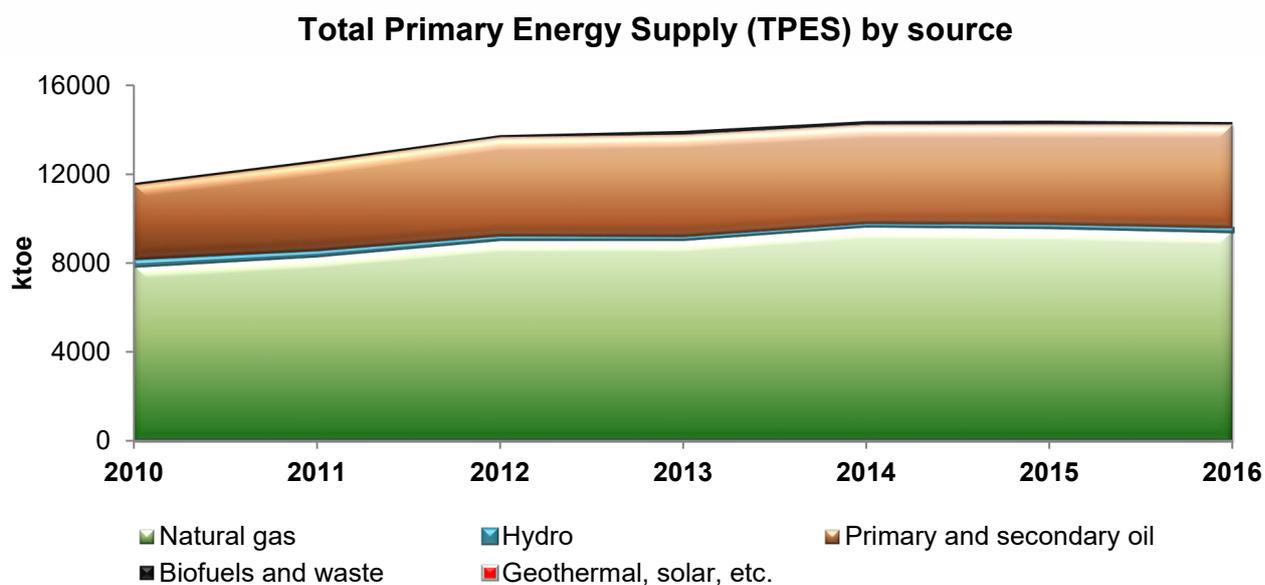
The oil and gas sector has played a dominant role in developing other sectors of the economy. A focused economic policy led to macroeconomic stability and sustainable economic growth. As a result of this, reforms were initiated in all economic fields and new measures were taken for the social welfare of the population.

Azerbaijan is a member of the United Nations (UN), Organization of Security and Cooperation in Europe (OSCE), Council of Europe (CE), Commonwealth of Independent States (CIS), GUUAM, Organization of Islamic Conference, Black Sea Economic Collaboration (BSEC), and Organization of Economic Cooperation (OEC). Azerbaijan also actively cooperates with the European Union, NATO, International Monetary Fund, European Bank for Reconstruction and Development, Islamic Development Bank, and other organizations.

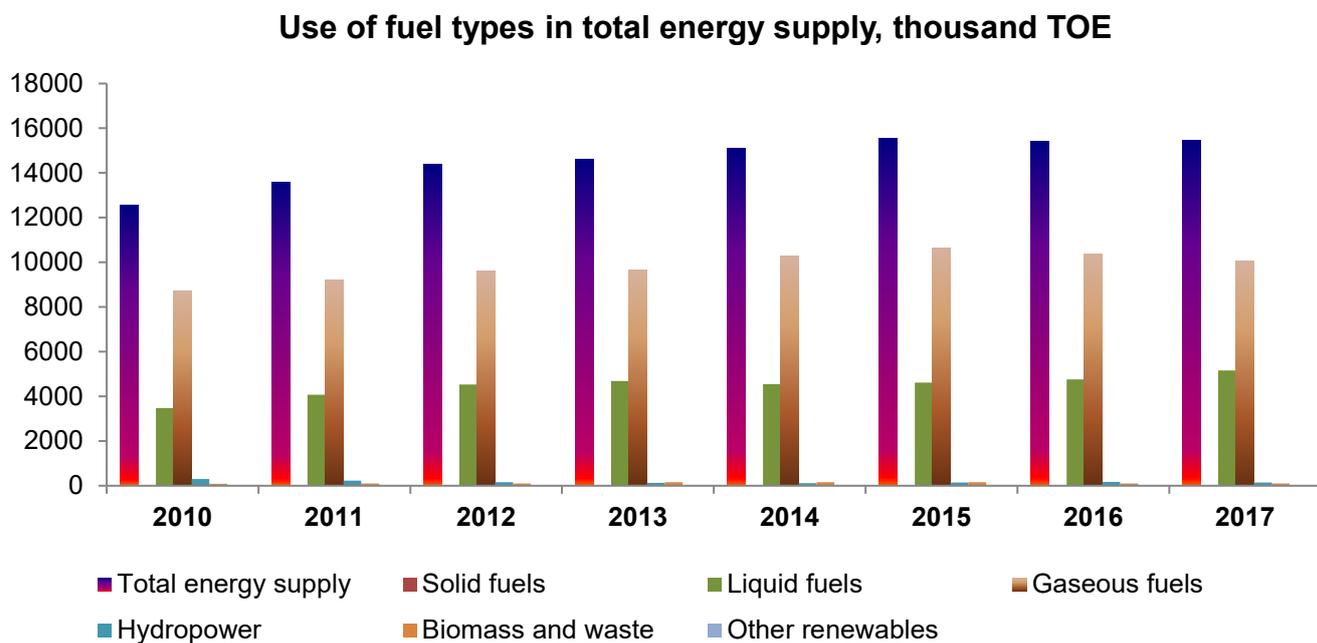
Energy Supply

Azerbaijan procures 100 percent of its gross energy consumption from domestic production, which is currently based mainly on the use of its own hydrocarbon reserves, namely oil and natural gas. The energy sector of the country does not depend on foreign energy. Azerbaijan exports oil, natural gas and electricity.

From the early 1990s to the end of 1997, the demand for primary energy decreased. The average growth rate from 1990 to 1997 was –11 percent. The demand for primary energy began to rise again only in 2001, but in the period from 2001 to 2009 the average growth rate remained low. The pace of energy resources has been changing in energy supply since 2010 and is shown in the graphics below.

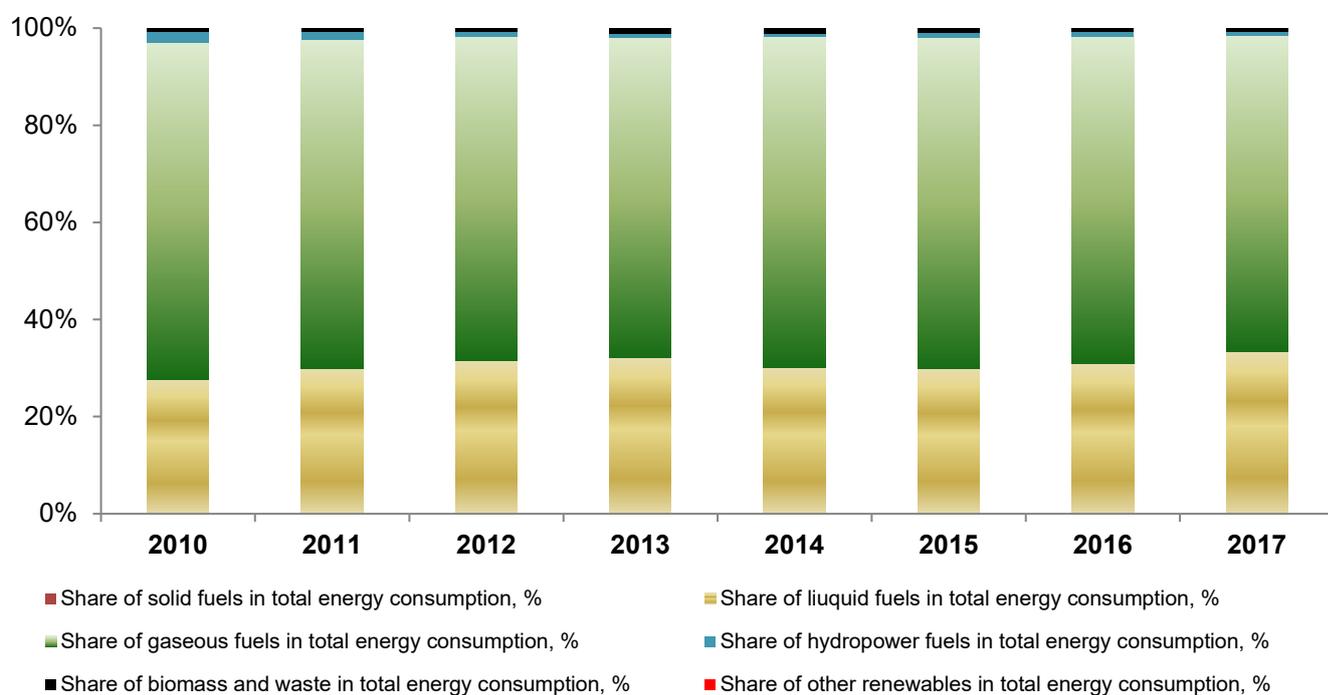


Source: IEA Statistics, 2018.



Source: Azerbaijan Statistics, 2018

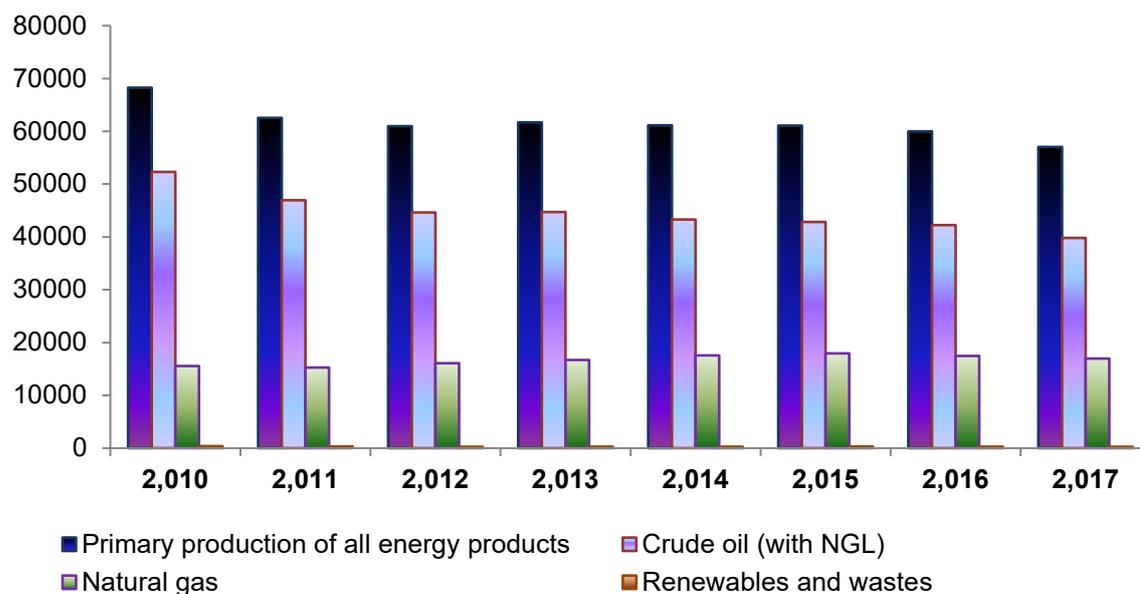
Use of fuel types in total energy supply, thousand TOE



Source: Azerbaijan Statistics, 2018

As can be seen from the figures, the main share of the resource base of energy supply is accounted for by petroleum products and natural gas- together they constitute more than 98 percent.

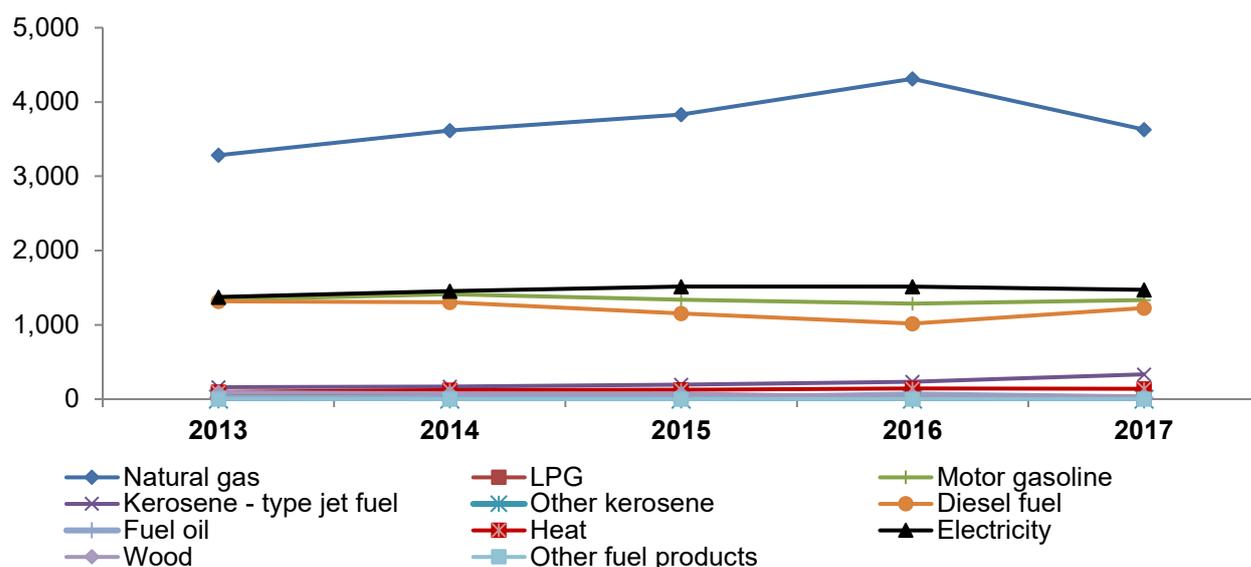
Primary production of all energy products



Source: Azerbaijan Statistics, 2018 .

Oil and natural gas are the main energy resources in the country's energy production. Their share is more than 99 percent. About 80 percent of the oil and gas produced is exported. The figures below show the final consumption of various types of energy. In the balance of final energy consumption natural gas has the biggest share (about 43-50 percent), followed by electricity - about 18 percent, motor gasoline - slightly more than 16 percent and diesel fuel - about 15 percent.

Final energy consumption, thousand TOE



Source: Azerbaijan Statistics, 2018

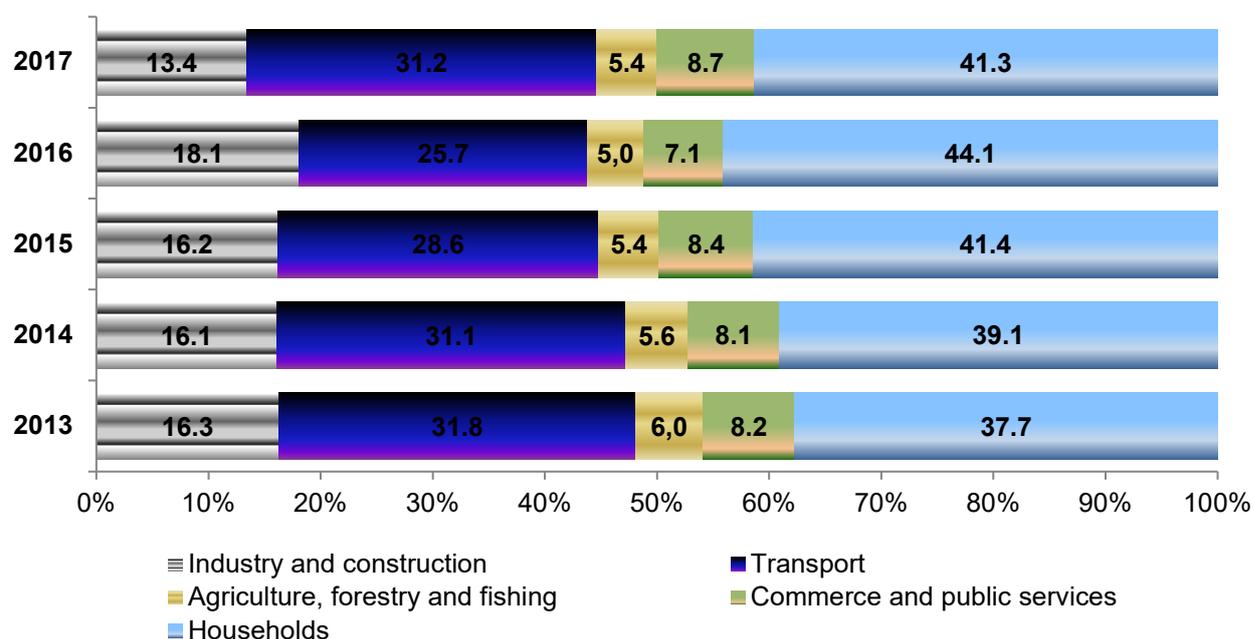
The share of the remaining 7 types of energy carriers in the balance of final energy consumption is insignificant, and in total does not exceed 4 percent.

Energy Demand

Final sector-wise energy consumption

In 2013, the share of consumption in the residential sector was 37.7 percent of the total final energy consumption, in the transport sector - 31.8 percent, in industry - 16.3 percent. Non-energy sector used 6.0 percent and consumption in the commercial sector was about 8.2 percent of the final energy consumption. The following figure shows the dynamics of the share of each sector over the past 5 years. During the period under review, consumption in the industrial sector decreased to 13.4 percent, while in the housing sector it increased significantly and became more than 41 percent.

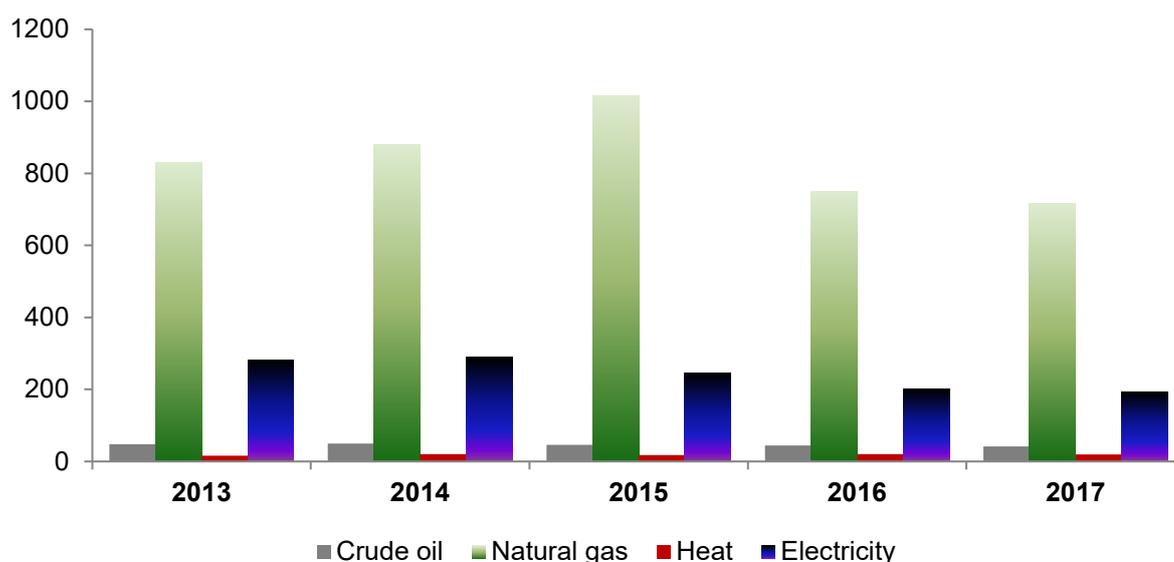
Final sector-wise energy consumption, %



Source: Azerbaijan Statistics, 2018 .

The figures below present values of energy loss over the last 5 years. It can be seen that a significant part of all losses is related to the loss of natural gas and, therefore, improving the business environment of the gas sector will lead to an appreciable increase in energy efficiency.

Losses, thousand TOE



Source: Azerbaijan Statistics, 2018

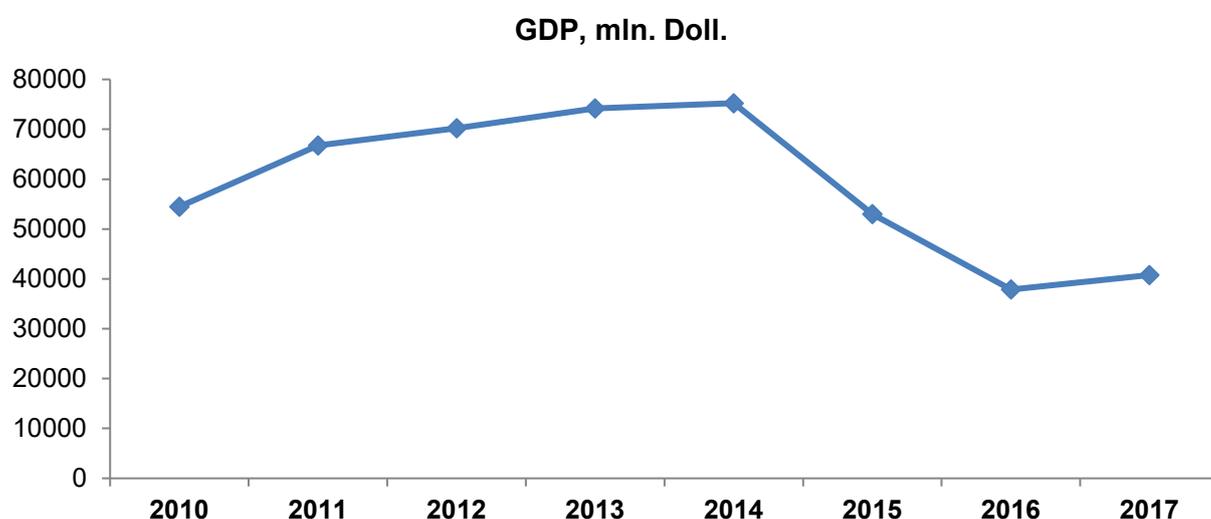
Economic conditions

Since gaining independence the economic development of the country can be divided into two main periods. During the first period, from 1991 to 1995, the economy underwent chaos. Azerbaijan faced a lot of political, military and economic problems, which were making the situation even more complicated. The second period is characterized by macroeconomic stability and dynamic development of the economy starting in 1996.

Due to the large-scale fundamental reforms undertaken in the economy since that time, the country has achieved significant results. The extraction and export of oil and gas are the main factors driving the growth of the Azerbaijani economy. The agreements on joint activities for the extraction of oil and gas, signed on September 20, 1994 with large companies representing the most developed countries of the world, stimulated the rapid development of the oil and gas sector. The production volume increased due to noticeable progress in all industries, including oil and gas, chemical and petrochemical, engineering, metalworking industries, building materials industry and construction.

Over the past few years, the Government of Azerbaijan has been working to integrate the country into the world economy, attract foreign investment, diversify the economy and reduce the impact of external shocks on economic development. The large-scale economic reforms that have been carried out in Azerbaijan over the past five years have achieved notable progress in improving regulation and promoting the diversification of the national economy, especially in sectors such as agriculture, tourism and information and communication technologies. In particular, the significant economic reforms of 2007 and 2008 gave grounds for including Azerbaijan into the World Bank's ranking of the 10 most successful countries in the field of economic reforms in the framework of the annual Ease of Doing Business report in 2009. Azerbaijan has achieved significant success in diversifying the economy and developing other sectors besides energy. .

In 2011 the share of non-oil sectors increased by almost 10 percent, while in the energy sector the growth rates did not change. In 2000–5, the average annual GDP growth rate was about 10 percent, in 2005–2007, the growth rate increased almost 3 times and reached an average of 28 percent, then decreased and in 2008–2009 it was 10 percent per year. The following figure shows the dynamics of absolute indicators and GDP growth rates for Azerbaijan in 2010-17.



Source: Azerbaijan Statistics, 2018

That change in GDP is related mainly to external conditions - the price of oil. Following the devaluation of the Azerbaijani Manat in 2015, 2016 was the worst year in economic terms in the last ten years, due to the fact that the price of oil decreased more than threefold and, accordingly, the inflow of currency from hydrocarbon exports decreased too.

With the increase in oil prices, 2017 has become a year of stabilization in the economy and since the beginning of 2018 there has been a real growth in the economy. In the first quarter Azerbaijan's economy grew by 2.3 percent, while growth in the non-oil sector was about 3 percent, industrial production increased by 2 percent, and non-oil industry - by about 10 percent. \$ 3.5 billion was invested in the country's economy during the first quarter, and a significant part of this comprises of foreign investments.

Foreign-exchange reserves increased by \$ 2.2 billion and now are equal to \$ 44.2 billion, foreign trade turnover grew by 31 percent, non-oil exports increased by 37 percent, total exports grew by 24 percent.

Market structure

Electricity

The main function of **Azerenergy joint-stock company** is to manage the production and transmission of electricity of the Republic of Azerbaijan. In addition, the joint-stock company distributes electricity in the city of Baku, its districts, and in other areas of the country, except the Nakhchivan Autonomous Republic.

Introducing new technologies, it increases power generation and the reconstruction of high-voltage power lines in the country. At the same time, it supplies electricity to foreign countries.

The Energy Supervision Authority was launched in the central office of the company. There will be departments of audit, energy sales, consumption analysis and forecast, energy supervision service, installation of meters, operation and maintenance of networks, and inspections for operation supervision.

The service for maintenance and repair of transmission lines, substations, and connecting new consumers works in the Bureau of Electricity Transmission.

Azerishig OJSC provides reliable, safe and efficient supply of electricity to consumers on the territory of the Republic of Azerbaijan. Introducing new technologies, the company ensures the modernization of the material-technical base and its rational use, and also performs other development work in this area.

The Cabinet of Ministers was entrusted with the task of transferring the authority to provide consumers with electric power to Azerishig JSC. This was previously executed by Azerenergy OJS. In addition, Azerishig JSC was tasked with taking the necessary measures to transfer property and other equipment of Azerenergy OJSC that was necessary for supplying consumers with electricity

The State Agency for Alternative and Renewable Energy Sources of Azerbaijan is a government agency under the Ministry of Industry and Energy. It acts as the main regulatory institution in the field of alternative and renewable energy sources in the Republic of Azerbaijan.

The main tasks of the agency are evaluation of sustainable potential energy, formation of appropriate policies, including tariff policies, development and enforcement of relevant procedures, such as the issuance of special permits for public and private entities for the construction of power facilities, increasing the share of energy, which is produced by alternative and renewable energy sources, in the energy balance, ensuring uninterrupted power supply to consumers, and reduction of technical and technological losses through the creation of generation sources in areas close to consumers. Efficient management of available resources is one of the priorities of reforms undertaken in the electricity sector.

Heating

Azeristeryktedzhizat OJSC executes the functions of production, transmission, distribution, sale and maintenance of thermal energy, and also provides heat supply to residential buildings and structures, educational, medical institutions and other social facilities in the city and in the regions of the republic.

Natural gas

Azerigas carries out production, processing, storage, transportation, and distribution of gas, as well as the construction, use, control, testing and certification of industrial and consumer devices.

It also handles the supply of gas over long distances through a pipeline, for the purpose of import-export and gas transit between producers, distributors, and consumers.

Azerbaijan has a large number of oil and gas fields and prospective structures in the Caspian Sea. The proven oil reserves in Azerbaijan amount to 7 billion barrels, natural gas - 2.6 trillion m³, and the estimated reserves for oil are 10 billion barrels, natural gas - 3-4 trl.m³. Among the Caspian fields, the most significant is the Azeri-Chirag-Gunashli (ACG) oil and gas field, its proven oil reserves are estimated at 1.2 billion tons, gas - 360 billion m³.

Another large field, gas condensate, is the Shah Deniz. Its reserves are estimated at 1.2 trillion. m³. According to forecasts in the second stage of this field, gas production can be increased to 24 billion m³ per year. Another 600 billion m³ of gas - in fields such as Absheron, Umid, Ashrafi, and Karabakh. In addition to the abovementioned fields, there are five more promising structures with a total stock of 2.2 trillion m³ of gas (Babek - 400 billion m³, Nakhchivan - 300 billion m³, Zafer-Mashal - 300 billion m³, Araz-Alov-Sharg - 700 billion m³ and Shafag-Asiman - 500 billion m³).

The development of oil and gas fields in the Caspian Sea became possible after the signing in 1994 of the "Contract of the Century" and the subsequent inflow of large investments. The project participants comprised of 13 companies, including BP (35.8 percent), SOCAR (11.6 percent), Chevron (11 percent), Statoil (8.6 percent), and others. After signing the "Contract of the Century" 26 agreements were signed with 41 oil companies from 19 countries.

Since 1997, within 20 years, 460 million tons of oil and 140 billion m³ of gas have been extracted from the ACG.

For the implementation of large oil and gas projects, the following pipelines were built or reconstructed:

Baku-Tbilisi-Ceyhan (oil - to the Mediterranean Sea), Baku-Supsa (oil - to the Black Sea), Baku-Erzurum (gas pipeline), Baku-Novorossiysk (oil).

In 2018, the construction of three important components of the Southern Gas Corridor was completed:

Shah Deniz-2, South Caucasus gas pipeline (through Georgia) and TANAR (gas transportation to Turkey).

By 2020, the construction of the 878 km TAP gas pipeline will be completed, as a continuation of the TANAR gas pipeline to Europe (Greece - 550 km, Albania - 215 km, Italy - 8 km).

By 2020, the length of the gas pipeline to Europe will be 3,500 km.

The cost of TANAR is \$ 7.9 billion, throughput is 16 billion m³ (to Turkey - 6 billion m³), (to Europe - 10 billion m³).

Oil

The State Oil Company of the Republic of Azerbaijan (SOCAR) is involved in a wide range of activities in the territory of the Republic of Azerbaijan. This includes the exploration of onshore and offshore oil fields, preparation, use, and transportation of oil, gas, condensate and their byproducts, processing, sales, providing for the stable demand of consumers for relevant energy, and ensuring the receipt of adequate compensation for their services.

The company carries out the following main activities, as defined by law:

- Drafting and preparation of long-term programs for the development of the industry, and targeted comprehensive scientific, technical, economic and social programs.
- Increasing production efficiency, implementing a policy of saving energy and material reserves, and creating profitable production-technological and economic ties between enterprises in the industry.
- Ensuring regular interaction between the Company and the relevant state authorities in determining the development prospects of the industry.
- Development of the industrial and social base of the industry, modernization of the enterprises included in the company, their expansion, reconstruction, and investment activity in providing them with the latest equipment and technology in a form defined by law.
- Conducting exploration works using modern construction technology and technical means, increasing the efficiency of field exploitation, accelerating the construction of oil and gas wells, as well as using the subsoil of the earth, improving the quality and accelerating the preparation of fields for exploitation, and observing the current legislation on environmental protection.
- Improvement of economic methods and forms, and the introduction of the latest scientific achievements into production.
- Attracting adequate finance from banks, including foreign banks and other sources for the implementation of economic and production-technical programs.

- Implementation of a human resources policy and training and development of personnel in the republic and abroad.
- Creation of favorable conditions for the social development of enterprises by ensuring they are adequately funded.
- Interrelated activity with government agencies, foreign companies and entrepreneurs.
- Enabling and facilitating geophysical and geological exploration, and arranging relevant approvals.
- Making decisions for new fields to be developed, development and approval of pilot operations of fields by enterprises, and technological schemes, and projects to develop oil, gas and gas condensate fields.
- Approval of the annual work programs for oil and gas companies, and, their annual budgetary funds.
- Organization of transportation of extracted crude oil and natural gas, ensuring payments to the transporting enterprises for the service.
- Organization of the processing of crude oil and natural gas and ensuring payment to service providers.
- Organization of the sales of crude oil, natural gas and petroleum products, and payment of supply costs in a systematic manner.
- Taking the necessary measures for land reclamation and environmental protection,
- Establishment of foreign economic relations in accordance with the procedure established by law.

SOCAR Azerbaijan has a 10 percent stake in the consortium to develop the Shah Deniz gas and condensate field. SOCAR also has a 25 percent stake in the Baku-Tbilisi-Ceyhan pipeline and 10 percent stake in the Azeri-Chirag-Guneshli oil project. Currently, SOCAR is actively expanding the development of markets in other countries.

Institutional framework

The Ministry of Energy of Azerbaijan is responsible for regulation of activities in the mining and energy industries of the Republic of Azerbaijan.

The Ministry regulates the activities of the industrial and energy sectors. The State Oil Company of Azerbaijan (SOCAR), Azerkimya State Company, Azerigaz, Azerenerji OJSC, Azneftkimyamash JSC are owned by the ministry. The main functions of the Ministry include identifying promising niches to draft state and regional programs and ensuring their implementation, forecasting the production of various energy sources, participation in international cooperation agreements in the energy sector, monitoring energy supply activities for all industrial sectors in accordance with norms and laws, creating favorable conditions for external and domestic investment in this sector issuing licenses, ensuring sufficient energy in the domestic market, research and development in the field of energy, the application of international standards and experiences within the country, the preparation of measures aimed to reduce potential losses in the process of production, transportation, distribution and use of energy resources, preparation of energy security programs for the Republic of Azerbaijan, and preparation of energy efficiency programs.

The Ministry of Energy of the Republic of Azerbaijan has agreements and cooperates with the European Energy Charter, the Black Sea Economic Cooperation Organization, the CIS Executive Committee, the Energy Council, the Economic Cooperation Organization, the US Agency for International Development, the European Commission of the European Union (INOGATE, TACIS, TRACECA), the United Nations Economic Commission for Europe (UNECE), the International Atomic Energy Agency, Coordinating Council for the Development of the and in the framework of GUAM, the World Trade Organization, the Working Group on cooperation with NATO, the International Monetary Fund, the World Bank, the European Bank for Reconstruction and Development, The German Development Bank (The KfW), the Islamic Development Bank, the Asian Development Bank, and the Japan Bank for International Cooperation.

The main purpose of creating the **Energy Regulatory Agency** under the Ministry of Energy of Azerbaijan is to bring the quality of public services in line with the requirements of a market economy, and ensure the further development of the industry, transparency and flexibility of the energy supply system, and the availability of these services for entrepreneurs.

The agency was established under the State Energy Control Directorate and the State Gas Control Directorate of the Ministry of Energy. Its main goal is to align the provision of utilities with market rules, as well as to improve control mechanisms, and thereby achieve sustainable development in this area. In addition, the Agency was created to ensure transparency and efficiency in the supply of energy resources, as well as make this process was more accessible to entrepreneurs.

The Azerbaijan Energy Regulatory Agency (AERA) is a member of The Energy Regulators Regional Association (ERRA).

Energy policy framework

The Government of Azerbaijan adopted the State Program for the Development of the Fuel and Energy Sector for 2005-2015, which defined development goals for various segments of the energy sector, as well as a package of special measures aimed at achieving these goals within 10 years. The overall aim of the State Program was to ensure the complete meeting of the demand of the population and the economy for electricity, gas and other energy sources through the continuous development of the fuel and energy complex - and this goal was achieved in time.

The specific objectives of the State Program such as

- Defining developmental priorities for the fuel and energy sector of Azerbaijan in accordance with best practices and modern international standards.
- Implementation of relevant scientific and institutional measures aimed at improving the operational efficiency of various sectors of the fuel and energy sector.
- Ensuring the implementation of appropriate technical measures in order to increase the level of production, processing, transportation, storage, accounting and consumption of energy resources.
- Promoting the integration of environmental protection measures in the development of the fuel and energy sector.
- Increasing investment in the development of the fuel and energy sector.

- Ensuring environmental safety of the fuel and energy sector.
- Ensuring improved collection of payments for fuel and energy (electricity and natural gas). In the following years, in order to develop the country's fuel and energy sector further, when it comes to oil and gas production, the following measures are envisaged:
 - Search and exploration of new fields.
 - Start of full-scale development of discovered fields.
 - Drilling new wells and reconstructing inactive wells at active fields.
 - Introduction of new equipment and technologies at active fields to increase oil recovery ratio.
 - Construction, reconstruction and modernization of systems for the extraction, transportation and processing of oil and gas, as well as the widespread use of science and innovation technologies and best practices

were fulfilled or partly fulfilled. The only fundamental task of the state program - the introduction of full-fledged involvement of market forces in the energy sector, has not been fulfilled. To solve this and other pressing problems of the energy sector and the economy as a whole, the President of the Republic of Azerbaijan signed 13 documents of strategic roadmaps for the national economy and major sectors of the economy.

Legislative Basis

The Parliament passed the following laws regulating activities in the energy sector:

- The Law “On Energy” (Baku, November 24, 1998, No. 541-IQ);
- Law “On Electric Power Industry” (Baku, June 13, 1998, No. 723);
- The Law “On Subsoil” (Baku, February 13, 1998, No. 439-IG);
- Law “On the use of energy resources” (Baku, May 30, 1996);
- Law “On electric and heating stations” (Baku, December 28, 1999, No. 84-IG);
- Law “On Gas Supply” (Baku, June 30, 1998, No. 513-IG);
- The Law “On Environmental Safety” (Baku, August 4, 1999, No. 172);
- Law “On Environmental Protection” (Baku, August 4, 1999, No. 173).

The Law “On the Use of Energy Resources”, adopted on May 30, 1996, defines the legal, economic and social foundations of state policy in the use of energy resources, as well as the general measures in policy implementation.

The Law “On Energy” ensures the regulation of the exploration, development, production, processing, storage, transportation, distribution, and use of all “energy materials and products”, including gas. In fact, the Law “On Energy” is a “framework” law in the sector of energy regulation. Any person planning to carry out energy activities prior to the commencement of such activities must obtain special permission from the Ministry of Industry and Energy on the basis of an energy contract or by submitting an application to this ministry.

The legal basis for regulating relations in the oil and gas sector in Azerbaijan was created by adopting the Law "On Subsoil". The Law "On Subsoil" regulates the issues of exploration, use, protection, safety and control in the field of the use of mineral resources, including oil reserves, located in Azerbaijan and the Azerbaijani sector on the shelf of the Caspian Sea. In accordance with the Law "On Subsoil," no natural or legal person may carry out activities in the sector of exploration and production of oil or gas without a license.

The Law on "Gas Supply" regulates the production, processing, transportation, storage, distribution, sale and use of all types of gas (including natural gas). In Azerbaijan, there is no network code and no access for third parties to pipeline networks. Access to the networks is controlled by Azerigaz.

The main legislative acts regulating the electric power sector include the Law "On the Use of Energy Resources", the Law "On Electric Power Industry" and the Law "On Electricity and Heating Plants". Under the Law "On Electric Power Industry", natural persons or legal persons are required to obtain a special permit to conduct activities in the field of production, transportation and distribution of electricity, unless otherwise specified by law.

Political and legislative basis

The Strategic Road Map on the development of the municipal sector in Azerbaijan has developed measures to improve the energy efficiency of the Azerbaijani economy, in particular the electricity, gas and heat supply sectors. There are plans to improve regulatory laws and other documents related to the above-mentioned sectors of the economy. The implementation of the following targets to improve the efficiency of the above sectors is envisaged:

- Reduction of electric power losses in the networks of Baku city from 8.5 percent from to 7 percent, and in the regions from 12 percent to 8 percent (the goal is to approach the level of similar indicators of European countries).
- Reduction of technical losses in gas distribution up to 8 percent (currently, losses in the gas distribution system are exorbitantly high - 18.6 percent). An investment of 1.515 billion manat will be required to achieve this goal.
- Increasing the production of heat energy to 1767 thousand Gcal per year,
- By 2020, building new generating capacities in the total volume of 1,900 MW (these generating capacities are for heating and hydroelectric power plants) 1.95 billion manat in investments are envisaged for this purpose.
- By 2020, building and connecting to the power grids 420 MW of generating capacities based on renewable energy sources.
- Decreasing expenses for own needs at thermal power plants up to 2 percent (currently this figure is 3.6 percent),
- Increasing the efficiency of combined-cycle power plants to 50 percent against the current 47 percent. 1.075 billion manat in investments will be required for the implementation of the last three targets.
- Elimination of subsidies in electricity sales,
- Use of differentiated tariffs for electricity for different times of the day.

- Monitoring to assess the efficiency of the use of energy resources in the supply of heating to residential and non-residential complexes in Azerbaijan and to develop measures to prevent the inefficient use of energy resources.
- Increasing the efficiency of using fuel (natural gas) for the production of thermal energy.
- Implementation of stimulating measures for the introduction of technologies to improve energy conservation and energy efficiency in the heat supply system.
- Taking measures to reduce and eliminate heat energy losses in the heating supply system of residential and non-residential buildings,
- Analysis of the possibility of using heat meters and suggesting options for their use.

As a result of the implementation of measures envisaged in the strategic roadmap only in the field of public services by 2020, GDP growth will amount to 832 million manat, at the same time it is predicted that 6,645 new jobs will be created. For the implementation of the planned activities funds from public and private sources totaling 8.15 billion manat will be used.

The strategic roadmap for the development of the municipal sector of Azerbaijan provides for the implementation of a number of important activities including:

- Increasing the National Generation Portfolio.
- Diversification of the National Generation Portfolio.
- The consideration of increasing electricity exports to neighboring countries, if feasible.
- Increasing the efficiency of power plants and the effective use of existing capacity.
- Reducing energy losses and increasing the quality of transmission and distribution of electric energy.
- Using optimal mechanisms to improve energy efficiency.
- Reducing all types of natural gas losses associated with its distribution.
- Expanding the optimal heating system in the country.

By order of the President of Azerbaijan dated June 8, 2005, OJSC Azeristilktedzhizat was established which was engaged in heat supply from 2005 to 2016. 166 heat sources in Baku and in regions of the Republic were created by Azeristilktedzhizat, 108 boiler houses were reconstructed, 271 gasification projects were completed, heating systems were restored in 1828 residential buildings and 350 educational and medical buildings. As a result of the work performed, the efficiency of heat supply has been significantly improved. Compared to 2011, the production of heat increased by 1.9 times in 2016 and amounted to 1235 thousand Qkal, the loss of heat energy decreased by 4.5 percent, the gas consumption for the production of 1 Qkal of heat energy decreased by 5.9 m³ / Qkal, and thus conditionally saved 7.4 million m³ of natural gas.

In order to increase energy efficiency in the electricity sector, market relations will be introduced and all areas of activity will be separated in accordance with electricity production management, transmission, distribution, and electricity sales. There are plans to open the wholesale electricity market for foreign investment, which will increase the competitiveness and efficiency of the sector.

In the Republic of Azerbaijan, for industry and some groups of the population, it is envisaged to expand the production and operation of electrical panels (alongside with solar panels installed on the roofs of houses, to build small thermal and electrical power plants, and small wind turbines). Universal use of solar panels is planned. There are also plans to replace the use of natural gas with electrical energy in order to improve production efficiency. To increase the efficiency of electricity production, two ways of development are envisaged:

- Complete modernization of existing thermal power plants and hydropower plants.
- The use of modern power generation plants with the highest rates of efficiency.

To increase efficiency in the transmission of electricity there are two ways:

- Reduction of electricity losses in the transmission and distribution of electricity to the level of European countries.
- Using the experience of advanced countries to eliminate weaknesses in the energy sector.

In the area of electricity retail there are two goals:

- Achieving the level of energy efficiency equal to European countries in industry and commerce - the government is expected to stimulate various energy efficiency methodologies (for example, to promote energy efficient buildings and goods);
- Building infrastructure for cars that use electricity to replace fuel.

Energy market liberalization

In accordance with the State Privatization Program, the President of Azerbaijan, on the proposal of the State Committee for Property Affairs, makes decisions on allowing foreign investors to participate in the privatization of facilities and enterprises in the energy sector. However, till now there has been no noticeable activity in this area, with the exception of the privatization of two small hydropower plants. Meetings with government officials and companies confirmed the absence of short-term plans for privatization and the separation of state-owned companies in the oil, natural gas and electricity sectors.

Competition is limited due to existing monopolies in the natural gas and electricity sectors. The electricity market of Azerbaijan is not yet open and there are no official deadlines for its opening. The legislation does not consider the separation of activities for the transmission and distribution of electricity from its production, nor the creation of separate operators for transmission and distribution of electricity. Separation at the accounting level, functional or management level is not carried out and is not considered by law. Nevertheless, a partial separation was carried out: some mini power plants were privatized and one independent regional distribution company was created. The principles of non-discriminatory access to network infrastructure are established by law, but in practice this is not implemented due to the current market structure.

All organizations in the natural gas sector are still state-owned, and there are no plans to change this in the near future. The President of Azerbaijan issued Decree No. 310 “On improving the rules for issuing special permits (licenses) for certain types of activities in Azerbaijan” dated March 28, 2000, which was subsequently amended. In accordance with the decree, only state-owned enterprises or joint-stock companies, whose controlling stake

is owned by the state, can carry out oil production and refining. In accordance with the Law “On Subsoil,” the right to conduct exploration and production activities can be issued in accordance with a special permit (license) to citizens and organizations of Azerbaijan, as well as foreign citizens and legal entities. Consumers cannot buy natural gas directly from producers, for example, from AIOC. Azerenergy purchases natural gas for power plants from SOCAR in accordance with the agreement. There is no access for third parties to the networks. Access to the networks is controlled by Azerigaz.

After the signing of the “Memorandum on strategic cooperation between Azerbaijan and the European Union in the energy sector” on November 7, 2006, this industry started to move closer to international standards. The Memorandum envisages the rapprochement and compliance of the legislative base of Azerbaijan with the European Parliament Directives and the European Union Regulation in the energy sector. For this purpose the Ministry of Industry and Energy conducted twinning programs together with the Federal Ministry of Technology and Economics of Germany.

The reform in the energy sector, included in the strategic roadmaps, envisages the creation of a market based on the experience of European countries, when the reforms improve the efficiency, level and quality of service.

Analysis of best practices in sustainable energy in Azerbaijan

Energy efficiency

The level of efficiency is influenced both by the costs of extraction of the energy carrier and losses during its transportation. In different countries, the cost of oil production varies, for example, in Kuwait it is \$ 8.5 per barrel of oil, in Saudi Arabia - \$ 9.9, in Iran - \$ 12.6, in Russia - \$ 17.2, in Azerbaijan on ACG (the Azeri field Chirag-Guneshli ") - \$ 15. SOCAR puts its cost at \$ 25 per barrel of oil. The relatively high costs of oil production in Azerbaijan are mainly related to the conditions of production (deep-water areas of the Caspian Sea).

Global experience shows that building the economy on the principles of energy efficiency and energy saving, the widespread use of modern technical means, norms and standards in this area are important means of solving the country's socio-economic, environmental and energy problems.

In Europe, the main document on energy efficiency problems is the Strategy 2020, which envisages the transition to an economy with sustainable and comprehensive development and efficient use of energy resources.

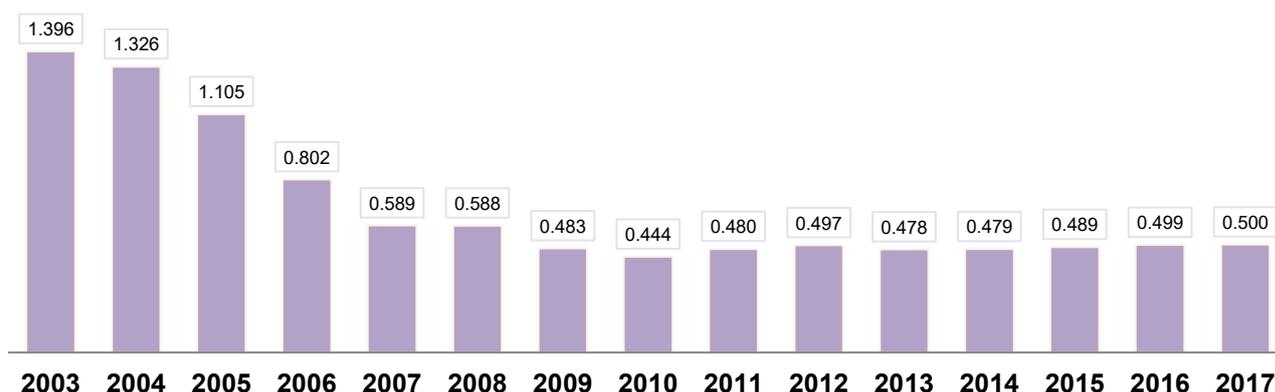
On May 30, 1996, the Republic of Azerbaijan adopted a law on the efficient use of energy resources, where the main areas for energy saving and energy efficiency are as follows:

- The increase in the efficiency of traditional sources of electricity generation (according to Azerenergy OJSC for 2015, the average efficiency was 40 percent or for each kWh of electricity the consumption of standard fuel was 292.2 grams, compared to 2014 this figure decreased by 1.6 grams according to the state program, the target value of this indicator is 260 g / kWh).
- Reduction of electricity losses for transmission and distribution of electricity (over the past 15 years, this figure has decreased from 40 percent to 12 percent).
- Utilization of secondary heat and power resources.
- increase energy efficiency in industry, construction, agriculture and government agencies.
- Reduction of energy consumption in the domestic sector.
- The intensification of the creation of new energy-efficient technologies, equipment and materials.
- Increased producers interest in energy efficiency.
- Stimulation of energy saving and efficient use of energy resources.
- The use of advanced international experience in the field of energy conservation and energy efficiency practices.
- Monitoring of the complex of performed activities.

Studies show that the cost of saving a unit of an energy resource is on average 2-3 times cheaper than the cost of its production. To assess the effective use of energy

resources by the International Energy Agency and other institutions, an indicator of the energy intensity of a country's GDP is used. In other words, this is the amount of energy consumed to produce \$ 1000 of GDP. The dynamics of changes in the energy intensity of Azerbaijan's GDP is shown in the figure below.

Dynamics of energy intensity of GDP, TOE/ ths \$, PPP 2005



Source: Azerbaijan Statistics, 2018

The energy intensity of Azerbaijan's GDP over the past 15 years shows a tendency to decrease and today it is 500 kg of oil equivalent per \$ 1000 of GDP. This indicator is almost 3.7 times higher than the world average of 156 kg AD per \$ 1000 and 6 times higher than the average value of EU countries. According to this indicator, Azerbaijan ranks 120th among 180 countries of the world.

The energy efficiency of the structure consists of 2 components (technological component - measured by the energy for the production of goods and the structural component - the production of which product prevails). The experience of advanced countries shows that with a change in the technological component, energy efficiency can be improved by 20-30 percent, and by improving the structure of production of goods, energy efficiency can be achieved several times. Energy saving is mainly achieved by reducing losses at all stages of energy transformation (from production to consumption) and by increasing the share of alternative and renewable energy sources in the energy balance.

The share of renewable energy in the production of electricity on average worldwide in 2014 was 30 percent, and for the CIS countries 17.2 percent. In Azerbaijan, this figure, depending on the operating modes of large hydropower plants, varies within 6 percent (2014) and 18 percent (2010).

The transport sector has a significant share in the country's energy consumption. The main share in the energy consumption of transport accounted for automobile gasoline. Number of cars in Azerbaijan is increased from 400,000 in 1990 to 1.29 million in 2014, 60-65 percent of them are concentrated in Baku. About 60 percent of the cars in Azerbaijan are manufactured in the CIS countries. These cars consume 30-40 percent more fuel than European-made cars. In 2014, the Cabinet of Ministers of Azerbaijan adopted a resolution

on the mandatory compliance of imported cars with the environmental requirements of Euro-4. Dynamics of consumption of gasoline is shown in the table.

Year	2007	2008	2009	2010	2011	2012	2013	2014
Petroleum use	768	931	968	1018	1034	1229	1285	1357

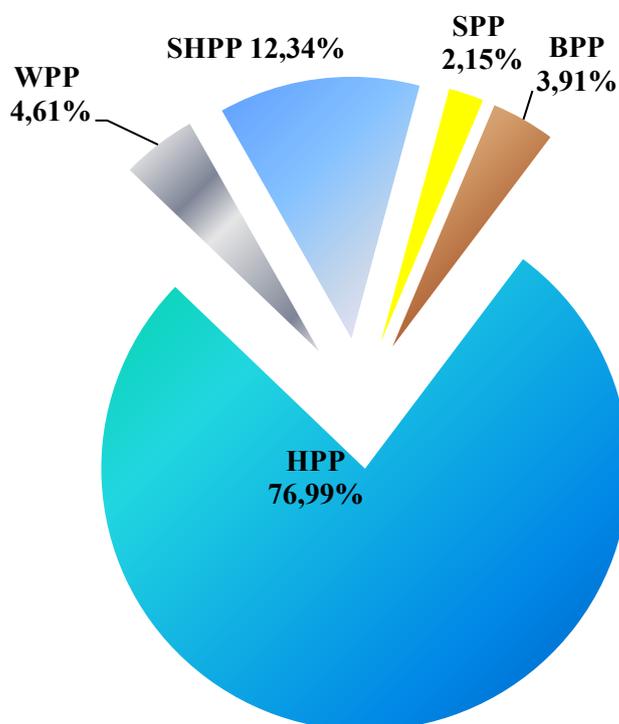
Source: Azerbaijan Statistics, 2018

As another parameter of energy efficiency, indicator of the level of technological development is used - it is an integral parameter of energy efficiency and is defined as the ratio of final electricity consumption to total final energy consumption. Despite some increase in this parameter - 8.33 in 2010 against 5.25 in 1990, it is still noticeably less than in such neighboring countries as Georgia (13.55), Ukraine (10.08), and Kazakhstan (10.99), Russia (10.2). Azerbaijan ranks 143 among 180 countries of the world on this indicator, the average global value of this indicator is 12.36.

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Renewable energy

There is a huge potential for renewable energy in Azerbaijan and there is a political will to use it everywhere. The use of renewable energy sources leads to an increase in the level of security of electricity supply, a reduction in the total costs of electricity generation, saving natural resources, creating new jobs and has a positive effect on environmental protection. Currently, technologies based on such renewable energy sources as water, wind, and solar energy have found the greatest application in Azerbaijan. The use of renewable energy sources is low compared to their potential (if you do not take into account large hydropower plants), therefore, in order to diversify the production of electricity, widespread use of renewable energy sources is planned, especially the use of large potentials of wind and solar energy.

The share of generated energy from renewable energy sources by resources (2014)

Source: The State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan, 2015

Electricity production in the Republic of Azerbaijan is mainly carried out on two types of sources. Currently, 94 percent of electricity is produced using natural gas, the remaining 6 percent is produced at hydroelectric power stations and other power plants. At the same time, 55 percent of electrical energy is produced at three thermal power plants using natural gas. If one of these three power plants is under repair (or is shut down), there may be serious risks in the power supply. From this point of view, the diversification of sources of production of electric energy is an important task and its solution will minimize the risks of power supply.

In addition, using less costly energy sources (including sources based on renewable energy) will lead to a decrease in the average cost of electricity production. Despite the fact that the cost of gas for each MW · hour of electricity is in the range of \$ 30 - \$ 40 and this makes the use of natural gas one of the most cost-effective options for generating electricity, even today the costs of generating electricity based on wind and solar energy can compete with it. Continuous improvement of technology reduces production costs of electricity based on wind and sun. For example, the prices of electrical energy from the sun in April 2016 in various parts of the world were \$ 29.9 per MW. If we take into account the fact that in the country electricity is produced from two types of sources, then the use of wind and solar energy for the electricity production can help to reduce the average cost of electricity production.

The State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan was established by the Decree of the President of Azerbaijan dated February 1, 2013, to improve the management system in the field of alternative and renewable energy.

The State Agency has drafted a strategy for alternative and renewable energy resources until 2020. The Azerbaijan 2020: Vision of the Future development concept includes provisions on the alternative and renewable energy sector. On December 29, 2011 the head of state signed a resolution on the preparation of a State Strategy on the Use of Alternative and Renewable Energy in the Republic of Azerbaijan for the period 2012 to 2020.

Azerbaijan currently hopes to triple its renewable energy capacity from 830 MW this year to 2500 MW by 2020. The program specifically calls to increase wind energy capacity from 240 MW to 800 MW and solar photovoltaics will increase from 290 MW to 600 MW all by 2020. Given the added potential of solar thermal systems, solar energy is the most promising form of alternative energy, as experts expect it will provide country with 950 MW of capacity by 2020.

In other segments, biogas will grow from 25 MW to 125 MW, geothermal from 15 MW to 150 MW, and small hydropower from 80 MW to 150 MW, all following the same timeline. The total investments for these projects will be about \$2.5–3.5 billion.

Azerbaijan has remarkable renewable energy resources. It has the potential for wind power, which blows more than 250 days per year and may generate over 2.4 billion kWh of electricity annually, and it offers 2400–3200 hours of sunshine per year. Azerbaijan therefore has promising potential for solar electricity and heat generation, however, hydro power is currently its most developed renewable energy source.

Types of energy	Power (MW)
Solar energy	>5000
Wind energy	>4500
Bio energy	>1500
Geothermal	>800
Small hydroelectric power plants	>350

Source: The State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan, 2015

Solar energy

A solar panel is one of the most favorable sources in the world, and it is especially promising for sunny areas. The natural climate of Azerbaijan provides extensive opportunities to increase the production of electricity and thermal energy by utilizing solar energy. Since the amount of sunny hours is 2400–3200 hours in Azerbaijan during the year, this means that the amount of solar rays falling on the territory of Azerbaijan is superior when compared to other countries and this can be estimated as one of the efficiency criteria for attracting investments in the use of solar energy. The development of utilization of solar energy can partly solve energy problems in several regions of Azerbaijan.

Wind energy

Azerbaijan is one of those countries where windmills could be a perfect fit due to its geographical location. In particular, the Absheron peninsula, coastline of the Caspian Sea and islands in the northwestern part of the Caspian Sea, the Ganja-Dashkesan zone in the west of Azerbaijan and the Sharur-Julfa area of the Nakhchivan Autonomous Republic are favorable areas. In 1999, Japan's Tomen Company, together with the Azerbaijan Scientific Research Institute of Power Engineering and Energy, installed two towers of 30 and 40 meters in Absheron. The average annual wind speed was determined to be 7.9-8.1 m/sec. A feasibility study about the installation of windmills with a total capacity of 30 MW has been prepared in Qobustan region.

Water Energy

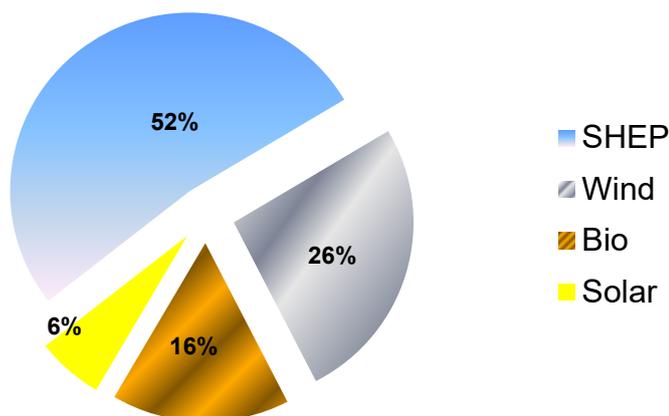
From the ecological point of view, water is the purest energy in the world. The production of electricity from this source is being increased since 1990. The specific share of production power of hydroelectric power plants is currently 17.8 percent in the total energy system of the Republic. There are wide opportunities for mastering hydropower resources that have not been used so far in the country. As a result of the construction of hydroelectric power plants, floodwater is regulated, electricity is ecologically produced, and new irrigation systems are created. The rivers in the territory of Azerbaijan are favorable for small hydropower stations.

Biomass energy

Biomass is also an alternative source of energy. There are several sources of biomass in Azerbaijan: industrial waste, wastes from forestry and wood processing, agricultural crops and organic compounding wastes, wastes of household and communal areas, wastes from areas polluted by oil and oil products.

According to research, most waste is composed of biomass products in all sectors of the economy. It is possible to obtain gas, liquid and solid biomass, which are used in electricity generation from those biomass substances. Thus, more than 2.0 million tons of solid and industrial wastes were thrown to neutralization zones every year in Azerbaijan. Solid and industrial waste processing can partially eliminate the difficulties of warming up of public buildings in Baku and major industrial cities of the country.

The underground temperature is widely used in many countries in industry, agriculture, household and communal fields and in medicine. The territory of Azerbaijan is rich in thermal waters. They cover large areas such as the Greater and Lesser Caucasus Mountains, the Absheron peninsula, the Talysh mountain-slope zone, the Kura basin and territories around the Caspian Sea and Guba region. It is possible to cover part of thermal energy needs in household and other areas by utilizing thermal waters in the mentioned areas.

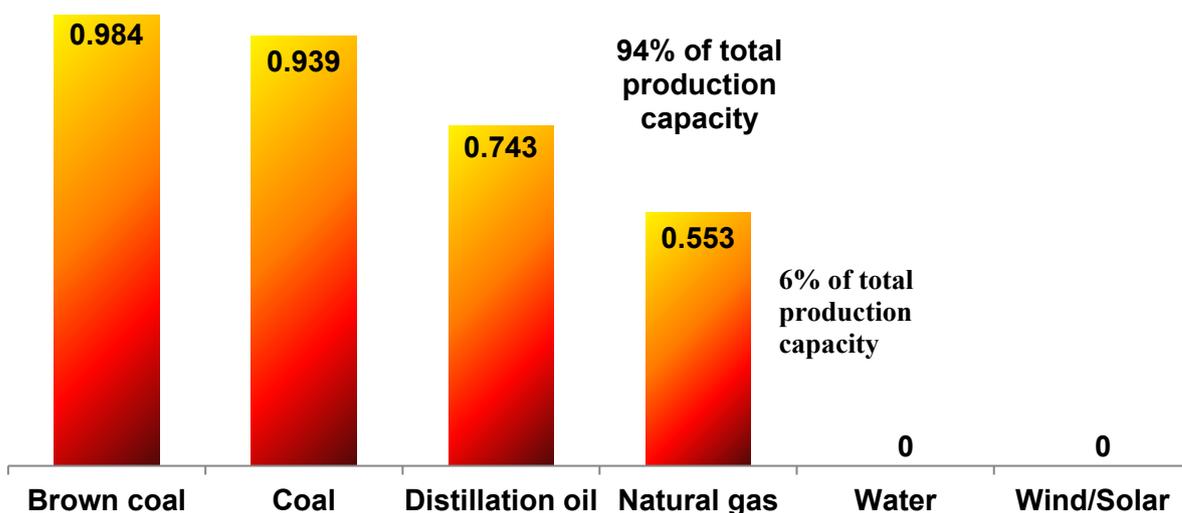


Source: The State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan, 2015

GHG emissions and climate policy

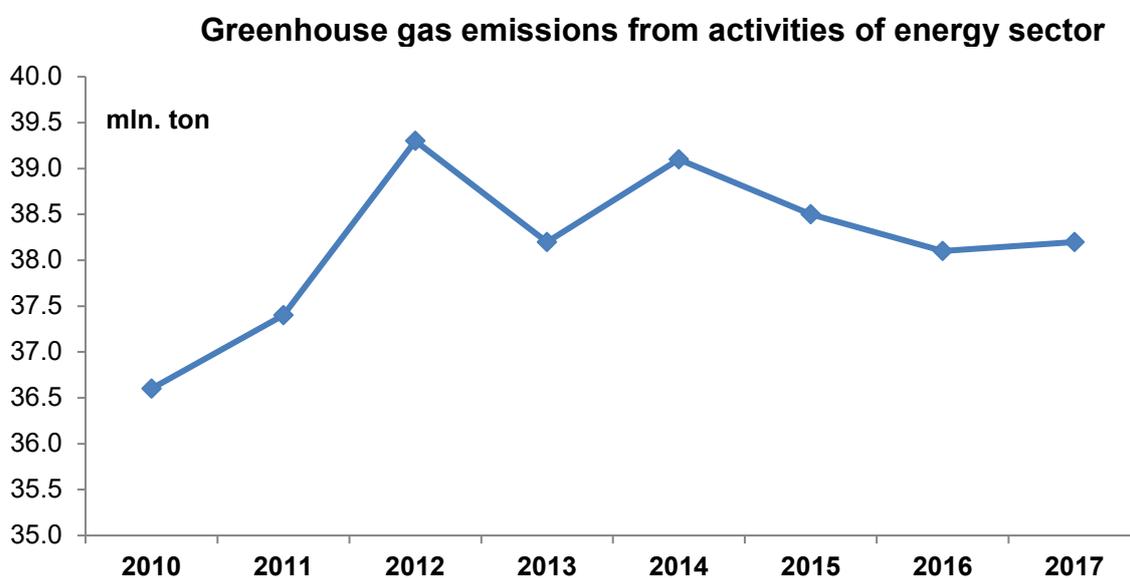
Increasing the use of renewable energy has a positive effect on the ecosystem. Compared with natural gas and water sources when using wind and solar energy to produce electricity, the level of CO₂ emitted into the atmosphere is much lower. This increases the attractiveness of these types of energy in terms of ecology.

The amount of CO₂ pollution from the production of 1 MW hour of electrical / thermal energy (in tons, 2016) 20



Source: Strategic roadmap for the development of the utility sector in Azerbaijan

The dynamics of changes in greenhouse gases emitted into the atmosphere as a result of the activities of the energy sector is shown in the figure below.



Source: Azerbaijan Statistics, 2018

The figure shows that the amount of greenhouse gases emitted into the atmosphere as a result of the activities of the energy sector in recent years has stabilized at 38 million tons, which is associated with stabilization of the level of natural gas in the overall balance of energy consumption.

Analysis of gaps in implementing energy efficiency practices and existing challenges for their implementation in Azerbaijan

Energy and energy efficiency sector

Azerbaijan has adopted strategic road maps for economic development and economic subsectors, which set development goals for various segments of the energy sector, as well as a package of special measures aimed at achieving those goals in accordance with the established deadlines over the next fifteen years.

At present, the model of the electricity market in Azerbaijan is an incomplete model, where there is the main producer of electricity, represented by AzerEnergy, and one single buyer-seller of electricity, Azerishig. The strategic road maps envisage the separation of energy activities: generation of electricity, transmission, distribution and sale of electricity and the creation of separate transmission and distribution system operators. Today, there is a positive experience in the separation of energy activities in the generation of electricity; some mini power plants have been privatized.

At present, the Ministry of Energy and various structures are developing 5 fundamental documents, where issues of energy efficiency are raised, in various aspects. Among these documents is the law "On the efficient use of energy resources and energy efficiency", which will determine the main goals and deadlines for the implementation of energy efficiency objectives. It is the most important document when it comes to energy efficiency matters.

Renewable energy sector

Since 2009, Azerbaijan has been a member of the International Renewable Energy Agency (IRENA). The country had established the State Agency for Alternative and Renewable Energy (SAARES). SAARES and the Ministry of Industry and Energy prepared the National Strategy on the Use of Alternative and Renewable Energy Sources for the Period 2012-20, including the Law on Renewable Energy Sources. In June 2012, SAARES was abolished, and in its place was launched the State Company of the Republic of Azerbaijan on alternative and renewable energy sources.

Despite the increase in the wholesale electricity price in 2016 - 2.94 cents / kWh for small hydropower plants, 3.24 cents / kWh for wind generators, 3.35 cents / kWh for solar power plants, relatively low tariffs for electricity is a major obstacle to the development of the renewable energy sector. Another obstacle is the absence of legally established connection rules. Overcoming these barriers to the development of renewable energy in Azerbaijan should be ensured by two projects:

- Preparation and implementation of the Action Plan in the field of renewable energy and energy efficiency.
- Improving legislation in the field of renewable energy and energy efficiency and ensuring compliance with the legislation of the European Union. Azerbaijan is seeking solutions to problems in the field of environmental protection and rational use of natural resources. To achieve the goals in the field of environmental protection in Azerbaijan, a number of important laws, legislative documents and government programs aimed at improving the environmental situation in the country have been developed and approved.

General evaluation of progress

In accordance with the Action Plan for 2011-15, approved by the President for the implementation of the State Program titled "Poverty Reduction and Sustainable Development in the Republic of Azerbaijan in 2008-15" (approved by Decree No. 3043 of September 15, 2008), the country should start the privatization of enterprises of the fuel and energy complex. However, there still has not been any noticeable activity in this area, with the exception of the privatization of several small hydropower plants. Despite the target objectives of introducing market relations in the energy sector, as envisaged in the strategic road maps, there are still no short-term plans for privatization and separation of state-owned companies in the oil, natural gas and electricity sectors. Azerbaijan has no strategy, action plan, or legislation in the field of energy efficiency. In addition, the only measures implemented in the field of energy efficiency are those financed by the EU or through projects of donor organizations, and only a few non-governmental organizations carry out activities in the field of energy efficiency. The creation of an institutional infrastructure in the field of energy efficiency in Azerbaijan is at a very early stage. Institutional development

should be based on an understanding of short-term, medium-term and long-term tasks, highlighting those tasks that require urgent and special attention from the Azerbaijani authorities.

The electricity (and gas) market in Azerbaijan is still a vertically integrated monopoly. The Tariff Council can set wholesale and retail prices for electricity. In December 2016, retail electricity prices were raised to 4.12 cents / kWh, they are still subsidized to a cost-reflective level - 7.5 cents / kWh. This tariff continued in effect in 2012 (and again this tariff does not reflect the costs). According to estimates, the potential of renewable energy sources in Azerbaijan exceeds 12 GW, which today is almost twice the installed capacity. Using renewable energy, the amount of electricity generated by gas-fired power plants could be significantly reduced. This would be a factor for a more sustainable and long-term growth of GDP, which is currently achieved through the export of oil and gas.

Outline of possible solutions for applying the best practices from other countries

Azerbaijan sent the IEC a request for assistance in developing a long-term energy strategy in accordance with the objectives reflected in the Road Maps adopted in December 2016. According to experts of IEC, the leadership of Azerbaijan understands that oil and gas reserves are irreplaceable and, therefore, limited. In addition, the Paris Agreement on the reduction of carbon dioxide emissions into the atmosphere will gradually affect global approaches to the development of energy resources. Thus, Azerbaijan should be ready for new challenges and is willing to reflect its new intentions in the long-term energy strategy, covering the issues of hydrocarbon production, efficiency of distribution of energy sources and their exports, as well as the management of the energy sector.

In Azerbaijan, a process of real unification of the fuel and energy complex (FEC) has emerged into a single mechanism, since oil, gas and electricity are interrelated.

There is still inefficient use of energy in Azerbaijan. While today this is somehow justified by the presence of large reserves of energy resources, for long-term periods the irrational and inefficient use of energy resources must be stopped. To implement this goal, the law "On the efficient use of energy resources and energy efficiency" is being developed together with IEC experts.

By today there are contours of this law, and there is a lot of work ahead to coordinate all energy efficiency issues between different departments involved in the process so that a result is achieved across the country.

Many of the energy efficiency measures are associated with the State Oil Company of Azerbaijan (SOCAR), which supplies both fuel for power generation and transport.

IEC experts believe that private investors will not be able to enter Azerbaijan's power industry unless the country specifies its tariff policy.

The task of the state is to create a balance between the interests of the investor and social aspects. If the cost of electricity generation is higher than the tariffs for its sale to the population, or state facilities and are not compensated in any way, then the investor will not come, since no establishment will want to work at a loss.

It is necessary to determine whether there will be some compensation mechanism for investors, or a change in tariff components (in terms of taxes or other aspects), or a financial burden, that is, real market prices falling on the consumers themselves.

Currently, large energy-saving potential is non-existent in the energy sector, but does exist in other sectors of the economy such construction and transport.

Among the problems of energy efficiency, an important place is occupied by the issue of reducing energy losses in the housing and utilities sector and in the construction or reconstruction of buildings. Buildings need to be built in a new way so that they are energy efficient. Yes, such buildings will cost more and pay off a little later, but we need to think about the future, about generations, about interests across the state.

The concept of an "energy-saving house" or, as it is sometimes said, "passive house", became a household name in 1970s, along with the advent of new technologies in construction.

The term “energy saving” implies a reduction in maintenance costs for items such as electricity, heat, water, sewage, and ventilation.

"Passive House" is a standard of energy efficiency in construction, which allows for the resident to maintain the comfort of living, while being economically and environmentally friendly. The consumption of heat energy by them is so low that either there is no need to install a separate heating system, or its power and size are small. Energy consumption for the needs of heating, hot water and electricity supply of an energy-efficient house for the total year does not exceed 120 kilowatt-hours per unit area. At the same time, consumption for heating is 10-15 kilowatt-hours per unit area.

One of the characteristics of an energy efficient house is the energy balance between ventilation or transmission loss of heat and its supply with solar energy, internal heat sources and heating.

In fact, the ideal “passive house” is a thermos-house without heating.

An important role in the creation of such houses is played by modern building materials, technologies and progressive thinking.

Among the advantages of such buildings there is a special engineering system that constantly maintains a pleasant microclimate, fresh air, balanced room temperature, no air leaks, humidity controls, and the cost of operating its power supply remains low even with the rising cost of energy.

It should be noted that totally 70 percent of heat is lost through the walls and windows of an ordinary house, and 25 percent through the roof.

By now, tens of thousands of “passive houses” have been built around the world, and such facilities have become widespread in Europe, in particular, in Germany, Finland, and Sweden.

As for energy saving in transport, since January 2015, environmentally friendly Tesla cars have been sold in Azerbaijan, which can be purchased at the “Green Car” electric vehicle sales center.

This project is being implemented by Green Car LLC with the support of the Azerbaijan Automobile Federation and the International Dialogue for Environmental Action (IDEA).

In June 2015, for the first time in Europe, a presentation of the Detroit Electric SP: 01 sports car took place in Azerbaijan (also the project Green Car LLC and IDEA).

Detroit Electric SP: 01 is the world's fastest serial electric car, which was created by the American electric vehicle manufacturer Detroit Electric.

From 0 to 100 kilometers per hour, the car accelerates in 3.7 seconds, and its maximum speed is 249 kilometers per hour. The electric tricycle Epic EV TORQ Roadster dials a “hundred” four seconds after the start, and the Tesla Model S sedan accelerates to 96 kilometers per hour in 5.4 seconds.

There are wide opportunities to create new production facilities in other sectors of the processing industry in Azerbaijan, In recent years, many competitive enterprises have been created in the country using advanced technologies, mainly in the food, light, and furniture industries as well in construction materials production. Along with the expansion of production in these sectors, measures should be continued to create new processing

enterprises in other areas, including chemistry, metallurgy, machinery and equipment, alternative power plants and equipment, and defense. When creating new industrial enterprises, the focus should be on using energy-saving technologies that meet high environmental standards.

Conclusions and recommendations

General recommendations

- Energy policy in the country should take into account the potential contribution of energy efficiency for increasing fuel exports, promoting economic growth and protecting the environment.
- High priority should be given to energy efficiency and renewable energy. A future energy policy should be supported by a detailed analysis of the economic potential of energy efficiency in all sectors of the economy, as well as an analysis of the obstacles hindering the realization of this potential.
- Reconstruction of assets in the segments of production, transmission and distribution in the power industry should be continued. This will maximize fuel efficiency and minimize technical losses during transmission and distribution.
- It is necessary to develop laws and secondary legislation in the field of energy efficiency and renewable energy.
- Special energy efficiency programs should be developed in different sectors of the economy, including specific targets and monitoring systems for continuous evaluation of program implementation.
- It is necessary to intensify the interdepartmental interaction of the energy sector and other government agencies in order to coordinate objectives in the field of the environment, in the field of energy efficiency of transport, in the housing sector and in industry.
- The government should support the efforts of various stakeholders, including local authorities, universities, research centers and non-governmental organizations, and promote their activity to improve energy efficiency in Azerbaijan.

Energy market and tariff formation

- It is necessary to consider the introduction of market principles in the energy sector and the corresponding regulatory framework, taking into account international experience.
- To ensure the implementation of energy efficiency measures, the existing tariffs for electricity, heat and gas should be revised. It is necessary to take into account the need for differentiation of tariffs by types of consumers, the introduction of block tariffs, as well as the issues of affordability of tariffs for the population.
- The government should allocate sufficient financial resources for the purpose of improving the energy efficiency of public and state buildings and public lighting systems, and at the same time introduce incentive systems for private and housing sector initiatives in energy efficiency and renewable energy sources.
- The government should ensure continuous dialogue with international financial organizations and the donor community to increase attention to energy efficiency and renewable energy.

Programs and measures in the energy efficiency sector

- High efficiency standards for new buildings under construction, energy efficiency labeling, and minimum energy efficiency standards for electrical equipment should be adopted and compliance procedures and application rights should be in place.
- It is necessary to introduce energy auditing and energy management systems for large industrial consumers.
- Energy efficiency issues should be an element of an integrated approach in the planning and provision of transport services.
- Implementation of programs for the reconstruction of district heating systems should be continued to reduce losses and attract new consumers and to encourage the introduction of individual metering devices, where possible.
- The government should promote the need to improve energy efficiency and raise awareness of energy efficiency issues among local communities, citizens, small and medium businesses.
- Azerbaijan should continue to participate in various international initiatives, such as the Green Building Council and the International Renewable Energy Agency in Abu Dhabi (IRENA) to ensure the exchange of information and best practices for successful energy efficiency and renewable energy projects in other countries .

Renewable energy sources

- The development of renewable energy sources should remain a priority for Azerbaijan.
- Efforts should continue to focus on the use of the potential of solar and wind energy, as well as to assess the possibility of using waste for energy purposes.
- Part of the revenues from oil and gas should be directed to the development of renewable energy sources. A fund for renewable energy issues should also be established.
- It is necessary to develop network connection rules, a tariff setting method and incentives for attracting investments in the renewable energy sector.
- The role of the State Agency for Alternative and Renewable Energy Sources should be enhanced to ensure the leading role of the organization in the field of renewable energy development in Azerbaijan.
- A project database should be created to ensure the monitoring of achieved results in all areas of activity in Azerbaijan aimed at improving energy efficiency.
- The existing building fund statistics should be used to support policy development and an assessment of the potential for energy savings in the building sector.
- In order to monitor the potential for energy conservation, an energy audit should be a mandatory starting point for large buildings. This should be the basis for the development of an Action Plan for the implementation of energy saving potential.

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