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# ASKUG SYSTEM - INTEGRATION OF "GREEN TECHNOLOGIES" IN THE PROCESS OF EFFECTIVE MANAGEMENT OF NATURAL RESOURCES

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***Abstract:*** *The article presents the results of a study to reduce greenhouse gases through the introduction of green technologies. Different countries are making rather tough decisions to reduce greenhouse gas emissions. The basics of environmental protection and conservation of natural resources are considered, the problems of green technology are analyzed. Uzbekistan has not yet taken tough measures to reduce greenhouse gases. But there are positive trends due to the introduction of green technology to reduce emissions. Also, green technology is being introduced into the gas transportation system, which will lead to the saving of natural resources. The ASKUG system for gas transportation was selected as a green technology, the results are shown before and after the implementation of ASKUG to reduce greenhouse gases.*

***Key words:*** *green technology, concept, green economy, resource saving, strategy, Paris Agreement, greenhouse gases, ASKUG system, gas transportation system, one-stage, two-stage, three-stage gas supply system.*

Green technologies are innovations based on principles of sustainable development, reuse or conservation of natural resources. In April 2018, Uzbekistan joined the Paris Climate Agreement, in which the main goal was to reduce greenhouse gases [1, 2, 3, 10].

Modern "green" technologies are aimed at:

- sustainable development that meets the modern needs of society and does not contribute to the emergence of problems, including those related to the depletion of resources, which future generations of people may face;
- production of products that can be completely restored or reused, the so-called “cradle to cradle” design, which can be translated as “from cradle to cradle”, replacing the cycle “cradle to grave” or “from cradle to grave”;
- reducing waste and reducing environmental pollution by changing the production system and consumption patterns;
- innovations that develop alternative solutions to technologies that previously proved to be harmful to public health or the environment, as well as those associated with fossil sources of raw materials or the use of chemicals in agriculture;
- life support that forms centers of economic development around fundamentally new technologies and products that have a positive effect on the environment, promote the introduction of green innovations, create fundamentally new jobs that really protect the planet.

As a result, a complex node is formed that links the technological, environmental, infrastructural, innovation and economic branches of a single conceptual tree. The general term "green technologies" today combines new solutions in the field of ecology and respect for natural resources, the search for alternative energy sources, resource-saving and resource-efficient innovations, methods of recycling and processing various waste [4, 5, 10].

In order to fulfill the country's obligations under the Paris Agreement, the Strategy for the transition of the Republic of Uzbekistan to a green economy for the period 2019-2030 was developed and approved by the President on October 4, 2019, aimed at the consistent modernization of industry, increasing energy efficiency and energy saving in key sectors of the economy, which will stabilize the level of greenhouse gas emissions.

The main goal of the Strategy is to achieve sustainable economic progress, which contributes to social development, reduction of greenhouse gas emissions, climate and economic sustainability, through the integration of the principles of the "green" economy into the ongoing structural reforms.

Traditionally, insufficient attention is paid to the problem of interaction between the economy and the environment. At the same time, it is difficult to argue that ensuring economic growth is associated with increased pollution and environmental degradation. This is reflected in the depletion of natural resources, imbalance in the biosphere and climate change, which limits the possibilities for further development [5, 6].

Environmental issues are now integrated into economics as a limited good; a new trend was formed and is actively developing - the "green economy". "Green economy" - a direction in economic science, within which it is believed that the economy is a dependent component of the natural environment, within which it exists and is a part of it; aims to preserve the well-being of society through the efficient use of natural resources, as well as the return of end-use products to the production cycle [3, 6].

Experts at the United Nations Environment (UNEP) view the green economy as an economic activity "that enhances human well-being and social justice, while significantly reducing environmental risks and environmental degradation." [7, 9].

The term "green" economy means an economy that leads to an increase in the well-being of people and strengthening of social justice, while significantly reducing risks to the environment and a shortage of environmental resources [3, 8, 10].

Green growth emphasizes the importance of integrating environmental and economic policies in a way that will identify new potential sources of economic growth without creating an “unsustainable” burden on the quantity and quality of natural resources (OECD, 2011a и 2011b).

Structural changes taking place in the economy of Uzbekistan have an undoubted impact on the use of natural resources and on the level of pollution of the environment. Therefore, during this period, the economic aspects of environmental decision-making, that is, the integration of environmental and economic policies, acquire special importance. In these conditions, the Government of the Republic of Uzbekistan pays special attention to pursuing a policy aimed at introducing resource-saving and low-waste (clean) technologies, new types of services, entrepreneurship, etc. with a wide range of economic instruments [9-11].

As follows from the considered definitions of "green" growth, the ultimate goals of its implementation lie precisely in the economic plane and consist in achieving a new quality of economic growth, building a new technological (and, more broadly, socio-economic) basis for world development. The key mechanism for achieving these goals is to serve as the "green" modernization of industries and the economy as a whole.

By the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 1062 of December 31, 2019 "On measures to accelerate the introduction of an automated system for accounting and control of natural gas", Uzbekistan is moving into a green economy. At the moment, work is gradually underway in the Republic of Uzbekistan to introduce an automated system for accounting and control of natural gas (ASKUG).

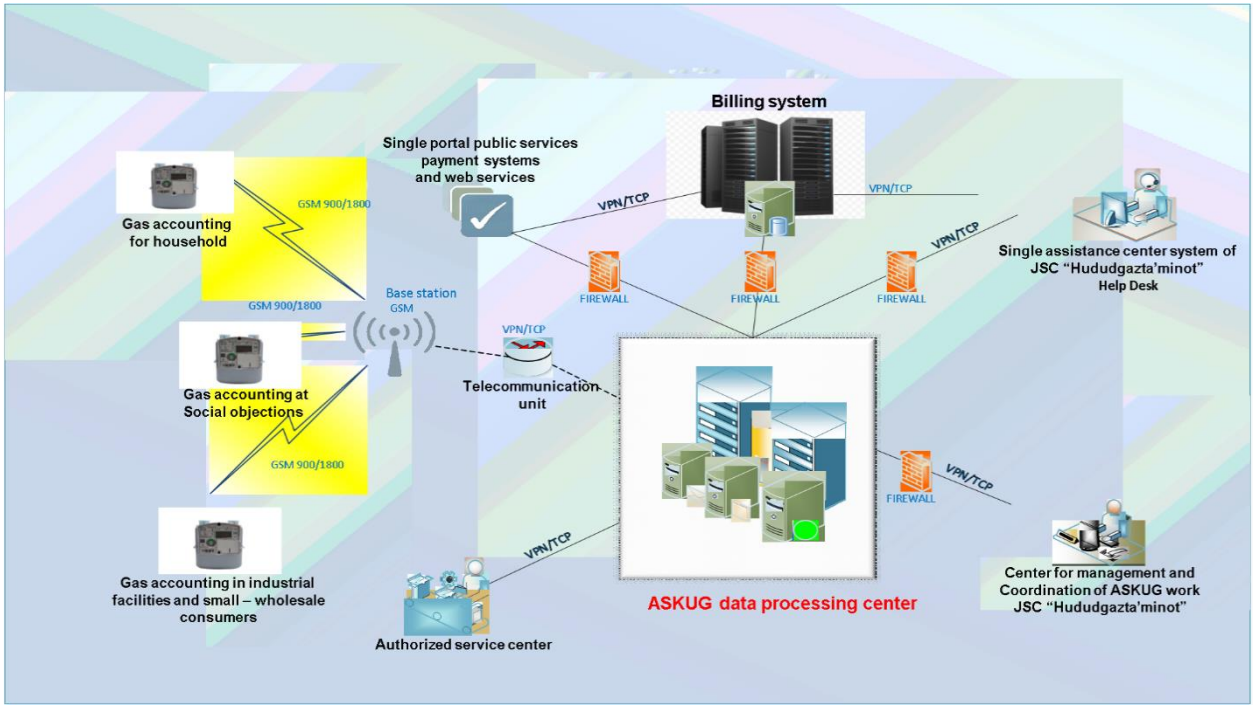


**Figure 1.** Schematic diagram of ASKUG functioning with interaction.

The automated energy control and accounting system (ASKUE) is a kind of resource that allows you to achieve a rational consumption of each of the energy carriers - hot water, electricity, gas and steam.

The question arises, how can the ASKUG system be related to ecology? ASKUG is based on, and is achieved by timely prevention of natural gas leaks, that is, emissions into the atmosphere. Since we know that natural gas emissions are considered greenhouse gases. The main greenhouse gases from gas transportation are methane, carbon dioxide and nitrous oxide.

The main goals of creating the ASKUG system are:

- obtaining reliable information on accounting for the amount of gas consumed in automatic mode for a certain period of time;
- replacement of morally and physically worn-out (operated meters that introduce a large error in measuring gas consumption, with modern GSPs with a small measurement error and the possibility of adjusting gas metering by temperature that meets international standards and standards of the Republic of Uzbekistan;
- provision of data for the operational compilation of the balance of receiving and supplying gas;
- remote automatic diagnostics of the state of the process equipment ASKUG;
- reduction of greenhouse gas emissions.

The gas distribution system depends on the number of stages of the gas pressure drop in the gas pipelines. The gas supply systems of cities and towns are divided into one, two and multistage [10-13];

- one-stage - a gas supply system, in which the distribution and supply of gas to consumers are carried out through gas pipelines of only one pressure, usually low. It is recommended for settlements and small towns connected to main gas pipelines, as well as for settlements with autonomous gas supply, when gas sources are stations for mixing vapors of liquefied hydrocarbon gases (LPG) with air, biogas or gas generating plants (figure 2);

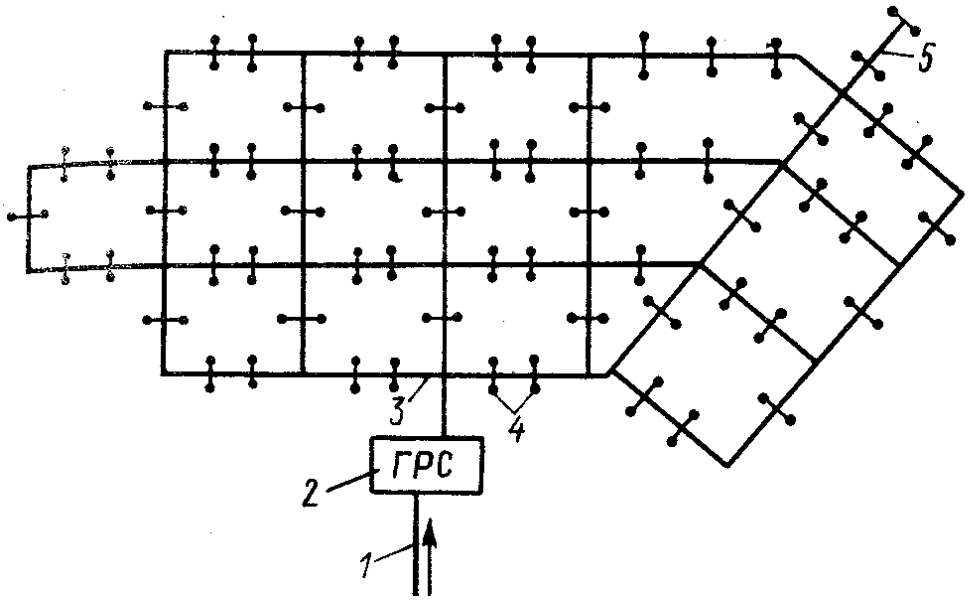


**Figure 2.** Diagram of a one-stage gas distribution system. 1 - main gas pipeline; 2 - GRS; 3 - ring gas pipelines; 4 - branches to consumers; 5 - dead-end gas pipelines.

- a two-stage system provides gas distribution and supply to consumers through gas pipelines of two categories: medium and low or high and low pressure. This system is recommended for cities with a large number of consumers located on a large territory and receiving gas from main gas pipelines (figure 3);

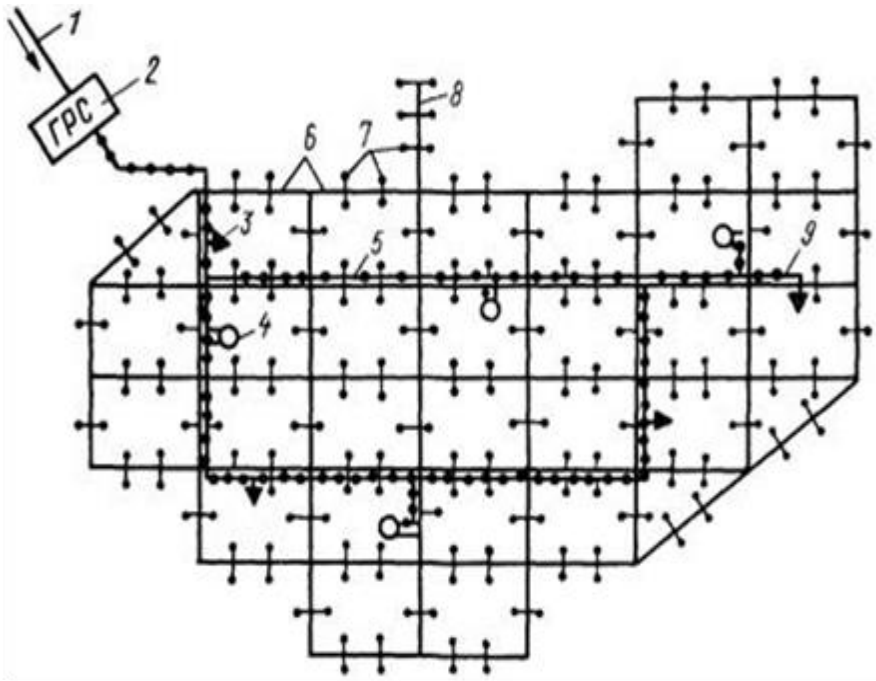

**Figure 3.** - Diagram of a two-stage gas distribution system. 1 - high pressure main gas pipeline; 2 - GRS; 3 - large gas consumers; 4 - city hydraulic fracturing stations supplying low pressure gas pipelines; 5 - high and medium pressure gas pipelines; 6 - ring low pressure gas pipelines; 7 - branches to consumers; 8-9 - dead-end gas pipelines (8 - low pressure, 9 - medium pressure).

- three-stage - gas supply system, where the distribution and supply of gas to consumers is carried out through gas pipelines of three pressure categories: low, medium and high. This system can be recommended for large cities (Figure 4).

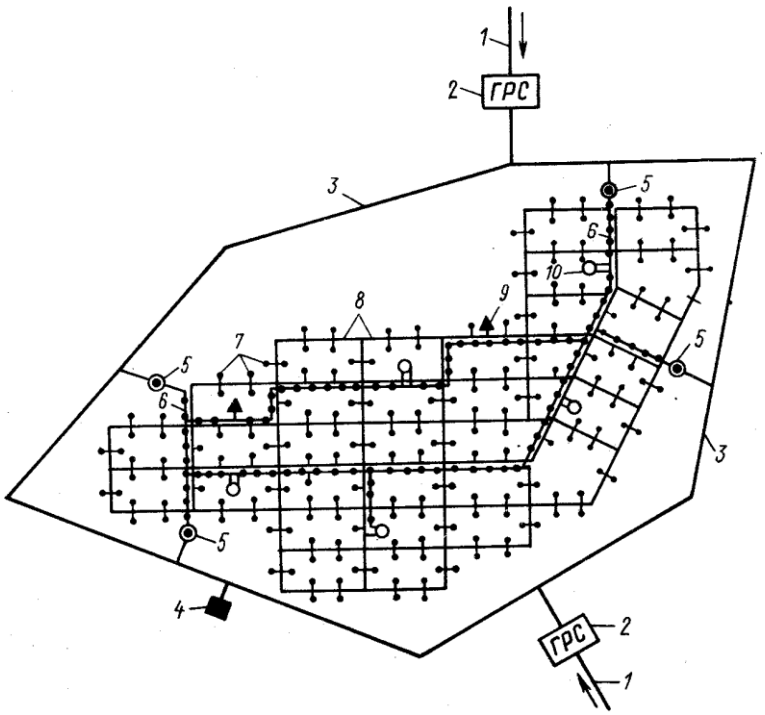


**Figure 4.** - Diagram of a three-stage gas distribution system.1 - main gas pipeline; 2 - GRS; 3 - high pressure gas pipeline (up to 1.2 MPa); 4 - industrial enterprises that require high pressure gas according to the technology; 5 - hydraulic fracturing, limiting gas pressure in medium-pressure gas pipelines; 6 - medium pressure gas pipelines; 7 - branches to consumers on low pressure gas pipelines; 8 - low pressure gas pipelines; 9 - large gas consumers connected to medium pressure gas pipelines; 10 - urban hydraulic fracturing, supplying low pressure gas pipelines.

The connection between gas pipelines of various pressures included in the gas supply system should be provided only through the hydraulic fracturing and the GRU. Each of the systems listed above, depending on the nature of the planning and building density of the city, can be circular, dead-end or mixed, branched or combined. Ring and mixed gas supply systems are preferable, since they provide the most uniform pressure regime at all points of gas sampling from distribution gas pipelines, and also increase the reliability of gas supply [14, 15].

The gas supply system in the Republic of Uzbekistan has a three-stage structure.

The three-stage - gas supply system, involves the distribution and supply of natural gas to consumers through gas pipelines of three pressure categories:

- low - up to 0,005 MPa (500 mm of water column excess);
- medium - from 0,005 MPa to 0,3 MPa;
- high - from 0,6 to 1,2 MPa.

Such systems can be recommended for large cities.

Modern methods and technologies make it possible to operate the gas supply system in a two-stage structure, excluding networks with pressures up to 0,005 MPa. The two-stage structure

provides for the installation of individual pressure regulators for each consumer, as well as smart meters and related equipment.

During the operation of the gas supply system, technological leaks of natural gas occur. These leaks are inevitable due to the impossibility of achieving absolute tightness of threaded and flange connections, valves, gas equipment. The release of natural gas and odorant can be observed during repair and maintenance work, as well as in the event of an emergency. Stable gas outflow into the atmosphere occurs with a minimum hole diameter of 4% of the gas pipeline cross-section.

In the ASKUG system, gas transportation is transferred to a two-stage system. The conducted inventory of greenhouse gases makes it possible to identify the main sources of greenhouse gas (GHG) emissions that have the greatest potential for the introduction of environmentally friendly technology [10]. The largest source of GHGs in Uzbekistan is the "Energy" sector, in which subsectors such as:

- production of electricity and heat;
- production, processing and transportation of gas;
- combustion of fuel for motor vehicles.

In the total volume of anthropogenic GHG emissions, the contribution of which is estimated at 82%. It can be concluded that the "Energy" sector emits the main contribution of greenhouse gases in the republic. Since the gas transportation system is included in this sector. At the moment, work will be introduced to reduce greenhouse gases. As noted in the Third National Communication of the Republic of Uzbekistan on the UN Framework Convention on Climate Change, our country is gradually switching to green technology [10].

If our country switches to a two-stage gas supply system, then networks with a pressure of up to 0,005 MPa will be excluded. Thus, it can be concluded that the use of the ASKUG system allows to obtain not only the saving of natural resources, but also leads to a decrease in the negative impact, in particular, of greenhouse gases (methane, carbon monoxide, nitrogen oxides) on the environment. For example, the specific gas loss per one anonymous hydraulic fracturing is on average 0,6 $m^3$ per hour. Over the year, these losses will amount to 5256 $m^3$ or 0,000166 $m^3$ / s of natural gas. According to the passport data, the specific gas loss per one rotor is 0,001 $m^3$ per hour. Over the year, these losses will amount to 8,76 $m^3$ or 0,0000003 $m^3$ / s of natural gas.

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