



SOLUTIONS FOR ADDRESSING ISSUES IN NATURAL GAS DELIVERY

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ABSTRACT

This study analyzes the modern innovative solutions being implemented in Uzbekistan to ensure the economical and efficient delivery of natural gas to consumers, the existing problems in this sector, and the ways to resolve them. The importance of digitalization, smart gas meters, automatic pressure control systems, and technologies aimed at minimizing losses is also highlighted.

Natural gas is one of the most important resources in the energy system. Since a large portion of the population and industrial enterprises in Uzbekistan rely on gas energy, its economical, safe, and efficient delivery has become a key direction of state policy. The goal is to improve the quality of energy supply through the modernization of natural gas infrastructure and the introduction of modern technologies in the country. Currently, 14 regional gas supply enterprises (RGSEs) under "Uztransgaz" JSC are responsible for the delivery of natural gas to households and wholesale consumers, as well as for the operation of distribution gas pipelines and related equipment throughout the republic. These regional enterprises include 201 district branches. The RGSEs manage a total of 115.9 thousand km of gas pipelines, including 12.3 thousand km of high-pressure, 25.8 thousand km of medium-pressure, and 77.8 thousand km of low-pressure pipelines. Of these, 24.1 thousand km are underground and 91.8 thousand km are above-ground pipelines [1].

Currently, many challenges have emerged in the management of the natural gas supply system in our republic, which include the following:

Identified Challenges in the Natural Gas Supply Sector Include:

- Use of non-standard gas appliances and burners by household consumers;
- Unauthorized connections to gas networks and illegal use of natural gas;
- Drop in gas pressure in natural gas networks during winter;
- Failure to make timely payments for natural gas;
- Inability to fully collect monthly meter readings from household-installed gas consumption meters;
- Negative impact on the financial situation of regional gas supply enterprises, which, having legal entity status and a separate balance sheet, are affected by uniform gas purchase prices across the republic.

In order to positively resolve or eliminate these listed problems, a number of decisive measures need to be developed and implemented. Specifically, to prevent the use of non-

standard gas equipment and burners by household consumers, as well as unauthorized connections and illegal use (theft) of gas, the following measures should be taken:

- Promote rational use of natural gas (reducing unnecessary losses);
- Standardize household gas appliances;
- Strengthen control over natural gas consumption;
- Install one-time numbered seals on consumer gas meters;
- Encourage the use of alternative energy sources (such as liquefied gas, coal, firewood, solar energy) and transition to decentralized heating systems [2,3].

The issue of decreased gas pressure in natural gas networks during the winter season leads to lower gas supply quality, which in turn causes delays in payment for consumed gas and dissatisfaction among consumers. This problem can be resolved by increasing the share of high-pressure gas pipelines in the gas supply system. Another important issue is consumers' failure to make timely payments for the natural gas they use. This problem contributes to an increase in the accounts payable of gas supply enterprises to the gas supplier ("Uztransgaz" JSC), to budgetary and non-budgetary institutions, and to rising wage arrears to workers and staff. Additionally, it creates a shortage of working capital necessary for production processes. One of the causes of this issue stems from Annex 5 of the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 57 dated February 5, 2004, "On continuing the implementation of market mechanisms for the sale of highly liquid types of products, raw materials, and materials." According to this annex, "strategic enterprises for which a separate procedure for settling accounts for consumed natural gas is established" are guaranteed uninterrupted gas supply despite having outstanding debts. Furthermore, the gas supply to these enterprises cannot be halted [4,5].

To address this issue, it is essential for the state to implement reforms aimed at financially rehabilitating these enterprises in order to improve their solvency. Currently, in the gas supply sector, a total of 245 inspectors are employed to serve the population and record monthly readings from gas meters installed in residential homes. Meanwhile, the number of gasified households stands at 4,596,100, which means, on average, one inspector is responsible for approximately 187 households (this figure varies by region). This clearly shows that inspectors are not able to fully collect the gas meter readings from all households each month, nor can they effectively monitor whether natural gas is being used efficiently and correctly by consumers. This issue, in turn, leads to increased consumer debt to gas supply enterprises, inefficient use of gas due to a lack of adequate monitoring, and several other related problems. To positively resolve this issue, it is necessary to install remotely managed gas consumption meters in residential homes and implement a centralized monitoring system at the city and district levels. This would enable strict control over gas consumption. Moreover, once this system is implemented, it would become possible to eliminate consumer debt and shift to a prepaid system. With such meters, payments are made via a card system, and once the prepaid balance is exhausted, the gas supply is automatically cut off via a centralized computer system. This is similar to the payment system used in mobile telecommunications. As a result, this would allow for disconnection of non-paying consumers without the need for manual intervention, significantly reduce reconnection costs after payment, and, most importantly, save time. Of course, developing and implementing these measures will require substantial material resources and financial investments. Given the current state of the gas supply sector, it lacks the financial capacity to independently implement these changes. Therefore, to develop the sector, it is necessary to gradually introduce market mechanisms and ensure a full transition to market-based relations. Naturally, this also requires attracting investments. Another important issue is the need to implement structural reforms in the gas supply sector. In our view, at the second stage, based on the current scheme of receiving gas from suppliers and delivering it to consumers, it would be appropriate to privatize the 14 regional gas supply enterprises (RGSEs) of "Uztransgaz" JSC

by transforming them into regional joint-stock companies (RJSCs) with city and district branches.

The assets of the RGSEs, including gas pipelines, equipment, buildings, and facilities, should be transferred to the charter capital of the newly formed RJSCs. It is proposed to distribute the charter capital of these RJSCs as follows:

- 26% of the shares should remain under state ownership;
- 10% should be sold to the enterprise's employees;
- 64% of the shares should be offered for public sale.

It should be stipulated that 25% of the proceeds from the sale of shares (from the open market) be allocated for the modernization of the newly established RJSCs, their equipping with new technologies, and the improvement of their gas metering systems. During the corporatization of the RGSEs, in order to increase the efficiency and engagement of city and district-level gas supply enterprises, property rights should be granted to regional branches, while maintaining operational oversight within the joint-stock company structure. The taxation regime for the newly established RJSCs should remain unchanged. The state-owned share packages should be handed over to management companies through a tender process, in accordance with existing procedures. In our opinion, to eliminate the centralized distribution system and create equal access to material and technical resources for all economic entities, the redundant intermediary structure of "Uztransgaz" JSC as a reseller should be eliminated. Instead, it should act solely as a gas transportation organization, operating based on contracts. Currently, the company engages in buying and reselling natural gas from extraction and processing companies, which contradicts the Resolution No. 57 of the Cabinet of Ministers of the Republic of Uzbekistan dated February 5, 2004, "On continuing the implementation of market mechanisms for the sale of highly liquid types of products, raw materials, and materials." It is proposed that the newly established RJSCs sign direct contracts with gas extraction and processing companies for the supply of natural gas (taking into account the transportation cost through the main gas pipelines). In turn, gas extraction and processing companies would sign contracts with the gas transport organization ("Uztransgaz" JSC) for the transportation of gas.

In this scheme, the internal accounts receivable and payable within the network between "Uztransgaz" JSC and gas extraction and processing companies would be removed from financial reports. Additionally, several other cost components affecting product cost would be reduced. The settlement boundary between the gas suppliers (extraction and processing companies) and the newly established RJSCs would be determined at the metering points within the GTS (Gas Transmission System) operated by "Uztransgaz" JSC. Due to the uniform purchase prices of natural gas from suppliers across regions—set by the Ministry of Finance (based on the overall ratio of residential and wholesale consumers across the republic)—different levels of profitability have emerged in each region. To address this issue, the Ministry of Finance should introduce differentiated purchase prices for natural gas from suppliers based on regional consumer structures (i.e., the ratio of residential and wholesale consumers). Additionally, differentiated pricing for natural gas supplied to companies providing heat to the population should be established—mainly to ensure continuous heating and to reduce accounts receivable between gas supply companies and these enterprises. This approach would help equalize profitability levels across regions. Equal profitability will not only create equal development opportunities for regional gas supply systems, but also eliminate the current negative financial impact caused by uniform purchase prices. In other words, once differentiated prices are implemented:

- Enterprises will have more balanced financial capacity;
- The large discrepancies in profitability will disappear;
- Previously highly profitable regions like Tashkent city and Tashkent region will move to normal profitability due to higher procurement costs;

- This will help solve the problem of overdue payments to budgets and extra-budgetary funds and ensure sufficient working capital for operations.

On the other hand, enterprises that previously operated with very low profitability will benefit from lower purchase prices, gaining sufficient profit margins. The savings from reduced purchase costs can then be reinvested in development. As can be seen, implementing regionally differentiated gas purchase prices across the country would lead to positive outcomes for the natural gas supply sector.

Gas equipment and devices operate properly only at specific gas pressure levels. In gas distribution systems, gas pressure frequently fluctuates. When consumption increases, pipeline pressure drops; when consumption decreases, pressure rises.

To avoid such fluctuations and to ensure stable pressure, regulation of gas pressure is necessary. The main goal of pressure regulation is to reduce pressure and maintain it consistently at a set level.

While gas pressure can theoretically be regulated using any shut-off device, in practice automatic pressure regulators are used in gas systems. These regulators, along with auxiliary devices, are installed in gas regulation points (GRPs), which can be housed in special buildings or metal cabinets.

There are various types and configurations of pressure regulators, but their main function remains the same: to reduce and stabilize gas pressure at the desired level.

GRPs serve as connecting elements between pipelines of different pressure levels, i.e., connecting low-pressure lines to medium or high-pressure ones. In a GRP, gas first passes through a filter to remove mechanical impurities.

To determine whether a filter is clean or clogged, the pressure before and after the filter is measured. If the filter is clean, the pressure difference will be small. As the filter becomes clogged, the pressure difference increases. If the pressure difference exceeds the acceptable limit, the filter must be cleaned.

During maintenance, gas is rerouted through a bypass line, and its pressure is manually regulated using two gate valves.

After the filter, a PZK (Safety Shut-off Valve) is installed. Its function is to automatically shut off the gas supply if the output pressure from the GRP increases by more than 20% or drops by more than 10% from the normal level.

The PZK detects pressure changes through an impulse tube connected to the outlet pipeline, which transfers the pressure to the PZK's diaphragm. This diaphragm then activates the valve to shut off the gas. To reopen the PZK and restore it to operational mode, a city or district gas emergency response team must be called.

After the PZK, a pressure regulator is installed. Its purpose is to reduce the pressure and maintain it consistently. At night, when gas consumption drops, if the regulator valve does not seal properly, it may allow gas to pass through, causing an increase in pressure in the outlet pipeline. To prevent this pressure rise, a relief valve (PSK) is installed on the GRP's outlet pipeline. If the outlet pressure increases by 10–15%, the PSK releases some of the gas into the atmosphere, thereby reducing the pressure and preventing the PZK from activating. If there were no PSK, and the pressure increased at night, the PZK would shut off the gas supply, leaving consumers without gas in the morning. If the PSK activates but pressure still continues to rise and exceeds the 20% threshold, the PZK will shut off the gas to prevent danger.

In addition to the main pipeline, GRPs have a bypass line equipped with two gate valves. If maintenance work needs to be performed on the GRP, the main pipeline is shut off, and gas is redirected through the bypass, with pressure manually regulated using the two valves. The purpose of two valves is to allow:

- The first valve for rough regulation, and
- The second valve for precise pressure adjustment.

Types of GRP

- GRP can be single-stage or two-stage
- They may contain one, two, or three parallel pressure regulators.

Single-stage GRPs have one pressure regulator.

Two-stage GRPs have two regulators connected in series, used when consumers require different pressure levels.

In such cases:

- After the first regulator, part of the gas is sent to consumers that require higher pressure

- The remaining gas passes through the second regulator, which further reduces the pressure before it is supplied to low-pressure consumers.

In some setups, parallel pressure regulators are used:

- If one regulator cannot meet the required flow capacity, a second parallel regulator is installed to share the load.

Classification by Input Pressure and Function

- Based on input gas pressure, GRPs are classified into high-pressure and medium-pressure GRPs.

- GRPs that supply gas to distribution networks are called network GRPs, which supply gas to the city system.

- Object GRPs supply gas to industrial facilities, boiler houses, or municipal utilities.

When addressing the issue of providing housing and communal services to the population, it should be taken into account that the formation of the service sector does not occur solely under the influence of limited demand, as mentioned above. It is essential to achieve a number of efficiencies, meaning that demand for such services must be actively shaped. In developing measures to improve the functioning of information systems at the regional gas supply complex level, we based our approach not on vague criteria of optimality, but on information support, which serves as a convenient tool for structuring based on a wide range of existing functions and powers of the relevant enterprises, in a simplified and efficient manner. Efficient and economical delivery of natural gas to consumers is a critical factor for Uzbekistan's sustainable economic development. Through the broad implementation of innovative technologies, digital management systems, and modern equipment, energy losses are reduced and the quality of supply is improved. By aligning state policy with technical solutions, significant achievements can be made in this sector.

References:

1. Resolution No. 421 of the Cabinet of Ministers of the Republic of Uzbekistan dated October 2, 2014, "On Measures to Improve the Management System of the Republic's Gas Supply."
2. Resolution No. 57 of the Cabinet of Ministers of the Republic of Uzbekistan dated February 5, 2013, "On Continuing the Introduction of Market Mechanisms for the Sale of Highly Liquid Types of Products, Raw Materials, and Materials."
3. Aleksandrov A.V. Automated Management of the Unified Gas Supply System. Moscow: Nedra, 2018.
4. Komyagin A.F. Automation of Production Processes and ACS of Gas and Oil Pipelines. Textbook for technical colleges. 2nd ed., revised and supplemented. Moscow: Nedra, 2019.
5. Zhyla V.A. Automation and Telemechanics of Gas Supply Systems. Textbook. Infra-M, 2007.