QUALITY CONTROL AND MANAGEMENT IN GAS SUPPLY SYSTEMS

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ABSTRACT

This article discusses topical issues in the field of gas supply systems and their evaluation. Based on the peculiarities of certain types of systems, the authors studied the properties characteristic of technical and operational systems and clarified the definition of the "quality" category.

Keywords: *system, classification of systems, gas supply system, quality, operational dependability.*

АННОТАЦИЯ

В статье рассматриваются актуальные вопросы в области систем газоснабжения и их оценка. Основываясь на особенностях отдельных типов систем, авторы исследовали свойства, характерные для технических и эксплуатационных систем, и уточнили определение категории «качество».

Ключевые слова: *система, классификация систем, система газоснабжения, качество, эксплуатационная надежность.*

INTRODUCTION

Terms such as systems, system approach, system management are among the most common and complex management categories today. In the 1930s, the theory of systemic management, which emerged as a separate school of management, embodied technocratic worldviews in the management of the national economy.

System - the word "system" is Greek and means a certain integrity of many elements that are legally connected to each other. There are two important aspects, namely the number of elements and their properties, as well as the nature and nature of the relationships between the elements [1].

A system is a set of interrelated and (or) interrelated elements [2]. Major scientists such as U. Deming [3], J. Djuran [4], A. Feigenbaum [5], K. Isikawa [6], F. Crosby [7] have made a significant contribution to the formation of the concept of quality management based on a systematic approach.

The research of foreign scientists Yu Weichao, Chio Lam, E. Zio, Benas Yoxhas is devoted to the study of the quality of gas supply systems [7,8,9,10,11].

METHODS

In the classification of systems, in our opinion, the division into the following groups allows to show their essence and characteristics of activity:

The first group is technical systems. Their composition consists of elements designed to perform a number of clearly limited functions, each of which is an independent function carrier. For example, a gas distribution device consists of several parts, all of which must be in good condition for it to work. Simply put, each can be evaluated alternately (yes - no). Then the system is also evaluated by this criterion. Failure of a single element will cause the system to shut down. This condition is often called "firing". An indicator of the overall assessment of the system is its reliability. Dependability - Indicates the ability to work as and when required.

The second group is operational systems, which are one step higher than technical systems and show that they are integrated with service systems during operation. An example of this is the city gas supply network. The stable operation of the system will depend more on the maintenance system than on the technical devices. Such a system is therefore evaluated by meeting a number of criteria. Unlike a technical system, in such systems, a generalized assessment is called quality. Quality is the degree to which a set of specific characteristics of an object meets the requirements [12]. Reliability is considered to be one of the characteristics of quality.

The third group includes production-technical systems, ie systems that represent the combination of dynamic systems consisting of production processes of technical systems. Such systems belong mainly to enterprises and complexes focused on the production of products, the main purpose of which is to ensure the production of the intended volume.

The fourth group is social-production systems, in which the addition of social systems that reflect the human factor in the above three systems is observed.

The fifth group, i.e., the influence and participation of the human factor in social systems, is a priority and all of the above systems are secondary.

In researching and evaluating systems, which group they belong to is of great importance. The main reason for this is that the objectives of the systems and the specificity of the subsystems and elements in their composition differ in the choice of evaluation criteria (Table 1).

Table 1

Classification of systems by their fundamental properties

	Type of system	Main purpose	Evaluation criteria	System failure	General evaluation

					indicator
	Technical system	Completion of a clearly defined function	Continuous performance of a function within a specified period	System shutdown (failure)	dependability level
	operating system	Performance of the functions assigned to the system	Continuous performance of all functions during operation	Decrease in operational properties	Quality level
	Production-technical system	Continuity of the production process	Compliance of the product with the requirements	Defects in production	quality level
	Socio-economic system	Efficiency of the production process	Meeting the socio-economic requirements of the product	Decreased production competitiveness	Quality level
	social system	Efficiency of the social process	General social efficiency	Socio-economic instability	Social quality level

Today, the concept of the system is applied not only to the design of equipment, but also to all types of complex complexes. We can also include a system of gas extraction and delivery to consumers.

RESULTS AND DISCUSSION

Providing the population and the economy with natural gas resources is one of the important national tasks. However, this sector of the economy involved many technical systems and organizations. The application of a systemic approach in the gas supply sector also requires that it be seen as an open, complex and large-scale operating system.

Based on the principles of the above systems theory, we propose to look at the complex of natural gas production and supply to consumers in the country as a large, multi-level and complex system. Based on this approach, the scientific and methodological conclusions obtained as a result of the study of a particular subsystem confirm that they can be applied to the whole field.

According to the normative legal acts of the country, "gas supply system is a technologically, organizationally and economically interconnected and centrally controlled producer and center for the production, processing, production, transportation, storage, distribution and delivery of gas to consumers. a property production complex consisting of other facilities. "[13] Based on this, this complex system will consist of a number of independent production systems, ie gas extraction, gas processing, gas production, gas transportation and gas distribution, delivery to consumers subsystems.

These subsystems are also independent in terms of economic activity, that is, the relationship between them is created on the basis of complete economic independence. Gas extraction, processing, purification and consumption are the tasks of specialized industrial enterprises. Transmission of natural gas and its delivery to the place of consumption is entrusted to the gas supply systems of JSC "Uztransgaz" and JSC "Hududgaztaminot". The systems in this sector of the industry are constantly evolving, as on the one hand the number of consumers, their coverage and directions of gas consumption are expanding, on the other hand complex technical and technological measures are being taken to reduce gas losses.

Based on the above, in the study of the quality of natural gas supply to consumers, we consider it expedient to separate the activities of enterprises and organizations owned by JSC "Hududgaztaminot" as a separate system. This conclusion is the basis for defining the term "quality of gas supply networks." In our opinion, the quality of gas supply networks means the ability to achieve the norms and technical and economic indicators set out in the project during the entire life of the pipeline, and as a result to meet the needs of consumers for natural gas in the most efficient way.

Given the wide range of gas supply quality research issues, we found it necessary to define the term "quality control" in the research process, ie gas supply quality control is the process of delivering gas to consumers through pipelines based on statistical methods to meet their regulatory and contractual requirements. is a set of verification measures.

The development of the above terms was the basis for offering scientific recommendations to the population and organizations on the quality of service in the natural gas supply system, the prevention of defects and thus increase the reliability of consumption of gas networks.

In the process of practical research, the laws of natural gas supply to the population and organizations in Samarkand were studied. The average monthly and daily gas supply figures were taken as the object of analysis.

If we look at the deviation of gas consumption, the biggest difference was observed in October, February and March. The largest daily consumption of natural gas is in the winter months, ie January (1867 cubic meters), February (1931 cubic meters) and December (1889 cubic meters). The lowest gas consumption was observed in May, June, July and September (Table 2).

Table 2

Average daily natural gas supply in Samarkand in 2020.

Months	Delivery rate, thousand m3	Actual delivery, thousand m3	Difference +, -
January	1816	1867	+ 51
February	1680	1931	+ 251
March	552	817	+ 265
April	660	749	+ 89
May	304	336	+ 32
June	388	412	+ 24
July	350	380	+ 30
August	635	627	- 8
September	403	396	- 7
October	475	912	+ 437
November	1350	1418	+ 68
December	1775	1889	+ 114

Based on this fact, several conclusions can be drawn regarding the satisfaction of consumer needs:

- A sharp increase in demand for natural gas in the winter requires an excessive increase in the pressure of the gas network.

- Seasonal pressure differences from day to day lead to rapid wear of short-term parts of gas appliances, resulting in an increase in the number of "failures" in GTQs.

Based on the above data, the average daily expenditure in 2020 was analyzed. Based on the use of mathematical statistical methods of data processing and analysis, it became possible to forecast gas consumption for the next year, ie 2021 by months (Figure 1).

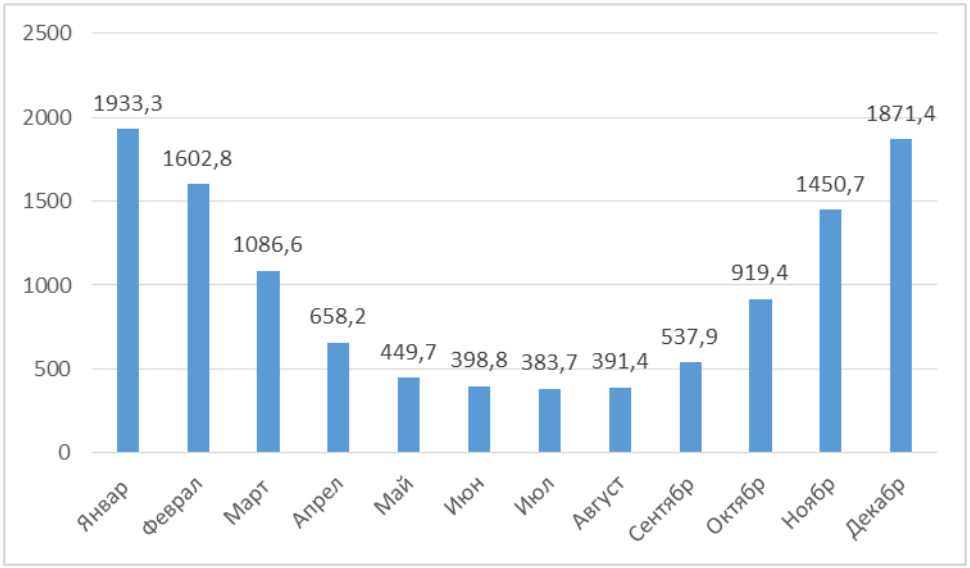

Figure 1. Average daily forecast of natural gas supply in months to 2021, thousand m3.

The method of determining the forecast as a result of taking into account the interests of all consumers, the seasonal patterns of gas consumption in the development of standards for the use of natural gas is also proposed (Table 3).

Table 3

Defined method of forecasting daily gas consumption in Samarkand.

	Months	**Forecast for 2021, thousand m3**	**Mathematical mean level of deviation**	**Forecast for 2021, thousand m3**	
				Optimistic	**Pessimistic**
	January	1933,3	+/- 4,933	1928,3	1938,2
	February	1602,8	+/- 21,075	1581,7	1623,9
	March	1086,6	+/- 55,33	1031,3	1141,9
	April	658,2	+/- 21,0	637,2	6792,0
	May	449,7	+/- 14,83	434,9	464,53
	June	398,8	+/- 14,5	384,3	413,3
	July	383,7	+/- 12,095	371,6	395,8
	August	391,4	+/- 19,353	372,1	410,8
	September	537,9	+/- 13,33	524,6	551,2

0	October	919,4	+/- 98,7	820,7	1018,1
1	November	1450,7	+/- 16,165	1434,5	1466,9
2	December	1871,4	+/- 10,0	1861,4	1881,4

CONCLUSION

The use of this method allows to know in advance the volume of gas consumption for the next two to three years and on this basis to determine the norms of gas supply. In our opinion, this method will be the basis for eliminating losses in the gas network and preventing unnecessary costs by setting gas supply standards. In practice, the adjustment of standards to the volume of consumption will serve to increase the stability of gas supply.

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