Reliability of gas supply system and quality indicators and ways to increase them

Khudoykulov Ural Chorshanbievich

Senior teacher of Samarkand state architectural and civil engineering institute

ABSTRACT: This article describes the quality, essence and composition of gas supply systems to the population and businesses. In the experts' opinion studying process, the author expressed his views on the quality indicator reliability content, its division into separate groups and areas for improving the system reliability in quality management.

KEYWORDS: product quality, gas supply system quality, quality indicators, reliability.

I. INTRODUCTION

The energy resources provision is momentous in the economy development of the Republic of Uzbekistan and the population welfare. If in 2019, 60711.9 million cubic meters of natural gas were produced in the country, from which 49711.0 million cubic meters were delivered to consumers [1]. The quality concept application in "Uztransgaz" and "Khududgaztaminot" is becoming a topical issue in saving and efficient use of our rich natural gas. Relying on the quality in the natural gas supply to the population requires an deeply quality category analysis. Quality applies to almost all society aspects and is closely related to the needs satisfaction level. If we look at the general state of social production, quality is the intrinsic ability (capacity) of a particular object or process and is the basis for its evaluation by man and society in benefit.

The "quality" concept is primarily applied to products and services. In recent years, as an active application result of the quality concept in all economy sectors, it has been observed that many quality definitions have emerged. Summarizing all of them, we can come to the following term.

Product quality is usually understood as a set of properties that form the ability to meet existing or potential needs in the performing process defined tasks. The following are important in this term:
- Quality is the intrinsic ability of a product (service), i.e., its integral feature;
- Quality is closely related to the functional purpose and the product functions and is evaluated for that purpose;
- Quality demonstrates the ability to meet needs;
- Quality is not only clearly defined, but also reflects future needs.

When we apply this term to gas supply systems, we have defined it as follows: the gas supply system quality is a set of indicators that form the ability of the population and businesses to meet the natural gas needs in the prescribed manner.

The quality concept in management was developed in the second half of the last century and is one of the most effective approaches today. In the works of E. Deming [2], W. Schuhart [3], A. Feigenbaum [4], K. Isikawa [5], one of the quality concept founders, quality is described in detail and the quality role in production relations is substantiated. In modern production management, the quality concept requires not only processes, but also the entire organization activity to be evaluated on the basis of quality criteria. The results application of theoretical and practical research conducted by scientists in gas supply systems is one of the current problems in the field today.

II. METHODS AND TECHNIQUES.

It is important to take into account its complexity and versatility when defining a quality category. The quality concept theory distinguishes three quality indicators levels of the object: primary, group quality indicators and integral quality. In the gas supply case, the primary quality indicators are the individual sub-properties of the system. For example: natural gas pressure gauge. While this indicator is part of the quality structure, it does not affect consumers' perceptions of the system. Group quality indicators can be the basis for assessing a particular gas supply direction. For example, the gas supply continuity indicator reflects the generalized state of several primary indicators. An integrated quality indicator is the basis for evaluating the entire system and is equal to the customer satisfaction level.

The problem complexity requires the use of the expert survey method in the gas supply systems study. From several expert questioning methods, we found it appropriate to use the interview. This conclusion was due to the fact that the problem is not sorted, quality indicators content and quantity corresponding to this object are not classified. The management and officials participation of "Khududgaztaminot" JSC in the interview confirms the results objectivity of the study.

Main part. The main problem of relying on the consumers needs (population and businesses) in assessing the gas supply system quality is to formalize these needs, i.e., to bring them to specific requirements. For this purpose, it is planned to set normative and technical requirements for each quality indicator (Table 1).

Table 1.
Normative and technical bases of quality indicators of gas supply system

Quality indicators	Normative and technical document	Scope of application
Integral indicator	Natural gas supply contract, legislation.	It is the basis for evaluating the gas supply system.
Group indicator	Industry standards, regulations, specifications, etc.	Some subsystems of the gas supply system will be the basis for the maintenance, structure and team evaluation.
Primary indicator	Technological requirements, equipment passport, production standards, internal regulations and procedures, specifications, etc.	In gas supply process will be the basis for the individual joints assessment, work quality, material resources, equipment, operations.

It is noteworthy that the quality concept application in gas supply systems requires their study in "quality carrier", i.e. the system itself is considered only as a set of quality indicators. Based on this, the forming issue of a quality indicators hierarchy will be of great importance. The integrated gas supply system quality is often assessed by society and is expressed in the Presidential, the government or local government decisions form. For example, the adoption of Presidential decree of the Republic of Uzbekistan № 6010 on June 18, 2020 shows a negative assessment of the system. [6] Lower level, i.e. primary indicators "Khududgaztaminot" structures provide an independent assessment of the work process and do not reflect the relationship with consumers. In our opinion, the main indicators involved in assessing the gas supply quality are group indicators. These indicators reflect the economic relations of the gas supply system with consumers, their representatives, gas suppliers, objects of the system infrastructure. As a result, the amount of group indicators has a direct impact on system performance. The research allowed to distinguish the following indicators group of the gas supply system:

− Functional indicators, i.e. indicators that determine the volume, level, pressure, duration and other function of gas supply;

–   Reliability indicators, i.e. indicators that represent the continuous performance of the assigned tasks for a certain period of time;

–   Safety indicators, i.e. indicators that determine people safety, facilities and the environment during operation;

–   Performance indicators, i.e. indicators that represent technological, organizational, technical and economic efficiency.

Among these indicators, it is the reliability indicator that has the greatest impact on the system quality and requires the most attention from organizations. The reason for this is the composition of the primary quality indicators and their non-fulfillment probability. For example, functional quality indicators are formed in the gas transmission systems design and are reflected in the construction process. Their changes are almost non-existent during the system use. In turn, the primary quality indicators in the security structure, although important in functionality, do not play a significant role in the gas supply organizations activities. The primary indicators of efficiency reflect economic activity and usually serve only as an evaluation criterion.

III. OBTAINED RESULTS.

If we look at the primary quality indicators in the reliability structure, the pipes integrity, the equipment integrity during its service life, the equipment suitability, maintenance times, etc., are exactly what the enterprises relationship with consumers during operation. According to experts, non-compliance with reliability indicators is one of the main gas supply companies problems. Indeed, system reliability breaches are a major consumer complaints part.

In order to study the problem deeply, we found it necessary to distinguish several system reliability aspects, i.e., to identify the technological, organizational, and economic reliability types depending on the system elements. (Table 2).

Table -2.
Gas supply system reliability elements

Reliability type	Technological	Organizational	Economic
Object	Pipeline construction, gas distribution equipment, gas transmission technology	Structures, organizational relations, technical inspection procedures and operations of gas supply companies	Market and partnership relations, economic mechanism, financial incentives
Subjects	Structural continuity during operation	Full and timely execution of all processes and operations in the system	Focusing the economic interests of market participants on the system reliability
Access terms	Modern design solutions, competitive equipment and materials, innovative technologies	Optimal organizational structure, perfect procedures and processes, effective quality control, qualified personnel	Mutually beneficial contracts, agreed prices, quality-based financial incentive system
Deterioration cases	Premature failure of equipment	Gas supply violation	Damage or losses
Ways to reach	Improvement of technological devices and equipment	Improving the management system	Economic indicators management

As can be seen from the table above, improving the gas supply system reliability requires a comprehensive approach, i.e., technological, organizational and economic measures should be considered as a whole.

The reliability analysis of the gas supply system of Samarkand revealed a number of shortcomings in its supply process.

One of the main inspectors tasks of Samarkand city gas supply department is to conduct regular inspections of gas supply facilities and pipelines in the attached area. For example, high-pressure gas supply devices are inspected daily, and medium-low-pressure gas supply devices are inspected once every four days, but the status data is not retained. Because the inspection is visual, small changes in the device are more likely to be overlooked and it is not possible to anticipate large defects. This makes it more difficult to analyze the data based on the daily survey results.

Information on defects in pipes and equipment shall be recorded in separate logs on the basis of inspections by inspectors and consumers. During our research period, we have witnessed two types maintenance of journals in the emergency dispatch service, namely, the samples in high and medium pressure pipes are recorded separately, and the population appeals and wholesale consumers are recorded separately. Firstly, journals take up a lot of space, secondly it is very difficult to analyze the data in them. As a result, a single policy development for dealing with deficiencies does not take place;

Another shortcoming identified in the system during the study was the failure to take into account the defects repairing cost as well as the amount of damage seen. For example, an emergency crew went to the defect scene based on a call and corrected it. In nowadays order, it is difficult to find answers to the questions of how long it took to repair, how much material was spent, what damage was done, because its regulatory framework has not been formed.

We also consider it necessary to point out the organizational shortcomings in the enterprise, the lack of a clear statistical methods idea of quality control in employees. Insufficient attention is paid to the daily data of gas consumption and quality control analysis documents. Process control maps, defect recurrence histograms, statistical analysis methods, diagrams common in world practice are almost never used. As a result, the level of the collected data use in decision-making remains low.

IV. CONCLUSION.

Improving reliability, which is an important part of the system quality, is the main task of gas supply companies, which includes the following areas:

improving management in the gas supply system. Organizationally, this area will include the quantitative indicators of system reliability, their monitoring using quality control methods and procedures, loss prevention of reliability, increasing the decisions management effectiveness and the management structures development;

technical and technological equipment modernization of the gas supply system. This direction is closely related to the investment and innovative development programs of the industry, as modern promising technologies serve to increase system reliability. It will focus on measures such as the capacity reserves formation, the use of flexible technologies, increasing the equipment reliability, improving the equipment quality. At the same time, this direction provides high efficiency in the daily activities of enterprises with the efficient use of internal resources;

improving the economic mechanism of natural gas supply to the population and businesses. This area, which is the economic sciences object, includes the formation of economic reliability indicators, the information systems creation to monitor them, the market mechanisms introduction of economic relations, decision-making and motivation.

All the above measures implementation requires, first of all, the service quality priority, system reliability assessment from the consumer's point of view and a systematic approach to them, i.e. deeply study of processes, development and implementation of scientific conclusions.

REFERENCES

1. Data of the State statistics committee of the Republic of Uzbekistan.
www.stat.uz. Entry date 30.11 2020.

2. Deming William Edwards. Way out of the crisis. A new paradigm for managing people, systems and processes.– M.: Alpina Publisher, 2018.

3. Wheeler D., Chamber D. Statistical process control. Business Optimization Using Shewhart Control Charts– M.: Alpina Publisher, 2009. – 416 p.

4. Feigenbaum A. Product quality control. - M. Economics 1986. - 470 p

5. Isikava K. Japanese methods of quality management. - M. Economics, 1988. – 215 p.

6. Presidential decree of the Republic of Uzbekistan on June 18, 2020 №6010 "On additional measures to improve the mechanism of sale of natural gas and electricity." www.lex.uz