



Innovative Methods and Technologies to Improve Operational Reliability and Safety of Gas Distribution Systems in Russia

Yuriy Yarygin, JSC "Gazprom promgaz"

Alexander Sherstobitov, JSC "Gazprom promgaz"

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Introduction

Gas distribution systems are the final link in the chain of gas supply to consumers. A safe and reliable gas supply to consumers along with an appropriate level of operation and maintenance of gas distribution systems and provision with necessary resources is a keystone for the proper functioning of industrial, agricultural enterprises, public utilities, as well as for comfortable living of the population.

Alongside with successful achievements in gasification, gas distribution development in Russia is associated with challenges, many of which are common for almost all regions connected to gas supply. Development of production facilities sometimes lags behind of development of distribution networks and construction of facilities, which with the same number and availability of equipment theoretically increases the likelihood of an accident.

The funds available at the disposal of gas distribution companies (GDOs) do not cover the costs required to maintain proper operating conditions of the system. Losses caused by accidents, incidents, failures of equipment and facilities are sensible for efficient GDO activities.

Implementation of innovative technologies to solve the most significant and urgent challenges that currently exist in the gas distribution sector appears to be a transition to a new level of development and often becomes a determining factor of economic stability and growth of the gas distribution companies.

To this end, a concept of technological development of the gas distribution system has been designed, which is currently implemented in the organizations of the Gazprom Group. The concept involves a transition from the service life-based operation to the operation based on actual technical condition, first of all, through the organizational activities, application of innovative technologies and improvement of conventional methods of operation and maintenance of gas distribution systems.

Objectives

Analysis of international practices has shown that the distinguishing features of gas distribution systems abroad are: the system of technical condition-based operation, the widespread application of intelligent and innovative technologies, the utilization of low-maintenance equipment (gas distribution substations, electrochemical protection, valving), the use of materials and equipment designed to minimize the share of manual labour when performing maintenance or repair works, the application of block-modular designs, etc..

The gas distribution pricing system existing abroad enables GDOs to cover all necessary costs, and to a certain extent stimulates investment in the development of the gas distribution systems, and is aimed at a stepwise reduction of tariffs. A share of the tariff for gas distribution services in the consumer end-price is 25-40% (while in the Russian Federation it is 10-15%).

However, the international practices in respect to the construction and maintenance of gas pipelines are not always applicable in Russia for several reasons. To operate gas distribution networks on the basis of technical condition, an effective monitoring and data collection system which is based on geographic information systems is required. Imported equipment becomes unserviceable long before the end of their service life by reasons of poor-quality gas. The lack of financial backing does not enable to perform renovation and



modernization of gas distribution networks using a comprehensive approach; therefore, GDOs have to manage it by partial or temporary problem-solving methods. Staffing problems and an imperfection of the regulatory and legal framework impede the application of advanced technologies and modernization of gas distribution systems.

The concept of technological development of the gas distribution system designed by JSC "Gazprom promgaz" is aimed at the listed problems solving and facilitating the transition to perspective forms of gas networks maintenance.

The technological development envisages a transformation of gas distribution systems from the currently existing state, not always satisfactory in the terms of reliability and cost-effectiveness, to a projected (desirable) state that meet contemporary requirements. Evaluation of the current state and description of the desirable state requires specific target criteria; however, some methods for various gas distribution aspects are still in the process of development including reliability, safety and efficiency aspects. Today, no sufficient and authentic information is available to solve many questions.

The concept key task is to prepare conditions for the transition of the gas distribution networks maintenance to the operation based on the actual technical condition. Preparation of conditions for the transition of the gas distribution networks maintenance to the operation based on the actual technical condition involves every stage of the life cycle and all the business processes related to gas transportation via gas distribution networks.

The following is required to resolve the key task of the Concept and to accomplish objectives of efficiency improvement of the business processes: implementation of innovative technologies and improvement of conventional methods, materials and equipment that ensure the required level of reliability and safety of gas distribution networks; development of the necessary methodological support for evaluation of technical condition, reliability and safety of gas distribution systems and individual facilities, as well as economical efficiency of GDOs' business processes; introduction of information technologies and automated process control systems; implementation of activities to improve the gas distribution staff training system; and improvement of the legal, regulatory and methodological framework for the gas distribution.

The Concept corresponds to the existing level of development and use of gas distribution equipment and technologies in Russia. Because of the absence of some system-forming regulatory documents, approved methods, and possibilities to obtain complete reliable and authentic information, the Concept defines qualitative directions of technological development. However, without any progress in these directions, it will not be possible to significantly improve the efficiency in any gas distribution organisations.

The progress will be assessed by the following criteria: to what extent the advanced methods and technologies provided by the Concept are used; readiness of necessary methodological support and provision of collection of reliable and authentic information; development of regulatory documents and accomplishment of the proposed plan of actions. Wide implementation of new methods and developments is anticipated only after their successful validation in separate GDOs.

Recent Developments

For the recent 11 years, the number of apartments provided with gas supply increased by more than 40%; and at present, this number exceeds 40 million apartments. For said period, the total length of the gas distribution networks increased twice, from 386 thousand km as at the beginning of 1999 up to 769 thousand km by 2011; and the natural gas quantities transported through them grew by 35% to make 325 bcm. More than 60% (485 thousand km) of the gas distribution networks are located in rural areas.

Polymer technologies have been more widely used: total length of polyethylene gas pipelines in the Russian Federation grew from 14.2 thousand km as at the beginning of 1999 up to 150 thousand km by 2011. Their share in the total length of the underground gas pipelines increased for said period from 5.4% up to 30% (or almost six-fold).

Advanced technologies have been actively used upon renovation and technical upgrading. Thus, for example, in the Programmes of renovation and technical upgrading of



the Gazprom Group gas facilities, laying and broaching of polyethylene gas pipelines, controlled directional drilling were used as well as telemetry control systems and automatic processing control systems were installed for more than 70% of the renovated facilities.

In the contemporary conditions, alongside with the provision of reliability and safety of gas supply, the issues of economic efficiency are of great importance. At the same time, a qualitative indicator of gas distribution economic efficiency – the ratio of transported gas quantities to the length of the networks – decreased by one third in the past decade (from 0.56 down to 0.42 mcm/km), and versus, for example, 1990 – more than thrice (from 1.4 down to 0.42 mcm/km). Costs for the provision of gas supply to apartments and gas transportation have been growing: thus, while there were 17.4 km of distribution gas pipelines per one thousand apartments provided with gas supply as at the beginning of 1999, now this figure has increased up to 19.2 km. These trends are objective and will be developing; therefore, the issue of achievement of the GDOs' economic efficiency performance becomes more and more relevant, in the crisis conditions in particular.

For the recent 10 years, maintenance schedules for gas distribution networks have not practically changed, and specific number of maintenance staff decreased almost twice for the same period, on the average. This is an indication of either the increased labour productivity in the GDOs or that, at the moment, the complete scope of works on maintenance of the networks have not been done in full in the GDOs. At the same time, further increase in the GDO staff will also lead to a dead-lock.

According to the technical passport of the gas facilities of the Russian Federation as at 01.01.2011, the number of the GDOs' staff per 100 km of natural gas distribution networks is within a range of from 10 to 85 persons per 100 km. And according to the International Gas Union, the same average range for the European companies is from 5 to 10 persons per 100 km.

Though the share of wages and salaries in the GDO structure of costs in Russia is big (45 to 75% in more than 60% of GDOs), the issues of workforce are particularly relevant for almost all the gas facilities. According to expert estimates, more that 50% of the GDO staff are under-qualified personnel. The current funding and to a certain extent organizational work of some organizations are insufficient for engagement, training and retention of highly qualified workforce in GDOs.

The accident rate in GDOs is quite high. According to OJSC Gazprom Gazoraspredelenie, the most frequent reasons for accidents and incidents in gas distribution are running-down accidents (29.4%) and mechanical damages when doing earthworks (18.7%). Based on the number of accidents associated with interference by unauthorized persons, the percentage of accidents and incidents associated with human intervention is more than a half (52.8%) of the total number of accidents and incidents. The problem of unauthorized persons' intervention is also extremely relevant abroad, where special measures are being developed for the solution thereof.

The need of renovation is growing. Today, the operating life of 6.4% (21.4 thousand km) of the steel underground gas pipelines is more than 40 years, 11% of the gas pressure reduction stations have been operating for more than 20 years and 12% of ECP units have been operating for more than 15 years. More than 11 thousand km of external gas pipelines that require electrochemical protection have none.

Still there are ownerless gas pipelines; however, their number is decreasing. Because the costs for maintenance of such ownerless gas pipelines are not included in the tariffs, and percentage of such gas pipelines in some facilities can be significant – up to 35% (2.2% on the average), this situation has a direct negative effect on gas distribution economic efficiency.

Automated control systems are being implemented too slowly.

Thus, to avoid a systemic crisis in gas distribution sector in the current conditions, active measures must be taken to improve the GDOs' efficiency performance and their technical policies.



Methods

According to the Concept objective, the technological development of the gas distribution systems shall provide a target level of their safety and reliability upon improvement of the GDOs' efficiency performance relating to natural gas transportation. To achieve the objective, some tasks of efficiency improvement for some of the GDOs' business processes must be solved (including construction, renovation and technological modernisation, maintenance and repairs).

When solving the Concept tasks, the following principles are met:

- Integrity that presumes comprehensive task solution, including legal, regulatory and methodological, technological, resource-related, and organisational aspects.
- Standardisation and unification of technological solutions and methodological approaches that ensure consideration of all necessary requirements for developments and cost reduction.
- Synchronisation of technological development of gas distribution systems with development of the Unified gas supply system and in accordance with regional and territorial gas supply schemes.
- Compliance of technological development of gas of distribution systems to the basic directions of the research and development policy of JSC Gazprom, as well as to the basic principles and directions of participation of JSC Gazprom in the gasification regions of Russia and management of the GDOs.

The basic tasks of the technological development of gas distribution systems and ways (actions) for their solution with respect to the life cycle stages of the gas distribution systems are provided below.

Design and Construction

The tasks to be solved at this stage envisage provision of required and projected quantities of gas transportation; provision of necessary level of reliability and safety of gas distribution networks; implementation of solutions facilitating transition to the operation of the gas distribution networks based on their actual technical condition; minimisation of life cycle cost of the entire projected systems (facilities); improvement of gas distribution energy efficiency.

In order to improve efficiency of works on design and construction, organizational activities shall be performed aimed at synchronisation of construction inter-village gas pipelines and intra-village distribution networks; improvement of current problem solution practices associated with obtainment of permit documents and registration of rights in land; establishment of regulatory framework and improvement of GDOs' technical supervision over construction gas distribution facilities; improvement of GDOs' technical control of performance of construction and installation works up to the supervision of performance of construction and installation works; control over energy efficiency upon design and construction; development and implementation of total quality management for design and construction .

Design and construction is oriented on the wide use of advanced technologies and solutions that provide safe and efficient gas distribution within the entire life cycle of gas pipelines, including: polymer technology, new materials for gas pipelines that require no ECP (reinforced polyethylene, glass-fibre plastic, polyamide, fosta nylon, corrosion-resistant metals etc.); equipment that requires minimal maintenance and extended warranty period and service life (GDS, valving, ECP); technologies and equipment which efficiently utilize gas and facilitate energy saving; ball valves with extended rods; automated process control systems (APCS), modern methods of trenchless pipeline construction in the space-limited environment and while overcoming natural and artificial obstacles; active use of the technical solutions that provide gas distribution network shutdown when specified gas flow rate is exceeded ("gas-stop" system, etc.), independent and emergency power supply; 100% electrochemical corrosion protection of underground steel pipelines which are being built in cities and urban settlements; required partitioning with installation of adjustable bridges,



preferable installation of cathodic protection stations that provide operation in the mode of automatic maintenance of potential; installation of metering stations for all consumer categories, and use of up-to-date methods of identification of and signage for gas pipelines routes etc.

The foregoing directions require additional research in the field of forecast and substantiation of development of regional (municipal) gas supply systems with respect to improvement of methods for drawing up prospective fuel and energy balances of the regions (municipal entities) based on the forecast of their social and economic development; development of efficiency assessment methods and methods of substantiation of criteria to compare alternative gasification options (using network gas, liquefied gas, compressed natural gas, or liquefied hydrocarbon gas); development of efficiency assessment methods for gasification of a region or municipal entity; development of recommendations for application of autonomous and emergency power supply sources for gas distribution facilities.

Operation

At the stage of operation of gas distribution systems, the following tasks are stated to GDOs: a stepwise change to the operation of the gas distribution networks based on their actual technical condition; provision of necessary level of reliability and safety of the gas distribution systems; reduction of operating costs during transportation of gas via gas distribution networks; improvement of energy efficiency of gas distribution.

Analysis of existing limitations of the repair and maintenance methods used in the gas distribution systems has shown that a systematic approach to the organizational management of maintenance and repair works is required to be applied.

The modification of organisational structure of maintenance and repair works should include: allocation of works related to the regular instrumental inspections of gas pipelines to monitor their technical condition into a basic scope of works, implementation of a new generation equipment, instruments and tools, improvement of mobility when inspecting gas pipelines, usage of computer equipment; modernization of the currently existing anticorrosive protection system and repair and maintenance of thereof; a gradual change from an annual preventative maintenance of stop valves and processing equipment of GDS (regardless of its actual technical condition) to new schedules of repair based on the monitoring of the actual technical state; transition to a low-maintenance equipment; application of more efficient equipment and devices for internal pipe inspection of underground and underwater pipelines, energy inspections and energy audits of GDOs etc.

The following is planned to be used in operation: up-to-date equipment for repairs and quality control of polyethylene gas pipelines; equipment for tie-in connections under pressure; new generation sealing materials for releasable joints of gas pipelines and gas pressure reduction stations; technologies for continuous monitoring of technical condition of external gas pipelines; new generation cabinet- and block-type gas reducing stations; telemetry equipment and information technologies for production control etc.

Renovation and Technical Upgrading

The main tasks of renovation and technical upgrading are: provision of flow efficiency and normal performance of all facilities of the gas distribution networks based on the quantities of actual and prospective gas consumption; implementation of solutions facilitating transition to the operation of the gas distribution facilities based on their actual technical condition; life cycle cost reduction of renovated facilities providing a proper level of their reliability and safety; improvement of characteristics and technological level of operation of the gas distribution facilities; transition to a whole new level of operation of facilities of the gas distribution systems due to the implementation of APCSSs; provision of resource and energy saving.

The implementation of the following organisational activities shall facilitate the accomplishment of the tasks: coordination of renovation projects and development of facilities of the Unified gas supply system and territorial gas supply schemes; change from the strategy of “renovation of separate facilities” to the “comprehensive renovation strategy”,



i.e. renovation of separate facilities considering a possibility of renovation of the entire section of the network to which such facilities belong, with matching to actual gas supply schemes of a populated locality or entire region; monitoring of new technologies and evaluation of their technical and economic efficiency; refinement of new technologies of renovation and technological upgrading of gas distribution systems, as well as adaptation of prospective foreign technologies to the Russian conditions at pilot GDOs as agreed upon with the national supervisory authorities; development and active use of special test facilities, for example, validation of modes of welding, tie-in connections, diagnostics technologies, corrosion protection, repairs etc; development of necessary regulatory and methodological documents for use of new technologies, materials and equipment in the event of positive results after testing thereof; strengthening requirements for the control of completed construction and installation works; implementation of methods and software to draw up the plans of renovation considering risks of possible occurrence of accidents and incidents in gas distribution facilities.

For the renovation and technical upgrading of gas distribution systems, the following specific technologies should be used: "pipe-in-pipe" broach, when a new segment of a polyethylene pipeline is pulled through into the shank bore of a pipeline under repair; broaching of a pre-profiled polyethylene pipeline (for example, «U-liner»), when a profiled polyethylene segment is pulled through inside a pre-cleaned pipeline under repair, followed by its straightening; "Phoenix" broach, when a synthetic jacket is pulled through into a pre-cleaned pipeline. As soon as the synthetic jacket has been pulled through, it will be polymerized and form on the inner surface of the pipeline a durable inert layer of adjustable thickness; the method of tie-in connections under pressure is an alternative that enables to connect pipe bends without interrupting the transportation of natural gas through the pipeline.

Gas Distribution Regulatory Framework

Improvement of the gas distribution regulatory framework must be made in close interrelation with the transition of Russia to a new system of technical regulation within the framework of implementation of the Federal Law *On Technical Regulation*, adoption of specific technical regulations in the field of gas distribution and gas consumption, and development of the national standardisation system, including in terms of its harmonization with the West European standardisation system.

Among the regulatory documents, to which development special attention must be paid for the transition to the operation of the gas distribution facilities based on their actual technical condition, are: methods for assessment of technical condition of facilities and gas distribution systems; accident risk assessment methods; methods for assessment of reliability and safety of gas distribution systems and individual facilities; procedures for implementation of new technologies, materials and equipment at currently operating gas distribution facilities.

Improvement and development of the gas distribution regulatory framework will serve as a basis for the direct technological development of the gas distribution systems, modernization of fixed assets of the GDOs, improvement of safety and reliability of gas distribution, efficient use of gas and reduction of its losses.

Information Support

Most methods that are being developed for the Concept implementation and that facilitate transition to the operation based on actual technical condition depend on available complete, authentic and timely updated information. Collection, processing and storage of such information must be reasonably organized within the framework of a single information space of the GDOs. The single information space of the GDOs presumes a multi-level distributed database integrating information systems (Geoinformation systems, SCADA-systems, accounting systems etc.) currently used and projected for the implementation in the GDOs. Creation of the GDO single information space will enable to improve efficiency of business processes in organisations; and will provide an opportunity to receive necessary information to exercise reasonable managerial decision-making.



The gas distribution information database must include without limitation: data on the companies that operate gas facilities of the Gazprom Group (main technical characteristics of GDOs); data on consumers and gas consumption quantities; data on all gas distribution facilities; reference data on technical and economic characteristics and manufacturers of equipment and materials; reference data on gas distribution regulatory and methodological documents etc.

The software for the gas distribution information database must provide a common interface, opportunity of data exchange, storage and analysis of information. Configuration and characteristics of the gas distribution information database must be defined under the GDO individual information system development strategy.

Workforce Preparation System

The contemporary level of the gas distribution technological development imposes even higher requirements for improvement of knowledge, skills and competencies of the GDO executives, specialists and workers. The GDO staff composition in Russia is heterogeneous and significantly varied because of the existing in practice organizational and managerial structures of some GDOs and their lines of business. A whole new composition and level of qualifications of the GDO staff is needed to make a transition to the operation system based on actual technical condition of the gas distribution facilities.

The current situation in the field of the GDO staff vocational education requires regulation through the establishment of the Uniform Workforce Preparation System for the gas distribution organizations on the basis of the current Continuous Vocational Education and Training System of JSC Gazprom.

The proposed workforce preparation system must cover both technical personnel of the GDOs and other qualifications in the GDO staffing structure (including accountants, financial specialists, legal advisers etc.) in terms of improvement of knowledge and skills associated with the gas distribution specificity.

The organisation of the Uniform Workforce Preparation System will enable to optimise the GDOs' material costs associated with vocational education and staff retraining; ensure functioning of the continuous vocational education system with coordination of the issues of training, retraining, primary and secondary assessment of the personnel; provide development of uniform training programmes (package of programmes for the personnel of different specializations, different levels of qualifications as well as for typical conditions of the GDO activities); coordinate the work of teaching and training centres (territorial test facilities, laboratories); provide unification of qualification requirements for the GDO personnel and monitoring of professional qualification of the GDO specialists; and to improve personnel motivation system.

The necessity of engagement and motivation of young specialists is of special importance. Therefore, the publication of special edition textbooks must be arranged in addition to creation of the uniform programmes, for the development of which engagement of representatives of research and development organisations and centres, and profession-oriented schools are required.

Results

In order to implement the adopted strategy for operation of the gas distribution systems based on their actual technical condition, the Gazprom Group has completed the following activities for the recent two years.

Regulatory Framework Development.

The regulatory framework in the field of gas distribution and gas consumption is being created within the framework of implementation of the laws *On Technical Regulation*, and *On Industrial Safety of Hazardous Production Facilities*, adopted technical regulations, and national standards and rules that are being developed at the sectoral level.

JSC Gazprom and their companies perform purposeful work on creation of the industry-based regulatory framework with respect to the issues of reliability and safety of gas distribution systems. For the purposes of the implementation of the adopted strategy for the



transition to the operation based on actual technical condition, the main attention is focused at present on the development of methods for the calculation of reliability and risk indicators, setting their rates, and reliability control.

Today, the following has been developed: indices of reliability, maintainability, reliability of the gas distribution network; methods for the calculation of reliability and evaluation of failure effects, rates for reliability indices; methodological approaches towards reliability control etc.

A complete regulatory framework for assessment of technical condition of the gas distribution facilities and forecasting risks in their operation will be created by JSC Gazprom during the period of 2012–2013.

Pilot Project

For the purpose of preparation of organizational and technical conditions for the transition to the operation of the gas distribution networks based on their actual technical condition, preparation and validation of a model plan of action, administrative documents, proposals on the structure and management of resources, the GDOs plan to implement a pilot project by the example of the gas facilities of the Republic of Tatarstan. The project results will be replicated thereafter for the gas distribution systems of the Gazprom Group.

The project provides the following implementation stages: evaluation of technical condition, condition of reliability, organisation of operation, adequacy of equipment of the gas distribution system; calculation of projected indices of reliability and efficiency of the operation of the gas distribution system; drawing up proposals on the transition to the operation based on actual technical condition; drawing up a model plan of action for the Russian GDOs.

The standardization system documentation of JSC Gazprom and OJSC Gazprom Gazoraspredelenie on provision of reliability and GDOs' efficiency performance will serve as the regulatory framework for the project. The project implementation period: 2012 – 2013.

Information Database and Monitoring

For the last years, JSC "Gazprom promgaz" has been creating information and analytical database on technical condition of the gas facilities of Russia, indicators of GDOs' business, reliability and industrial safety of facilities of the gas distribution systems.

Collection and analysis of statistical information about characteristics of the gas facilities of Russia, elements of its economic activities is performed within the framework of the monitoring system of JSC Gazprom and OJSC Gazprom Gazoraspredelenie and is used when creating the programmes of construction, renovation and technological upgrading, when developing standardisation system documents, project documentation etc.

At present, a project of development of a single information and technological space for the dispatcher services of the Gazprom Group of Companies is being implemented. The project envisages that gas transportation companies, gas distribution organisations, and gas selling companies will be united in the single information and technological space.

OJSC Gazprom Gazoraspredelenie has developed a programme of automation of technological facilities for the period of 2011 – 2015. Within the framework of the implementation of the programme, equipping of the gas pressure reduction stations, electrochemical protection units, and block valve stations with the telemetry systems is being made.

The implementation of the automated systems at the facilities of the gas distribution systems will enable to avoid contingency situations due to the correct setting of threshold values of technological parameters and timely detection of their emergency changes; to avoid incidents at the facilities of the gas distribution networks by means of unauthorized access alarm system; to receive statistical material in the form of technological parameter change diagrams (pressure, temperature, gas flow rate etc.) and to use it when setting parameters of facilities of the gas distribution networks, to plan technical maintenance and repair of equipment; reduction of response time of emergency services, reduction of scopes of periodic walk-round checks, and to release transport and human resources etc.



Application of Up-to-Date Technologies and Equipment

The key issue of the concept of the operation based on actual technical condition is the implementation of innovative technologies and methods for identification of technical condition, for performance of technical maintenance and repair, renovation of gas pipelines; application of new materials, tools and equipment in the gas distribution sector of Russia. The report includes examples illustrating application and implementation in practice of construction and operation of gas pipelines made of polymer materials, systems of independent power supply to gas pressure reduction stations, gas distribution pipeline technical condition control system, GDS and ECP parameters control system, controlled directional drilling, use of ball valves with extended rods, excess flow shutdown system ("gas-stop" system), non-metallic jackets, non-detachable electrical insulating joints, special technologies for renovation ("pipe-in-pipe" broach technologies, broaching of a pre-profiled polyethylene pipeline, "Phoenix" broach method, method of tie-in connections under pressure etc.

Human Resource Policy

With the adoption of the Concept, priorities change in the human resource policy of the Gazprom Group of Companies. The weight shifted to the issues of maintenance of relevant level of knowledge, skills and competencies of the personnel, as well as to the issues of preparation of the future workforce in education institutions and development of efficient motivation package.

The concept and the programme of development of the human resource and social policies of OJSC Gazprom Gazoraspredelenie and their associated companies have been designed to provide a complete set of actions for selection, assessment and use of the personnel, training, development, and motivation thereof. Documents of the system of education and development of the employees of OJSC Gazprom Gazoraspredelenie, recommendations for adaptation and vocational education of young specialists, and training programmes have been drawn up.

Conclusion

Since 2008, JSC Gazprom has been carrying out research and development activities aimed at creation of the regulatory framework for implementation of new approaches to the planning of production and economic activities of the GDOs based on the necessity of provision of reliability and safety of the gas distribution systems. Such activities have been approved as priority research and development works of JSC Gazprom.

Similar approaches have been actively developed and implemented by foreign gas distribution companies.

A Concept of technological development of the gas distribution systems was developed by the initiative of JSC Gazprom in 2009. The necessity of its creation had been caused by certain challenging trends in the gas distribution development in Russia. A strategy proposed by the Concept for maintenance of the gas distribution facilities envisages reduction of the scope of scheduled maintenance, redistribution of resources available with the GDOs for maintenance of the most critical sections in terms of technical condition and importance.

Optimization and redistribution of resources is being made by ranking of the gas distribution facilities, costs for their maintenance and repair depending on risk and reliability criteria. A necessary component of the adopted strategy is application of up-to-date technologies, materials and equipment, efficient tools of monitoring and diagnostics of technical condition of facilities, control systems at each stage of their life cycle.

Preparation of conditions for the implementation of the adopted strategy and related tasks of scientific, methodological, information and organizational nature becomes a key task of the current period.