PRESENT-DAY SYSTEMS OF MECHANICAL SERVICING GAS PRODUCTION FACILITIES AS BASIS FOR BASIC ASSETS MANAGEMENT

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ABSTRACT

Modern systems of technical maintenance of gas producing facilities are studied as the main constituent of capital funds management concept. The paper demonstrates new approach to capital funds management where (in contrast to conventional approach) technical maintenance on the basis of actual state and respective reliability management are presented. Such approach allows to raise efficiency of capital assets of gas producing equipment and in combination with the expenditure management system to increase economic parameters of operation.
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1. BACKGROUND

In implementation of Gazprom’s strategy of reducing gas production costs improvements in the use of the production basic assets (in construction, operation and repair) are urgently needed.

The goal is set out in the following way: to insure the efficient functioning of the basic facilities and to maintain their technical state at the level sufficient for realization of short-term and long-term production plans while capital assets recovery is economically feasible.

This goal is met by creating an industrial system of capital assets management and diagnostic service of the gas production facilities.

Gazprom is the owner of major assets for production of gas, gas condensate and oil which are in operation for a long time. That leads to the production facilities deterioration and increase of expenses for repair and maintenance. In such situation it is important to solve an optimization problem of reducing costs. It is obvious that this is a multifactor problem which combines technical, economic and organizational matters. The paper focuses on the technological component.

The algorithm for solving the said problem is presented in Fig. 1

![Fig. 1 – Gazprom’s strategy of the basic assets management in gas production](image)

2. CONCEPT OF THE BASIC ASSETS MANAGEMENT OF THE EQUIPMENT AND PIPELINES

The concept of the basic equipment assets management provides for solving the interrelating tasks of the gas production equipment optimum operation with minimum costs and is aimed at (Fig. 2):

- enhancing the efficiency of assets and funds utilization;
- creating the basic assets management system on the basis of a progressive “maintenance-by-technical-status” system;
- developing the cost management system which uses the results of the basic assets management system;
- setting up of managerial decision-making system.

For this purpose stage 2 (maintenance and rehabilitation of the equipment technical status) represented in the diagram on Fig. 3 is the most labor-intensive stage of the concept development.
Development of the basic assets management system is currently carried out in several industries and creation of such a system allows for solving the aforesaid basic tasks and also some minor specific tasks including:
- reduction in the equipment idle time due to more skillful maintenance and repair;
- formation of a complete catalogue of assets and funds;
- fixation of a complete equipment history for subsequent analyses;
- more efficient employment of the personnel;
- optimization of the material and technical supply chain;
- complete accounting of maintenance and repair costs;
- transfer to management with focus on the process of production.

Fig.4 presents the basic assets management system. Unlike the systems with basically accounting and planning functions this system is a production oriented one, and it makes it possible to introduce in practice such advanced methods as:

- preventive protective maintenance and repair;
- optimization of the material and technical supplies service;
- maintenance and repair management closed loop (permanent improvement);
- technical servicing according to the actual status;
- reliability management.

![Fig. 4 – Basic assets management system](image)

The output information of the basic assets management system is used to develop the costs management structure, which considers:

- policies and objectives in the cost management;
- planning and management account system;
- technical-organizational provision of the cost management;
- analysis and detection of reasons for actual versus planned parameters bias;
- making corrective decisions and improving of cost management.
As one can see this system describes the planning-managerial functions. When the basic assets management system and the costs management structure are available the Company development strategy for the short-term period (for 3 and 10 years) is made possible.

3. MAINTENANCE AND REHABILITATION OF THE TECHNICAL STATUS OF GAZPROM’S GAS PRODUCTION FACILITIES

Analysis of field operational data of process equipment and pipelines within JSC Gazprom demonstrates that highly efficient and safe operation of dangerous production facilities cannot be achieved without a system of special measures to enhance reliability. Besides, the current stringent requirements of environmental protection, technical status level and high reliability of the dangerous production facilities urge to necessarily develop and introduce the diagnostic assistance system insuring the reliable operation. The basic components of the maintenance system are:

- information technology;
- acquisition of the structured data on equipment (works, plant, function, unit level);
- planning and work control (work operations, execution periods);
- diagnostic assistance system.

Implementation of the maintenance and repair of equipment and pipelines according to the actual status based on the results of diagnostics is a matter of principle for the basic assets management system. This provides for the possibility of motivated planning of scopes and periods, which will result in reduced operational costs due to decrease in services and failure number. The main elements of technical servicing according to the technical status are:

- technical status monitoring (evaluation of the technical status of field pipelines and equipment and comparison of actual parameters with the design ones);
- technical services (maintaining field pipelines and equipment in the operable and serviceable condition during operation);
- repairs (a series of operations to restore the serviceable and operable condition of field pipelines and equipment);
- replacement of equipment (works to remove from service, dismantle and remove the equipment and replace it with the new one).

The required conditions for transition to servicing according to the actual state are:

- economic expediency;
- instrument basis;
- procedure for appraisal of prediction of technical status;
- trained personnel.

The basic elements of the maintenance according to actual state are:

1. Equipment is provided with manufacturer’s defined technical status parameters (admissible, alarm and critical parameters levels standardized by the manufacturer’s instruction);
2. Intermittent control of parameters (monitoring is planned automatically);
3. Records of the parameter history are kept and monitoring of the exceeded admissible levels is provided;
4. When the admissible parameter level is achieved, the specialist takes a decision about equipment shutdown or the period and further operation conditions of equipment, type, time and volume of maintenance works or repair.

Important factors of the process equipment and pipeline reliability requirements are specific features and conditions of their operations. Above all, these are corrosive environment, temperature fluctuation, dynamic loads and (under Arctic conditions) frost heave. Special attention is paid to the operating environment of equipment and pipelines on the H2S and CO2 – containing fields due to risk of being cracked and destructed.
Based on these specific features one should establish a system of servicing according to technical status. In this connection one must decide what kind of inspection (diagnostics) in terms of scope, types, efficiency is needed for the technical status analysis.

The organizational structure of the integrated technical inspection of the gas production and processing facilities technical status must be based on the centralized control system. This system consists of the central managerial bodies, gas-producing and gas-processing enterprises, specialized inspecting organizations (Orgenergogaz, VNIIGAZ, etc.).

Draft of the inspection structure can be divided into four interaction levels:

1. Interaction between Gazprom’s departments in elaboration of strategic plans of the sector development on the whole, and also planning research activities.
2. Interaction of the gas, gas condensate and oil production Department with gas-producing enterprises in adjustment of strategic plans of the enterprise development.
3. Interaction of gas-producing enterprises with other organizations (prospecting, research, of experts) for provision of the equipment diagnostics assistance.
4. Interaction of Gazprom’s departments with research organizations in creation of new equipment and technologies both in the area of principal activities and in the areas of diagnostics assistance and development of new control schemes.

Under Gazprom’s guidance the activity to create diagnostics assistance systems should be aimed at enhancing gas industry cost–effectiveness through extensive use of integrated diagnostics of up-to-date achievements of science and technology in instrumentation, communication, aviation and space.

4. CONCLUSION

1. JSC Gazprom has performed development of an up-to-date system of the basic assets management and gas production facility diagnostics assistance capable of considerable enhancement in the equipment operation quality, extension of its service life and optimization of the entire process of procurement, construction, operation and brining into repairs field and gas-processing enterprise equipment.

2. Maintenance of the equipment according to its technical status with required diagnostics and inspection checks is the foundation of the basic assets management system.

3. The efficiency of maintenance according to technical status is determined by the level of diagnostics means and by the organizational, regulatory and engineering documentation. The industry uses “Regulation on Organizing the Diagnostics Assistance of the Process Facilities for Extracting Gas, Gas Condensate and Oil from the Deposits of Gazprom’s Subsidiaries” and “Provision on Accreditation of the Specialized Organizations for Carrying out the Equipment Diagnostics …”.


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Fig. 2. Concept of the basic assets management for the gas production equipment
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