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Improving the Efficiency of Underground Gas Storage Facilities Created on the Basis of Depleted Hydrocarbon Deposits

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ABSTRACT: The article examines the issues of creating an underground gas storage facility, with the aim of regulating seasonal unevenness in gas consumption and thereby increasing the reliability of its supply to the consumer, which is an effective approach to using the remaining reserves of depleted hydrocarbon deposits.

KEY WORDS: natural gas, underground gas storage, modernization, fields, horizon, operation, storage volume

I.INTRODUCTION

Recently, consumers in Uzbekistan have been experiencing a shortage of natural gas supplies during the winter season. The study of this problem showed that its solution is determined by the implementation of the following system-related tasks [1]:

- reconstruction and modernization of the republic's gas transportation system for the efficient organization of gas supplies to consumers;
- increasing the volume of natural gas storage in underground gas storage facilities to organize its supply to consumers during the winter season.

The solution to the above-mentioned problems is expected to be achieved by increasing the efficiency of operation of underground gas storage facilities (UGS) created on the basis of the depleted Gazli and Khodjaabad oil and gas condensate fields, and by increasing their storage volumes [2].

II.METHODOLOGY

For this purpose, the work [1] proposes a concept for attracting investments and volumes of natural gas, including gas from the neighboring states of Turkmenistan and Kazakhstan, to increase the active volumes of the Gazli and Khodjaabad UGS facilities and the effective development of oil and gas horizons of the Gazli field.

The relevance of solving the problems under consideration is dictated by the results of an additional study of reserves and their assessment at the Gazli and Khodjaabad fields, which showed the sufficiency of the current resources of their hydrocarbon raw materials for the effective modernization of gas storage facilities, with the aim of increasing its supplies, including for export, in the winter season from the Gazli gas transportation hub to 11.0 billion m^3, taking into account foreign sources [2].

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Further development of the gas and oil horizons of the Gazli field will make it possible to increase the volume of natural gas production at the expense of the remaining reserves to cover the deficit in its supply to consumers, as well as to increase the volume of oil production to replenish the refineries in order to replenish the country's oil products.
The available geological materials reflect the potential of the Gazli field, but for the subsequent operation of the UGS and the production of oil and gas, additional exploration work and geological study of all horizons are required, using modern technologies for geological exploration drilling, geophysical and petrophysical studies, and the construction of geological and hydrodynamic models of the dislocation of residual geological reserves and their volumes.
The paper [3] proposes solutions for further exploration and modernization of the Gazli field, including:

- extraction of up to 10 billion m³ of gas per year from horizon IX with drilling of horizontal wells to increase gas storage volumes in underground gas storage facilities;
- gas production from X - XIII horizons up to 1 billion m³ per year with drilling of vertical wells;
- increasing oil production from the oil rim XIII horizon up to 105 thousand tons per year with drilling of horizontal wells.

The overall scale of the modernization of the Gazli field, taking into account the concept, is expressed in an increase in:

- the volume of gas storage in UGS facilities is approximately 58 billion m³ (stage I – 33 billion m³, stage II – 25 billion m³);
- total volume of commercial gas produced at 7.4 billion m³;
- the total volume of commercial oil produced by 0.5 million tons.

Total investment costs for the modernization of existing facilities, construction and development of new facilities at the Gazli field are expected to be up to $858 million or, taking into account financial costs during the investment period, up to $885 million [2].
The Gazli field is located in a strategic gas transportation hub, which makes it possible to regulate natural gas supplies in three main directions [1]:

- Uzbekistan-China (PRC);
- Gazli-Chimkent (Kazakhstan);
- Central Asia-Center (Russia).

Taking into account the availability of industrial infrastructure at the Gazli UGS facility, as well as the possibility of supplying natural gas to this UGS facility from both the fields of Uzbekistan and the fields of Turkmenistan and Kazakhstan in the summer season [1], the paper [2] proposes a solution to three interrelated problems for the most efficient use of the existing potential of the field in four main types of activity:

- storage of natural gas produced in Uzbekistan for supply to domestic consumers during the winter season;
- storage of natural gas supplied by foreign companies from their sources, as well as under joint venture and production sharing agreements (PSA) projects, with the organization of deliveries for export during the winter season;
- restoration of natural gas production from residual geological reserves of gas horizons, based on the results of additional exploration work;
- a significant increase in the volume of oil production from the oil rims of the XIII horizon, in order to reduce the import of oil raw materials and increase the workload of oil refineries in Uzbekistan.

The increase in gas storage capacity in the Khodjaabad UGS facility is aimed at reducing the unevenness of natural gas supplies to consumers and meeting the needs of the population and industrial sector of the Fergana region [4].
At the same time, it is envisaged to redistribute the volumes of gas supplies via the GTS from the fields of the Bukhara-Khiva region to the Tashkent industrial hub with a reduction in gas supplies in the winter period to the Fergana region.
In order to increase the volumes of active natural gas from 0.9 to 1.82 billion m³ per season, a set of scientific, technological, technical, economic and financial solutions has been developed on the possibilities of modernizing the Khodjaabad UGS [5].
Analysis of actual performance indicators of the Khodjaabad UGS shows the presence of additional pore volumes in the operational facilities XIX - XXII horizons, which predetermined the possibility of re-evaluating the parameters of UGS operation with an increase in the volume of active gas from 0.9 to 1.82 billion m³ [5].
Of the options considered, the most acceptable for further implementation is the combined option, which provides [5]:

- drilling of additional production wells in the amount of 59 units, including: XIX horizon – 26 units; XX -

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XXII – 33 units;

- total gas storage volume - 3.106 billion m³, including: active gas 1.82 billion m³; buffer gas - 1.277 billion m³;
- The maximum reservoir pressure in the production facilities is 250.0 kgf/cm², the minimum is 49.0-70.0 kgf/cm².

The period for bringing the storage facility into cyclic operation with an investment capital of 432.745 billion sum is 5 years [5].

III.CONCLUSION

1. The creation of an underground gas storage facility, with the aim of regulating seasonal unevenness in gas consumption and thereby increasing the reliability of its supply to the consumer, is an effective approach to the use of residual reserves of depleted hydrocarbon deposits.
2. The increase in the efficiency of UGS operation in Uzbekistan is due to the modernization of the existing gas transportation system of the republic, along with the increase in the active volume of existing gas storage facilities.

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