APPLICATION OF MODERN METHODS TO INTENSIFY HYDROCARBON PRODUCTION

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ABSTRACT

The article briefly describes the results of the oil and gas industry in recent years and some problems, negative trends associated with objective and subjective reasons, and their consequence, such as reducing the volume of oil and gas condensate production and natural gas .

In addition, the technology to increase production efficiency through the use of rational field development systems, the widespread introduction of modern methods such as hydraulic fracturing.

Key words: fractured rock, hard-to-recover reserves, low-permeability, weakly drained, productive formation, intensification, production, depletion, low production, preserved, rock, pressure, injection, fluid, fields, heterogeneous, dissected reservoirs, development, injection well, hydraulic fracturing.

INTRODUCTION

Although the oil and gas industry occupies a leading place in the economy of the Republic, the industry has a declining trend in hydrocarbon production and as a consequence of this, various problems have arisen, such as with the deterioration of the geological conditions of production and the increase in the costs of extracted energy and mineral resources, falling volumes of oil and natural gas[1].

The industry implements projects to further increase hydrocarbon production associated with the replenishment of reserves and increase hydrocarbon production by attracting advanced technologies of the world oil and gas and oil service companies, conducting exploration work in poorly explored and complex subsurface areas, intensification of production at depleted, low-yielding mothballed and developed oil and gas fields with hard-to-recover reserves.

In order to develop appropriate measures to address the challenges faced by the industry, it is necessary to conduct sufficiently thorough and objective scientific research, since the study of problems will allow developing a set of measures to address them.

Uzbekistan has a significant hydrocarbon potential that allows implementation of long-term projects. According to expert estimates, the country possesses about one third of all mineral resources of Central Asia, and in terms of gas production it is one of the twenty world leaders.

Today there are 243 hydrocarbon fields in the country, 111 of which have been discovered in the last 20 years, 15 of which were developed by foreign investors. Of the total number of fields, 104 are under development.

Along with the positive results of the oil and gas industry in recent years, there have been problems and negative trends due to objective and subjective reasons, and their consequence was a decrease in the production of oil and gas condensate, as well as natural gas. Oil production in the Republic has been decreasing since 2002, while consumption has only been increasing. During the 1990s of the 20th century, oil production increased sharply.

In 1991 to 8.1 million tons by 2002.

According to experts, the objective reasons for the steady decline in oil and gas condensate production can be attributed to the depletion of the reserves of existing fields, with the current volume of recoverable reserves of liquid hydrocarbons not exceeding 0.1 billion tons (the reserve-to-current production ratio is 18.9) [1]. In addition, the reason is also considered to be the limited resource base and the unsuccessful exploitation of existing reserves in the first years of independence.

Also, there are problems associated with various production technologies, such as extraction of residual hydrocarbon reserves from fields with complex geological conditions.

It is known that nowadays hard-to-recover oil and gas reserves confined to low-permeable, poorly drained, heterogeneous and dissected reservoirs are widely involved in development.

It is possible to increase production efficiency by applying rational field development systems, broad introduction of modern methods of oil and gas recovery enhancement, as well as by control and regulation of development process, ability to effectively use the technology, which is really necessary for efficient field development.

TECHNOLOGY

It is known that hydraulic fracturing is one of the effective methods of increasing productivity of the wells penetrating such reservoirs and increasing the hydrocarbons recovery rate.

Hydraulic fracturing has two main goals:

- improving reservoir productivity by increasing the effective drainage radius of the well;
- creating a high permeability flow channel in the damaged bottomhole zone.

As a result, the production rate of producing wells or injectivity of injection wells increases manifold due to reduction of hydraulic resistance in bottomhole zone and increase of filtration surface of the well, as well as the final hydrocarbon production increases due to recovery of poorly drained zones and interlayers [2-3].

The highest efficiency of this method can be achieved when designing hydraulic fracturing as an element of development system, taking into account the system of well placement and evaluation of their mutual influence at different combinations of processing of production and injection wells. The effect of hydraulic fracturing is different in the work of individual wells, so it is necessary to consider not only the increase of flow rate of each well due to hydraulic fracturing, but also the influence of the relative location of the wells, the distribution of reservoir heterogeneity, etc. [4].

Based on that, for further effective development of oil and gas fields, let's consider the technology, which today is considered not only modern but also necessary.

Technology of hydraulic fracturing was implemented in the gas condensate fields, Chigil, Talimarjon, Ernazar, Devhona, etc., and the effective results were obtained.

The Chigil field was discovered in 2009 and gave a commercial gas flow of 125,36 thousand cubic meters per day. A total of 4 wells were drilled in the area of the field, as a result of which a deposit with commercial gas reserves was identified.

Commercial gas content of the field is associated with Upper-Middle Jurassic carbonate sediments. Hydrodynamic connection in the volume of carbonate formation is provided by fractured rocks, widely developed in the sediments of Upper-Middle Jurassic carbonate formation.

In order to study productive characteristics of reservoirs in wells 1, 2, 3 and 4, we carried out interval testing of the penetrated horizons in the cased wellbore.

A total of 20 intervals in the productive strata sediments were tested in the evaluated area. Commercial gas flows were obtained from 9 test sites with flow rates of 15.75 thousand m^3/day and weak gas flows were obtained from seven sites with maximum flow rates of up to 6.0 thousand m3/day.

In well 2, in 2019, 121 m^3 of acid was injected and hydraulic fracturing was carried out, with P_{max} = 700 atm, P_{last} =350 atm, before hydraulic fracturing the well flow rate was up to 22 thousand m^3/day of gas, after the well flow rate increased by 80 thousand m^3/day. In 2020 well 4 was injected 25% acid with volume of 148 m^3, and

hydraulic fracturing was held with P_{max} = 600 atm, P_{last}. = 387 atm, before the conduct of hydraulic fracturing the well flow rate was up to 21 thousand m^3/day of gas, after the conduct of 140 thousand m^3/day of gas. Gas, the increment after hydraulic fracturing was 119 thousand m^3/day, in well 1 in 2019, 222 m^3 of acid was pumped and hydraulic fracturing was conducted, with P_{max} = 680 atm, P_{last}. =480 atm, before hydraulic fracturing the well flow rate was up to 0 thousand m^3/day of gas, after hydraulic fracturing the well flow rate was 60 thousand m^3/day of gas, in 2019 the well flow rate was up to 0 thousand m^3/day of gas, in 2019 well 1 well was pumped up to 680 atm, P_{las}. =480 atm. In well 5 in 2019, 150 m^3 of acid was injected and hydraulic fracturing was carried out, with P_{max} = 579 atm, P_{last} . =248 atm, before hydraulic fracturing the well flow rate was up to 0 thousand m3/day of gas, after hydraulic fracturing the well flow rate was 65 thousand m^3/day of gas. Nazarkuduk field was discovered in 2009, in which commercial gas content of the field is associated with the Upper-Middle Jurassic carbonate sediments. Hydrodynamic connection in the volume of carbonate strata is provided by fractured rocks, widely developed in the sediments of Upper-Middle Jurassic carbonate formation.

In the well 11, in 2019, 240 m3 of acid was injected and hydraulic fracturing was carried out, with P_{max} = 667 atm, P_{last} = 336 atm, before hydraulic fracturing, the well flow rate was up to 0 thousand m3/day gas, after the well flow rate increased by 90 thousand m^3/day gas, the increase is 90 thousand m^3/day.

The analysis showed that the effect of hydraulic fracturing in the conditions of Chigil and other fields is quite stable, the flow rate increase is on average 65.0 thousand m^3/day, and its duration is not limited to the analyzed period. Short period of exploitation after hydraulic fracturing does not allow making unambiguous conclusions yet.

Conclusion. Based on the results and analyses we can make the following :

- fracturing technology in the Chigil field gave effective results.
- Approximately the same results were obtained at the Tolimarjon, Ernazar and Nazarkuduk fields.

But, as the statistical data and the results of scientific research show, after hydraulic fracturing is characterized by high water cut of well production, including the wells of the above mentioned fields.

In order to increase production and stabilization we recommend to make hydraulic fracturing in oil and gas fields, but at the beginning it is necessary to conduct comprehensive studies in wells and additional processing of hydrodynamic research results.

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