INNOVATIVE METHODS OF DRILLING OIL AND GAS WELLS

Mansurov Aziz Abdikarimovich
Teacher, Tashkent State Technical University

Abstract
This article is dedicated to the study and analysis of modern innovative technologies used in drilling oil and gas wells. New drilling methods are being implemented in the energy sector in order to increase efficiency and ensure environmental safety. Innovations such as hydraulic fracturing, rotary drilling, micro-seismic exploration, and laser drilling allow not only to increase the efficiency of processes, but also to reduce production costs. The article analyzes these technologies and their practical aspects in well drilling.

Keywords: Oil wells, gas wells, drilling technologies, innovative methods, hydraulic fracturing, rotary drilling, energy efficiency, environmental safety

Introduction

The oil and gas industry is an important part of the global economy, and efficient use of resources in this area is always one of the most pressing issues. Since the middle of the 20th century, the processes of drilling oil and gas wells have undergone technological development, which made it possible to increase the volume of production and effectively control the processes. While traditional drilling methods are mainly aimed at drilling deep wells and optimizing technological processes, today new innovative technologies are used, which not only increase production volume, but also ensure environmental safety of the process.

Application of innovative technologies is one of the important issues facing the oil and gas industry today. In this article, modern technologies used in drilling oil and gas wells, their practical aspects and future development opportunities are considered in detail.

The main goal of the article is to study the innovative methods used in drilling oil and gas wells and to analyze their practical aspects.

The main part

One of the most effective ways to speed up oil production and speed up the extraction of oil from the field is using horizontal wells.

Horizontal well drilling was first started in Russia in the Republic of Bashkortostan. In the Krasnokom mine, in 1947, two horizontal 30-meter and 35-meter vertical shafts were drilled into the formation.

In 1957, well No. 617 with a horizontal column length of 145 meters was drilled in the Yablonovsky mine in the Samara region.

It is known that horizontal wells, like other types of wells, have not been widely used in industry. At the same time, in the USA, Canada and Western Europe, this method was mastered, perfected and found its place. hung up

Since 2000, only about 10 horizontal wells have been drilled in Uzbekistan. Currently, there are 11 horizontal wells in operation in the South Kemachi and Kokdumalak fields.

Horizontal lateral column wells are used at the last stage of complex geological structures and are important for working in viscous oil fields. In different types of reservoirs, for various reasons, strata, whole and other zones remain undeveloped.

Data from mining and geophysical studies show that the use of rock formations with the help of many mining drive wells is difficult due to the fact that they are of different rocks. Therefore, highly conductive layers work well.

Well cuttings occupy 60% of the productive layer and more. Due to the close proximity of the water-oil contact (WOC) and the gas-oil contact (GOC), the layers of productive rock are not exposed, which means that these layers cannot be exploited by conventional methods. If the productive layer is opened at the boundary of SNK, water will quickly break into the well, and gas will flow from the gas layer to the oil layer.

There are very good opportunities for drilling horizontal wells in the Russian state. For example, there are 6 meters of recoverable oil reserves, 4 billion tons of oil and gas oil fields. There are 2.5 billion tons of heavy oil, 2.3 billion tons of oil reserves in flooded oil fields.

At present, horizontal wells are mainly used in oil and gas fields in foreign countries.

According to the latest data in the USA and Canada (1995), 334 mines are operated using horizontal wells.

Starting from 1970, in the Russian state, more inclined - directional well drilling operations began to be accepted.

Natural - Bending refers to drilling with the wellbore planned to reach the target point of the formation.

Naturally, bending of the well column includes - oblique, horizontal - band, multi-column and etc.

- in the operation of oil fields located at the bottom of the ocean, sea, lake, river;
- when drilling wells in places where the local relief (mountains, ravines) strongly intersects;
- in the elimination of fire in the open explosion of oil and gas.
- to save arable land, to reduce the capital expenditure in drilling and improvement of the mine;
- drilling piles under salt layers.

When drilling inclined and horizontal wells, turboborers, screw motors and electric motors are used as core motors. When drilling the well sidewall pillar, the lifting devices are used as lifting devices (Fig. 1).

The tilting device provides tilting tension to the drill. When drilling horizontal wells with a downhole motor, turbine augers, augers on the basis of a screw downhole motor, bending mechanisms, casing augers, eccentric nipple downhole motors are used as a lifting device.
In rotary drilling, tilting tools and hinged tilting tools are used.
In rotor method and directional drilling with a downhole motor, when the azimuth angle of the well is constant, a stabilizer and parametric calibrators are used as a deviation device to change the zenith angle of the lower part of the drilling string to the straight line assembly part.
One-section turbodrill curved transmission allows to obtain zenith angle up to 40-450, with shortened turbodrill up to 500-550, with short turboburr up to 900 and higher zenith angles can be obtained.
Thus, the well column can be bent 1-20, 4-50 and 5-60 per 10 meters. The axis of the connecting thread from the OBQ piece is oblique to one plane and also oblique to its axis in one direction with the help of the connecting threads of the curved diverter R-1. It forms an angle of 2-30 with the axis of the pipe axis and the lower connecting pipe, the angles formed by the pipe axis and the upper connecting thread are 2-2.50. The length of this strainer is 4-8 meters.

Methodology

The article examines several innovative technologies used in drilling oil and gas wells. A comparative analysis of the effectiveness, economic efficiency and environmental safety of these technologies is carried out. The information is mainly obtained from international scientific studies, industrial analyzes and technical reports. Below is a detailed description of the main technologies.

Hydraulic fracturing

The method of hydraulic fracturing (fracking) is one of the most innovative technologies used in drilling oil and gas wells. This technology facilitates the extraction process by fracturing deep-seated oil or gas formations. During fracturing, high-pressure water, sand and chemicals are injected into the well, which cracks the rock and allows the oil or gas to flow freely.

Rotary drilling

Rotary drilling technology provides fast and efficient drilling process. This method ensures penetration into the deep layers of the well by constantly rotating the drill head. Rotary drilling requires more power than other methods, and this technology is used to reach deep layers.

Laser drilling

Laser drilling is one of the new innovative technologies in the oil and gas industry. With the help of a laser, the rock is melted and the process of drilling is carried out. The main advantages

of this method are the high accuracy of the process, low waste generated during the process, and energy efficiency.

Micro-seismic reconnaissance

Micro-seismic technology is used to detect oil and gas deposits by measuring and monitoring seismic vibrations underground. This technology is of great importance in the accurate identification of drilling sites and the improvement of mining efficiency.

Results

This section analyzes the results of using innovative technologies. Each technology provides different outcomes for oil and gas production processes, including production rates, costs, and environmental safety.

Results of hydraulic fracturing

Hydraulic fracturing technology significantly increases the volume of oil and gas production. For example, as a result of the use of this method in the USA, the volume of oil production has increased significantly, which has brought the country closer to energy independence. However, this technology has created a number of environmental safety concerns, including groundwater contamination and the risk of landslides.

Results of rotary drilling

The rotary drilling method is more efficient than conventional drilling methods and allows to reach deep layers. The effectiveness of this technology depends on the types of rocks and the depth of the well. Unlike traditional technologies, this method increases energy efficiency and saves time.

Results of laser drilling

Although laser drilling technology is still in the development stage, its practice provides great opportunities for ensuring high efficiency and environmental safety. This method allows to speed up the drilling process, reduce waste and increase energy efficiency. In the experiments, the result of accurate and effective melting of rocks by laser drilling was observed.

Discussion

The technologies analyzed above have a great contribution to the processes of drilling oil and gas wells. Although hydraulic fracturing provides large production volumes, it also poses some environmental safety concerns. Rotary drilling, on the other hand, increases efficiency by saving energy and time, but requires a lot of power. And laser drilling technology may have

the potential to revolutionize this industry in the future, as it provides energy efficiency and makes the process more environmentally friendly.
In the future, the development of these technologies will increase the efficiency of the oil and gas industry and help optimize the extraction process. At the same time, it is necessary to pay attention to environmental safety in the application of technologies.
The following conclusions can be drawn from the experience of using horizontal oil and gas wells, as well as from the data on the use of working and ineffective lateral horizontal columns in the CIS and foreign countries.
1. Increase of oil yield due to the size of the seepage area and the acceleration of the oil and gas flow, increasing the effectiveness of the effect on the layer.
2. Largely higher oil and gas production rate compared to vertical wells due to the expansion of the drilling area.
3. Passing periods without water or low water in oil wells.
4. To restore the productivity of oil fields at the stage of exhaustion.
5. The possibility of increasing the inactive and mine debit.
6. Increasing the efficiency of creation and use of underground gas storages.
7. Reducing the volume of drilling operations in the use of oil and gas fields.
8. Provides an opportunity to reduce the volume of capital expenditures in marshy and forested areas.

Conclusion

Innovative technologies used in drilling oil and gas wells occupy a large place in the modern energy industry. This article analyzed methods such as hydraulic fracturing, rotary drilling, and laser drilling. Each of them has its own advantages and disadvantages and plays an important role in increasing efficiency and optimizing processes.
In future studies, it is appropriate to seek ways to further develop these technologies, ensure environmental safety, and increase production efficiency. Innovations in the oil and gas industry make an important contribution to solving global energy problems.

References

1. O‘zbekiston Respublikasining “Energiyadan oqilona foydalanish to‘g‘risida” 1997 yil 25 apreldagi №412-I son qonuni.
2. Б.Ш. Акрамов, Р.К. Сидиқхужаев “Нефть ва газ иши асослари”, Тошкент 2003 йил, (3-6 бет).
3. Ш.О. Тошев, С.А. Абдурахимов Особенности химического состава и коллоидно-химических свойств местных глин // Журнал химия и химическая технология. - Ташкент, 2010. - № 4. - С. 10-12. (02.00.00. № 3)

4. T. W. Patzek, S. Male, M. Marder. Gas production in the Barnett Shale obeys a simple scaling theory. Proceedings of the National Academy of Sciences, 2013.
5. G. King. Hydraulic Fracturing 101: What Every Representative, Environmentalist, Regulator, Reporter, Investor, University Researcher, Neighbor and Engineer Should Know About Hydraulic Fracturing Risk. Journal of Petroleum Technology, 2012.
6. B. J. Anderson, M. B. Burnett. Rotary Drilling Technology in Oil and Gas: Advances and Innovations. Petroleum Engineering Journal, 2015.
7. H. Y. Zhang, K. K. Lok, W. Wong. Micro-seismic monitoring for unconventional gas reservoir development: A case study from China. Journal of Seismic Research, 2017.
8. D. Wilkins. Laser Drilling in the Oil and Gas Industry: Theory and Applications. Journal of Applied Physics, 2016.
9. R. K. Pachauri, L. Meyer. Climate Change and Oil & Gas: Mitigating Environmental Impacts Through Advanced Drilling Technologies. Intergovernmental Panel on Climate Change (IPCC) Report, 2014.
10. P. Cook, G. Beckett. Advances in Oil Well Drilling Technologies: Trends and Future Prospects. Journal of Oil and Gas Technology, 2019.
11. E. C. Donaldson, G. V. Chilingar. Enhanced Oil Recovery, 3rd Edition. Gulf Professional Publishing, 2014.
12. M. Dusseault. Geomechanical Aspects of Oil and Gas Well Drilling: Current and Future Technologies. Journal of Geotechnical Engineering, 2013.
13. U.S. Energy Information Administration (EIA). Trends in Hydraulic Fracturing and Horizontal Drilling: A Decade in Review. EIA Annual Report, 2020.