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ANALYSIS OF ECONOMIC EFFICIENCY OF OIL RECOVERY FROM FIELDS IN BUKHARA-KHIVINSKY REGION AND WAYS OF ITS IMPLEMENTATION

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Abstract:

Currently, in the oil and gas sector of the Republic of Uzbekistan, one of the highest priority tasks is the production and development of oil and gas wells. Despite the fact that the world oil and gas community is still discussing oil and gas prices, mandatory or limited volume of oil production for the country, the supply of raw materials, the construction of gas pipelines, etc., it becomes more and more difficult to approach one common solution to the issues raised and harder.

Key words: oil economics, oil field development efficiency, directional drilling flow rate.

Introduction

From 2017 to 2020, inventories in the United States, Russia, and the Middle and Far East fell sharply, while demand for petroleum products reached an all-time record. In August and September 2021, world oil reserves fell by 7.2 million barrels to 425.4 million barrels, compared with analysts' expectations of a decrease by 3.1 million barrels. In September 2021, the demand for products supplied by the refinery, which is an indicator of demand, increased to 22.8 million barrels per day. Global production rose to 11.5 million bpd, the highest since May 2020, although weekly production is volatile and analysts tend to rely more on monthly data from the Energy Information Administration (US Energy Information Administration).

The main results and findings :

So Russia and the countries of the Middle East, according to the results of the OPEC + meeting, will increase oil production in October and November 2021 by 100 thousand bpd. The OPEC + countries agreed to adhere to the previously agreed course of increasing oil production and the decision to increase oil production in October by 0.4 million b / d. Since August 2021, the alliance has been increasing production by 400 thousand bpd per month, hoping to gradually withdraw from its obligations to reduce it by the end of September 2022. As of September 2021, they amount to 4.96 million b / s.

Now the capacities of Uzbekneftegaz allow producing about 70 billion cubic meters of gas and 8 million tons. oil. However, due to the depletion of reserves, hydrocarbon production is constantly falling. Oil production in Uzbekistan in 2018 decreased by 8.2% - to 745.4 thousand, natural gas - increased by 6.1% to 59.842 billion cubic meters. The main volumes of produced hydrocarbons are exported. Data for 2019 has not yet been released.

It is important to note that the current state program to increase hydrocarbon production in 2017-2021 was approved in Uzbekistan in 2017 by decree of Shavkat Mirziyoyev. The goal of this program is to develop oil and gas and gas condensate fields in the Ustyurt, Bukhara-Khiva, Surkhandarya and Fergana regions and increase gas production by 53.5 million cubic meters. or ea 87%, gas condensate - by 1.1 million tons and oil - by 1.9. million tons. The total cost of the program was then estimated at $ 3.8 billion, and the first stage, calculated for 2017-2018, at about $ 2 billion.

At present, Uzbekistan ranks 11th in the world in terms of natural gas production and 10th in terms of natural gas consumption. According to official estimates for 2016, the proven oil reserves are about 82

million tons, gas 1.85 trillion cubic meters. Exports of energy carriers, as well as chemical products last year amounted to over 28% of all exports of goods and services.

At the moment, the situation in the oil and gas sector of the Republic of Uzbekistan is being maintained through the policy announced by the incumbent Prime Minister Abdulla Aripov on January 19, 2020 that by 2025 it is planned to stop the export of natural oil and gas from the country, which in turn alerted all investors present in the Republic.

The Uzbek government will demand to refine oil and gas domestically "creating value-added products." This means that at least new investments will be required, not only in production, but also in such production as drilling. And this radically changes the matter.

That is why specialists have to look for new ways to solve these problems in a technical and economic way, investing ideas and resources in drilling in order to minimize the costs of a finished well for production.

This work, the topic of which is technical and economic solutions in production, is based on a reasonable and efficient well construction by drilling directional and horizontal wells. It is important to note that it is the initial well design that determines the production of hydrocarbons in one volume or another, all other things being equal. In turn, field development is based on the final production string diameter and reservoir characteristics. [5.P.9-11]

The task in the construction of any type of production well is to bring the wellbore to the design productive depths and to ensure the production of raw materials by means of communication between the bottom and the wellhead. However, well design is very important for further production and development in the fields.

By “well design” we mean the design of the well, which will be considered horizontal and / or deviated. By comparing vertical and deviated / horizontal wells, all the advantages and disadvantages in both cases can be deduced, although everything will depend on the final purpose of the well construction. Meanwhile, in our case, the ultimate goal of well construction is to increase the performance of the finished off precisely with the help of a directional or horizontal well, depending on all conditions of the field.

It should be noted that horizontal drilling is a method of well construction, in which they have a complex spatial profile, including a vertical upper interval, followed by sections with specified deviations from the vertical. [1.P.614-620] Drilling such wells allows you to quickly develop new fields, increases oil recovery, reducing capital costs and reducing material costs.

Well type selection method :

1. Analysis of vertical and horizontal wells
2. Analysis and justification of the use of horizontal profiles for the Bukhara-Khiva region
3. Evaluation of the efficiency of a horizontal well
4. Evaluation of the economic effect

Analysis of vertical and horizontal wells:

Calculation of the expected production rate of a single horizontal well:

There were 147 [Data collected according to reports provided by UzLITI, 2020] operating drilling rigs in the country as of August 2021. Of these, only 14 drilling rigs drilled directional and 5 horizontal wells.

These small numbers are due to the fact that the profitability of such wells comes at a high cost, which is justified for production wells, in which the share for all wells ranges from 30 to 55%.

A number of theoretical and experimental works by domestic and foreign scientists are devoted to solving problems of fluid flow to horizontal wells. The flow rates and cumulative production of such

wells are usually much higher than the corresponding vertical wells. However, this production does not always correspond to the calculated data. [3] Despite this, the main goal was to determine the optimal drainage parameters, based on the calculation of which the subsoil user receives information about the degree of influence of various geological and technological factors on development indicators, including the productivity of wells with horizontal completion. [2.P.212-222.]

Let's make a calculation of the input flow rate of a production well in the conditions of the J1 formation of the Shurchi field, which lies in the Bukhara-Khiva region. To do this, we will take into account the length of the horizontal wellbore by calculating the flow rate for each of the values L = 100 ... 600 m and compare it with the flow rate of a vertical well in this field.

Parameter	Meaning
Average net pay thickness, m	1,6
Oil-saturated reservoir coefficient, fraction of units	0,43
Permeability, 10-3 μm2	5,1
Initial reservoir pressure, MPa	40
Oil viscosity in reservoir conditions, mPa s	0,73
Volumetric coefficient of oil, unit fractions	1,233

Table 1.

The parameters of the Yu1 reservoir of the Shurchi field required for the calculation

Analysis and justification of the use of horizontal profiles for the Bukhara-Khiva region :

$$Q_{\text{В}} = \frac{2\pi kh * \Delta P}{\mu_{\text{Н}} * \ln\frac{R_{\text{К}}}{r_c}} \qquad (1)$$

$$Q_{\text{Г}} = \frac{2\pi kh * \Delta P}{\mu_{\text{Н}} * B\ \ln\frac{R_{\text{К}}}{r_c}} * \frac{\Delta P}{\ln\frac{4R_{\text{К}}}{L}+\frac{h}{L}* \ln\frac{h}{2\pi r_c}} \qquad (2)$$

Qw - oil production rate of a vertical well, m3 / day;

Qg - oil production rate of a horizontal well, m3 / day;

k - formation permeability, m2;

h - oil-saturated thickness, m;

ΔP - drawdown, Pa;

μ - oil viscosity in reservoir conditions, Pa · s;

B - is the volumetric coefficient of oil, unit fraction;

L - is the length of the horizontal part of the wellbore, m;

Rk is the radius of the well feed contour, m;

rc — borehole radius, m;

Next, consider an example of a calculation for a horizontal well with parameters (reservoir anisotropy is not taken into account):

L = 100 м;

Rk = 200 м;

rc = 0,1 м;

ΔP = 5 МПа.

The flow rate of a horizontal well according to the Borisov formula [4.P.215] (2):

$$Q_{\text{В}} = \frac{2\pi kh * \Delta P}{\mu_{\text{Н}} * B \ \ln\frac{R_{\text{К}}}{r_c}} * \frac{\Delta P}{\ln\frac{4R_{\text{К}}}{L} + \frac{h}{L} * \ln\frac{h}{2\pi r_c}} = \frac{2*3.14*5.1*10^{-9}*1.6}{0.73*10^{-3}*1.233} * \frac{5*10^{6}*86400}{\ln\frac{4*200}{100} + \frac{1.6}{100} * \ln\frac{1.6}{2*3.14*0.1}} = 5.87\text{м}^3/\text{day}$$

The flow rate of a vertical well is calculated using the Dupuis formula (1)

$$Q_{\text{В}} = \frac{2\pi kh * \Delta P}{\mu_{\text{Н}} * \ln\frac{R_{\text{К}}}{r_c}} = \frac{2*3.14*5.1*10^{-9}*1.6*5*10^{6}*\ 86400}{0.73*10^{-3}* \ln\frac{200}{0,1}} \ = \ 3,13\text{м}^3/\text{day}$$

The calculation results of the well flow rate according to Borisov's formulas with the length of the horizontal section L = 100 ... 600 m are presented in Table 2.

Table 2

Well flow rates, м³/day

	L, м					
	100	200	300	400	500	600
DEBIT	5,87	6,83	7,32	7,62	7,82	7,97

Evaluation of the efficiency of a horizontal well :

For this field, the well design had a short horizontal section of only 600m. Most of the wells in the fields of other oil and gas regions have a fairly long horizontal section (up to 1100 m). In this case, the production rate of the well increases many times compared to a vertical well. Based on these calculations, it can be concluded that the optimal length of the horizontal well completion for each of the boreholes is L = 600 m for the Shurchi field, the flow rate of which exceeds the flow rate of a vertical well in the same field by 2.6 times.

Economic impact assessment :

According to the estimate of the working group project of the Shurchi field, the cost of construction of one vertical well is about $ 3.2 million and the horizontal one is about $ 5.1 million.

As of 2020, the price of Brent crude oil was $ 32 per barrel. It was during this period of time that oil was produced at the Shurchi field. According to the plan, 38 and 57 days were allocated for the construction of a vertical and horizontal well, respectively. It is not difficult to calculate the cost of drilling vertical and horizontal wells per day.

For vertical 3,200,000 $: 38 = 84,211 $ per day

For horizontal 5,100,000 $: 57 = 89,474 $ per day

Let's calculate the output flow rate conditionally for one year for a vertical and horizontal well:

First, let's convert US barrels to m3:

1 US barrel = 159 liters;

1 m3 = 1000 liters.

It is not hard to calculate that 1 m3 = 6.29 US barrels.

This means that for a vertical well the cost of the volume of crude oil per day is 3.13 * 6.29 * 32 = $ 630;

For horizontal 7.97 * 6.29 * 32 = $ 1605.

A vertical well of the Shurchi field for the customer's company pays off for:

$ 3,200,000: $ 630 = 5079 days

$ 5,100,000: $ 1605 = 3178 days

It should be noted that VAT, the cost of transportation and other operations are not taken into account here. Also, the conditions for calculating the price of produced crude oil do not have constant numerical values. So, for example, the debit cannot give such volumes on a constant basis to make calculations for the long term. The production rate will always depend on the expected reservoir pressure and the volume of reserves in the productive horizon.

Conclusion:

The development and production of oil wells in the territory of the Republic of Uzbekistan has less and less prospects for investment in this type of energy resources, since oil reserves are very small and actual low production rates require a revision of cases in the economic aspect, and the industry gives its preference to the production of natural gas and gas condensates ... Despite this, these conclusions can be applied to countries where the oil flow rate ranges from 28 thousand m3 / day to 60 thousand m3 / day (Venezuela, UAE, Libya, Iraq, Oman, etc.) for which the economic effect of horizontal wells was would be "explosive".

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