Повышение эффективности разработки Юбилейного нефтегазоконденсатного месторождения

GENERAL INFORMATION

Abstract

» Most of Western Siberia's unique gas fields are at the final stage of development. The number of idle wells at the fields is increasing. At the same time the volume of residual gas reserves in the Cenomanian deposits exceeds several trillion cubic meters of gas. In this regard, there is a need to use methods to improve gas recovery and maintain the operating stock of wells

Goal

» Improving the development efficiency of the Yubileynoye oil and gas condensate field

Tasks

» Analyze the geological and physical condition of the Yuzhno-Yubileinaya area
» Analyze the current state of development of the Yuzhno-Yubileinaya area
» Analyze existing enhanced gas recovery methods
» Calculate the proposed method of enhanced gas recovery with an assessment of technical and economic efficiency

General information about the Jubilee field

Administrative location

» Nadym district, Yamalo-Nenets Autonomous Okrug

Geographic location

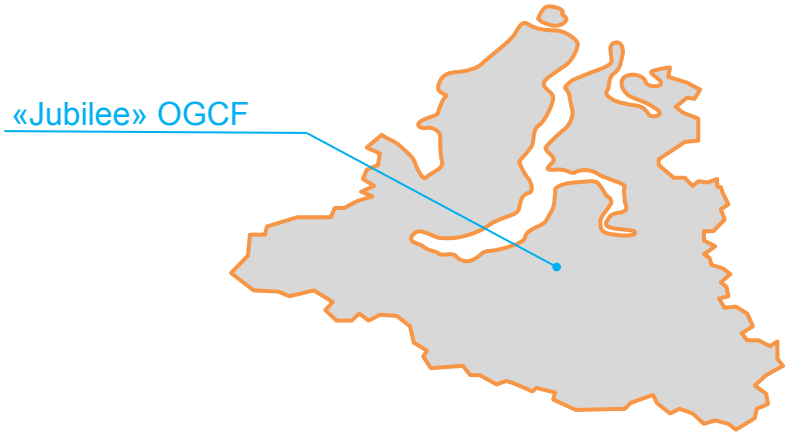
» Northern part of the West Siberian Plain within the Nadym-Pur interfluve

Characteristics of the area

» The territory of the Yubileynoye field is a hilly and rugged plain with a large number of small rivers, difficult to access for all types of mechanical transport

Main challenges

» Increase of current gas recovery factor
» Presence of trapped gas reserves, 27 bln. м³



Geological and physical characteristics of the Cenomanian gas deposit

General characteristics of the deposit

» The PK1 gas reservoirs are massive and overlain by clayey sediments of Turonian-Paleogene age. The area of the deposit is 424.6 million m2. Absolute elevation of the roof is 938 m. GWC is observed in the interval of -1080 to 1087 m.

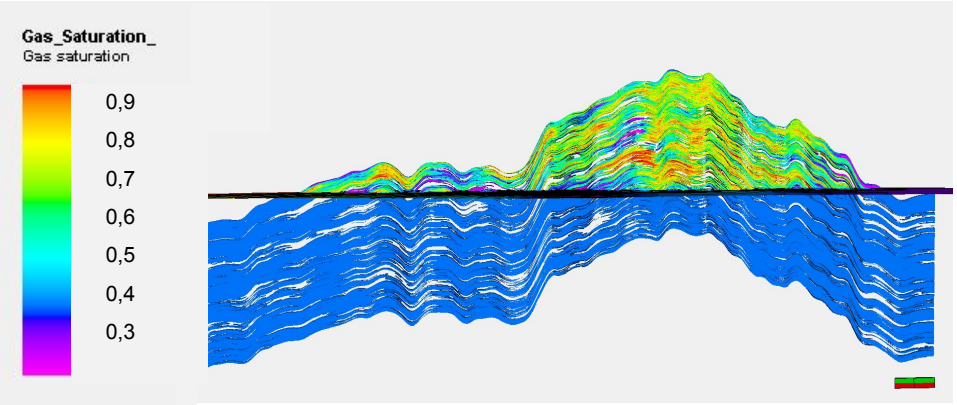
Geological and physical characteristics of the reservoir

» Reservoir type - terrigenous porous
» Effective gas-saturated thickness - 5-44 m
» Formation porosity - 0,24-0,32
» Permeability - 0.341-0.745
» Initial formation pressure - 11.2 Mpa
» Initial formation temperature - 32℃

Information about reservoir

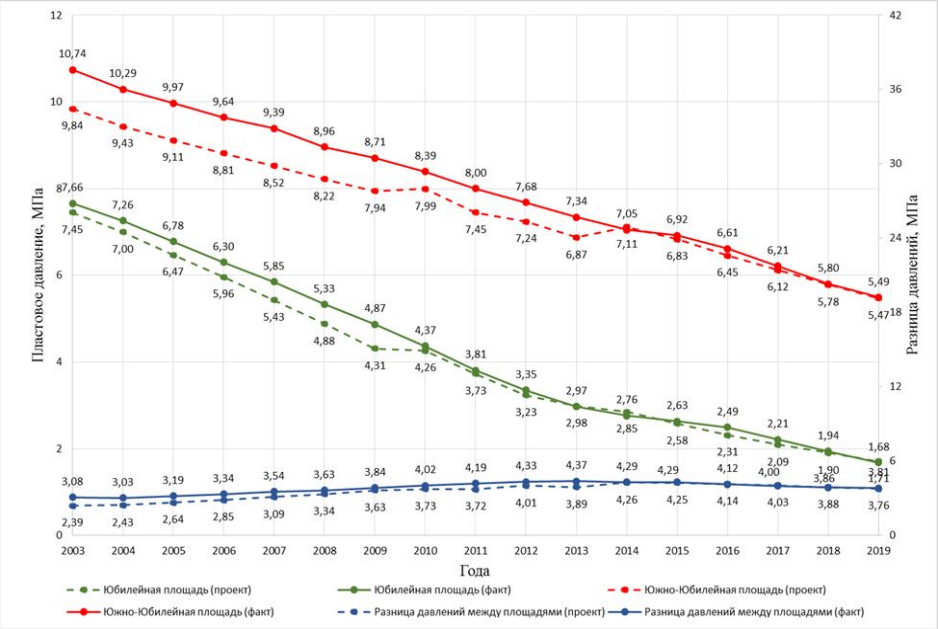
» **522** – Initial geological reserves, bln. м^3
» **140** – Remaining recoverable reserves, bln. м^3
» **0,86** – Project КИГ

Consolidated geological and geophysical section of the current gas saturation of the deposit

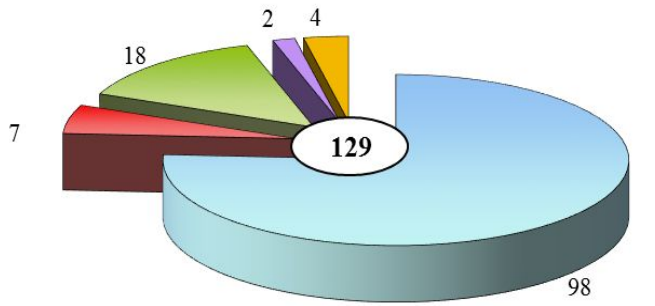


Analysis of the current state of development of the Cenomanian gas reservoir

Pressure dynamics



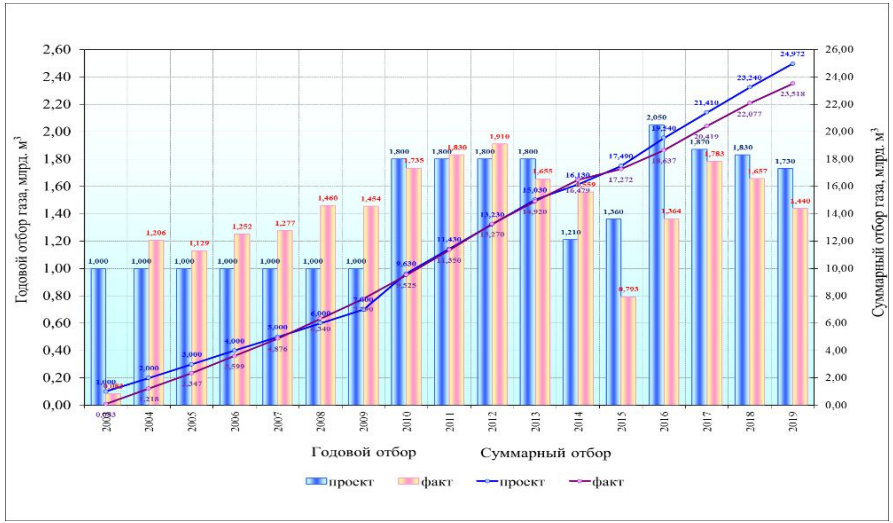
State of the well stock



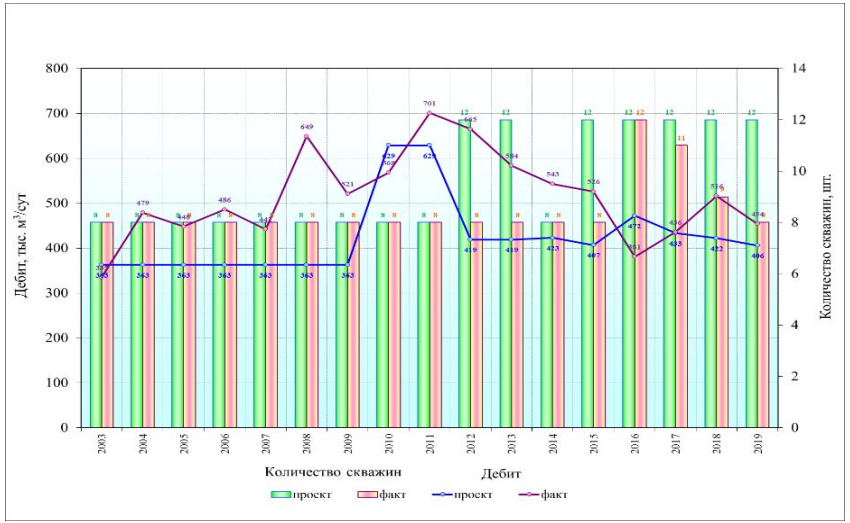
- current
- Injection
- inactive
- liquidatione
- observation

Analysis of the current state of development of the Cenomanian gas reservoir

Comparison of design and actual gas withdrawal indicators

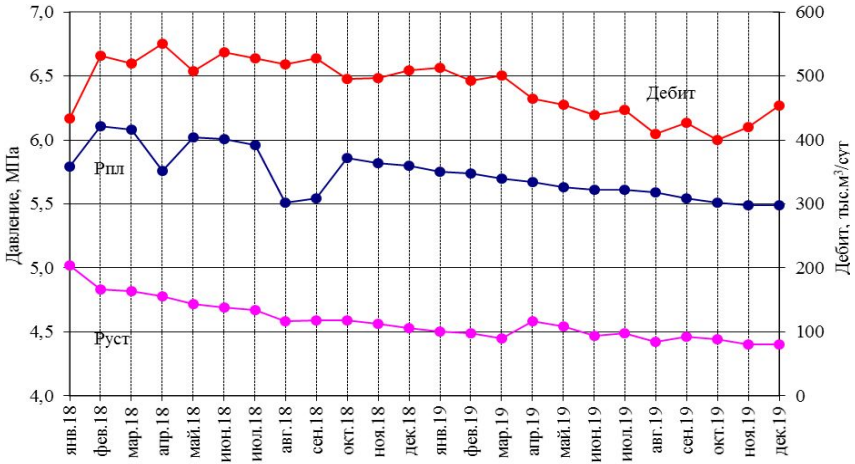


Comparison of design and actual indicators on the flow rate and the number of wells



Analysis of the current state of development of the Cenomanian gas reservoir

Comparison of design and actual indicators of pressure and flow rate



Conclusion:

Based on the results of the analysis of the current state of development and geological and physical characteristics, the following conclusions can be made:

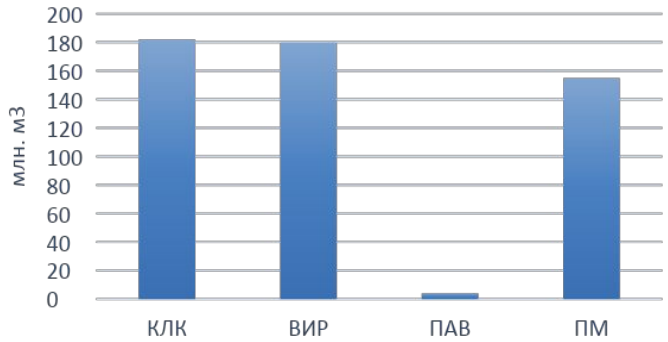
- The Cenomanian gas reservoir has high filtration-capacitative properties
- The average daily production rate of the well was 454 thous. m3
- The development of the Cenomanian gas deposit at Yuzhno-Yubileynaya area is lagging behind the project
- The number of producing wells at the field is 33.3% lower than the target
- Within the last year, 1.44 bcm of gas was produced, which is 16.7% less than the projected volume (1.73 bcm)
- During the last two years reservoir pressure decreased by 0.39 MPa
- Average reservoir pressure in the gas withdrawal zone for 2019 is 5.49 MPa
- Average wellhead pressure for 2019 is 4.4 MPa

Analysis of existing methods for increasing and intensifying gas production

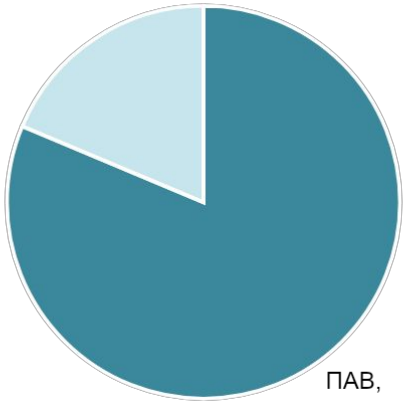
Methods to intensify production and increase hydrocarbon recovery

- Physical-chemical methods (surfactants)
- Liquids removal from wells (LRW)
- Water shut-off works (WSW)
- Perforating methods (PM)

Production efficiency per operation



Number of operations



Number of operations, %

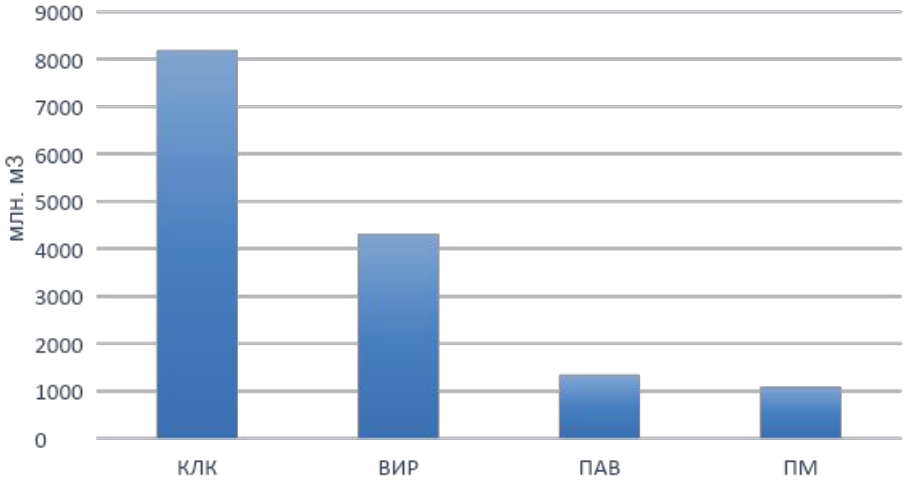
Analysis of existing methods for increasing and intensifying gas production

Conclusion:

Based on the analysis of the efficiency of component recovery enhancement methods, it should be noted that concentric elevator string (CLC) descent is the most effective method, with 182 million m3 of gas per operation. The most inefficient method was physical-chemical methods (SAW), additional production per operation was 3.3 million m3 of gas.

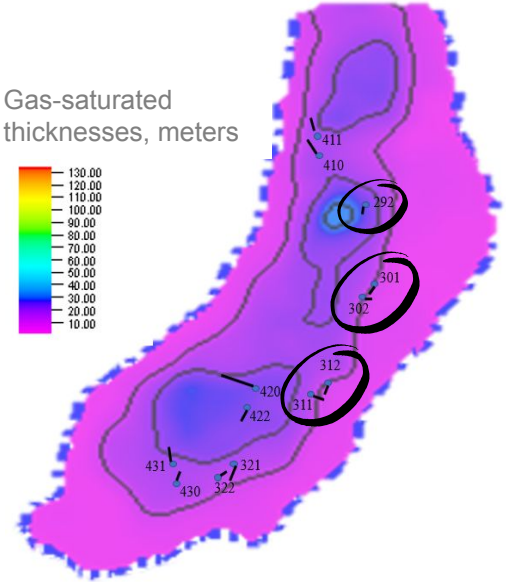
There are currently 7 idle wells in the Cenomanian gas reservoir. I recommend considering these wells for sidetracking.

Extraction

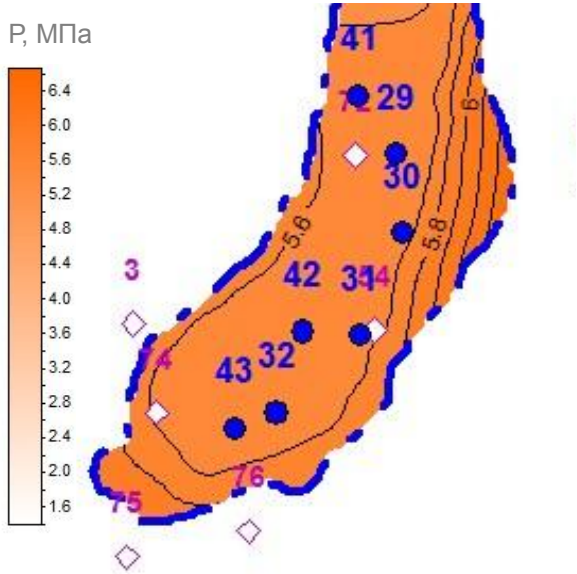


Rationale for the sidetracking section

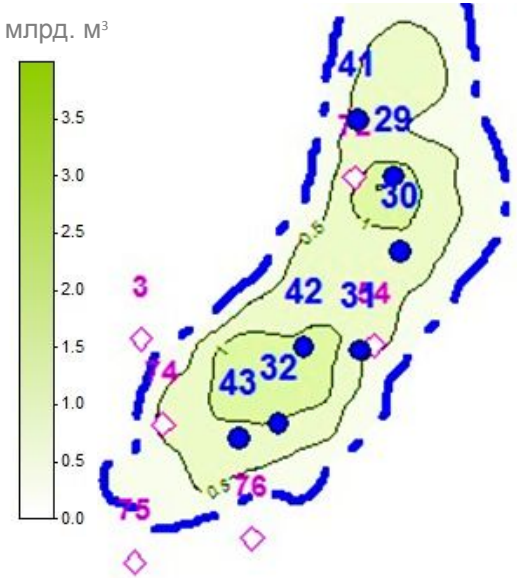
Analysis of maps of the South Jubilee area



Location map of current well bottomholes



Pressure map

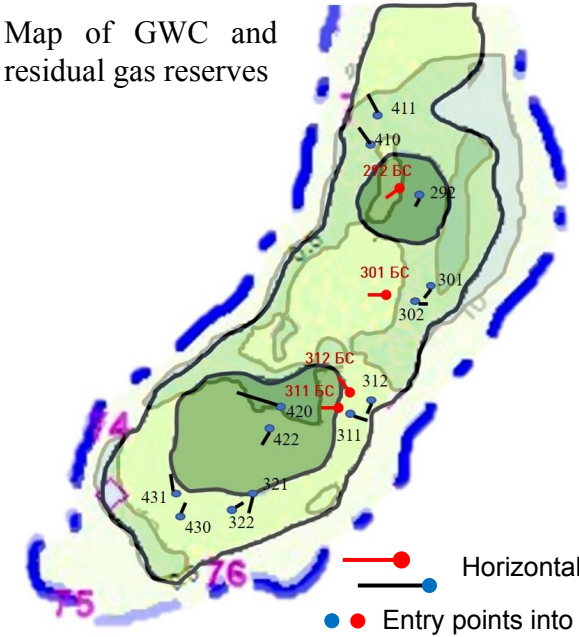


Residual reserves map

Rationale for the sidetracking section

Map of justification of sidetrack zone

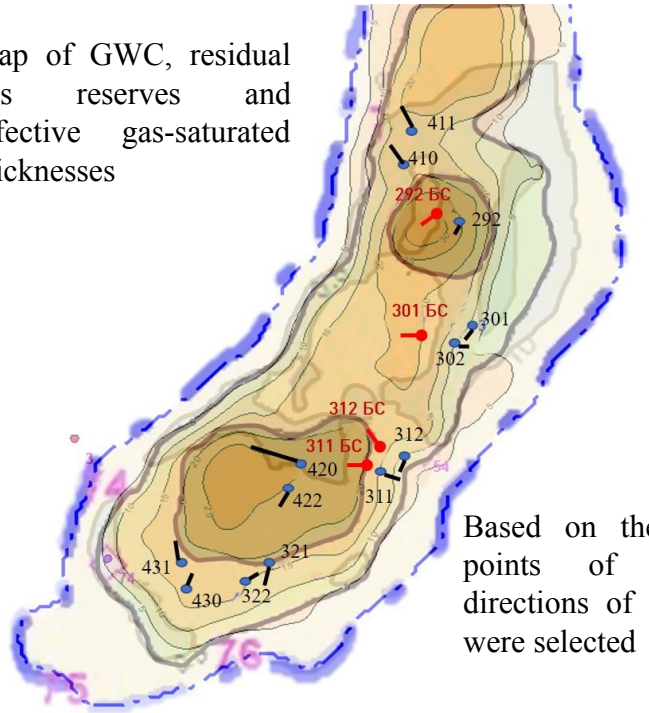
» Map of GWC and residual gas reserves



Horizontal section direction

Entry points into the formation

» Map of GWC, residual gas reserves and effective gas-saturated thicknesses



Based on the maps, the points of faces and directions of lateral shafts were selected

Determination of optimum horizontal section length for 301 wells

Let's set the following function of the drilling cost increase on the length of the horizontal section

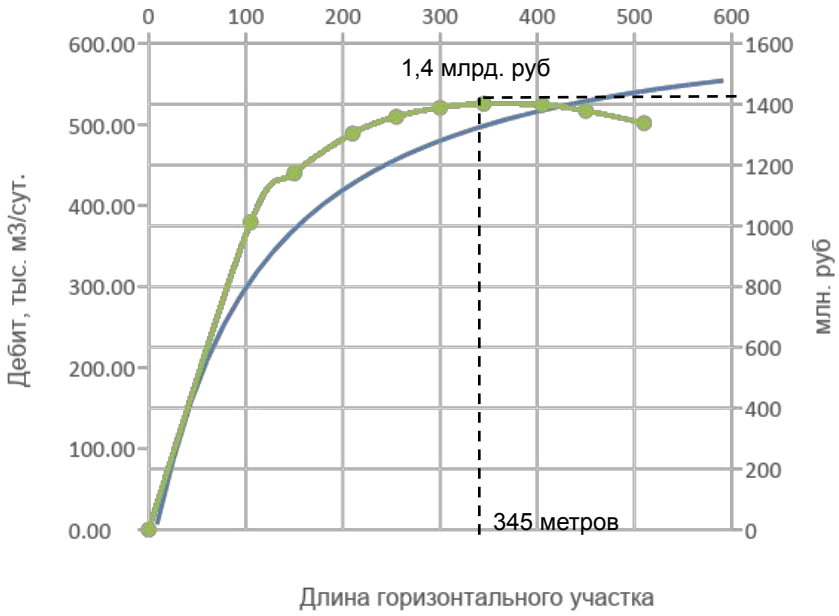
$$Z(L) = \alpha L^{\varepsilon} + t$$ [2]

t – cost of the lateral wellbore section up to the entrance to the formation; α – drilling costs per unit length of horizontal section; ε – cost factor

As an economic indicator of the project efficiency let's take PDD for 11 years, and as a criterion - the maximum of this indicator

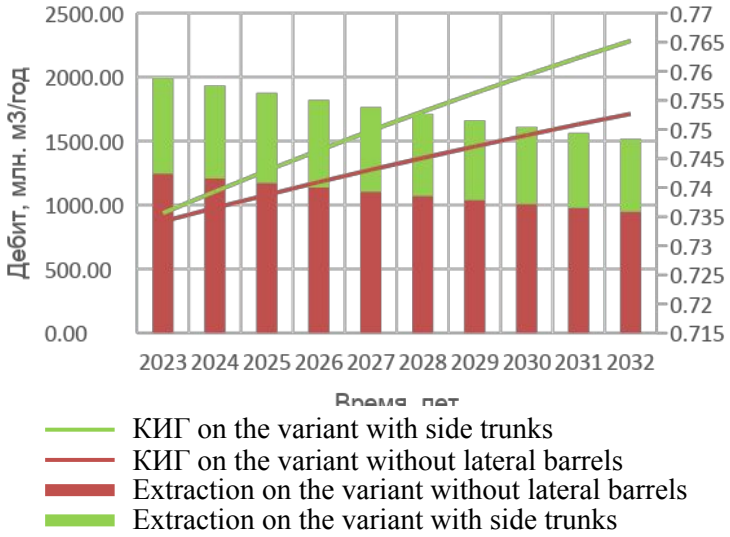
For well 292 optimum length of horizontal section is determined by the criterion of maximum allowable flow rate of 670.5 thousand m3, so the optimal length of the horizontal section will be characterized by the maximum allowable flow rate, that is, at a length of 255 meters well flow rate will be 670 thousand m3.

Flow rate vs horizontal length for 301 wells

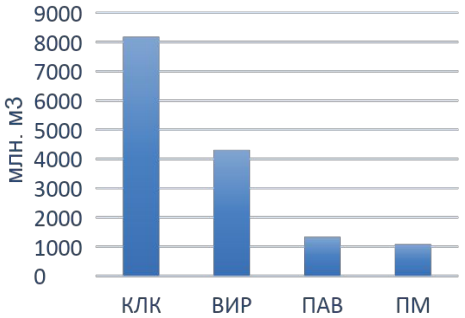


Technical and economic effect of project implementation

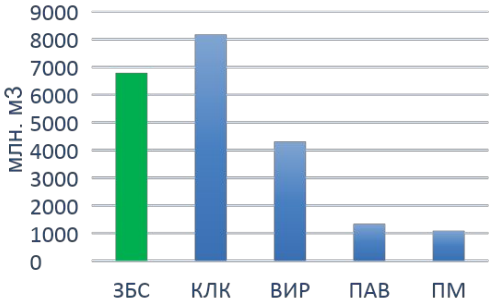
Additional production from the implemented method

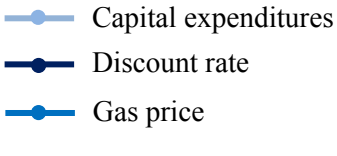


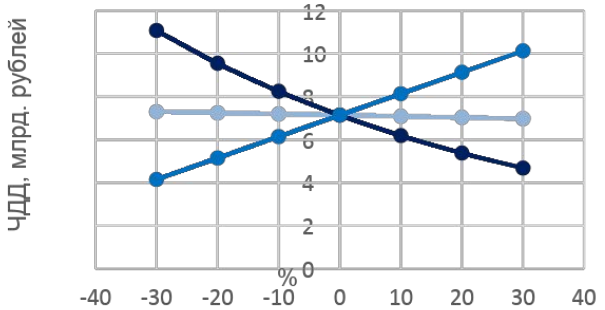
Extraction on the variant without lateral barrels



Extraction on the variant with side trunks

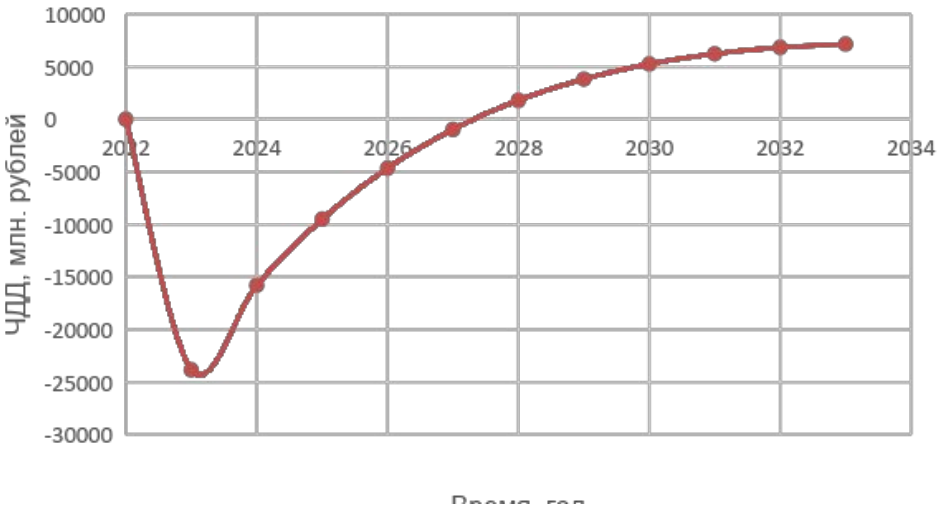






Technical and economic effect of project implementation

NPV of the project for 11 years



Conclusion:

According to the results of techno-economic analysis of sidetracking in wells 292, 301, 311, 312 the following conclusions can be made:

The optimum length of the horizontal section for well 292 is 255 m, for wells 301, 311, 312 - 345 m.

Project BFD made 7.15 billion rubles for 11 years at the discount rate of 15 %.

Project profitability - 18% per annum

Project pay-back period - 6 years