A METHOD FOR EVALUATING FIELDS IN ORDER TO SELECT CRITERIA FOR CONFIGURATIONS OF INTEGRATED MODELS

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Integrated modeling is currently being increasingly used by engineers when solving problems in the development of oil and gas fields. It allows you to combine several models at once, thereby improving the accuracy of the assessment of key indicators and the quality of decision-making. The main input elements of the integrated model are the reservoir model (calculation of development indicators for the short and long-term horizon), well models (calculation of multiphase flow along the wellbore, analysis and design of well operation methods), a model of the collection, transportation system and a model of reservoir pressure maintenance (hydraulic calculations, optimization calculations), a model of the preparation system (calculation parameters of operation of technological installations, optimization of operational indicators, logistics model (calculation of delivery/shipment dates, taking into account opportunities and limitations) and economic model (calculation of economic indicators according to development scenarios). However, before making a decision to use and build an integrated model, it is necessary to understand whether it would be advisable to build detailed, full-scale integrated models (IM) for a particular field [1].

However, at the moment there is no single classification or recommendation for the application of integrated models of various details to certain development objects with unique sets of characteristics. In this connection, there is a need to create a method for evaluating the criteria for determining the configurations of integrated models at various facilities, taking into account the specifics of fields and grouping the Company's assets according to this methodology. As a basis for making a decision, it is proposed to use a set of composite criteria that allow you to determine how much an asset is a priority and significant in the company's portfolio. Then it is recommended to understand the complexity of the asset in terms of ground and underground components and, finally, to determine how much detailed IMA component models are needed for this asset. Obviously, the higher the complexity of a particular indicator, the more difficult it is to reliably predict its potential. With the correct selection of configurations of integrated models, the engineer will have the opportunity to save both material and time resources while obtaining optimal scenarios for the development of his field. And as a result, this classification of assets will be a tool for balancing costs and results [2].

Step 1. Preparation of the source data

To implement this methodology, you need information about all the estimated fields within your sample. It is proposed to use the classification of fields according to three composite criteria – the importance of the field in the company's portfolio and its potential, the complexity of the reservoir and the intensity of development, the complexity and loading of the ground infrastructure. These criteria are divided into indicators of the field.

Step 2. Determination of field performance scores

It is proposed to rank each indicator of the field from the 1st to the 10th. The variation of the value will be a geometric progression. The minimum value (b1), which will be the first value of the progression, and the maximum, which will be the last (b9), are required as input data. The calculation of each subsequent value will be calculated according to the geometric progression formula.

Step 3. Selection of weighting coefficients

It is recommended to estimate the weighting coefficient of the field indicator independently, depending on the characteristic features of the analyzed asset portfolio. This is presented if the fig. 1.

After the process of assigning a score, it is necessary to proceed further to the process of calculating the weighted score. The formula for calculating it is the product of the weight coefficient within the group by its score, defined above.

Step 4. Calculation of points for all three criteria for each field

Then, for each of the three criteria, the sum of all its corresponding weighted scores is calculated. Below, in the application section of step 3, an expert assessment of the weighting coefficients of the indicators is given.

Step 5. Grouping by median indicator

In order to determine the group of fields, it is necessary to set a number of conditions for three points of criteria. To do this, you first need to calculate the median indicator for each criterion, respectively. Then compare the individual value of the criterion of a certain field with the calculated median indicator and correlate it into the appropriate group. For example, if the indicator of significance and potential for an individual field is higher than the median, then it automatically falls into group 1 or 2. Information about the characteristics of the groups is listed below. Then the collector complexity indicator is compared with the median value, if it is exceeded, the asset falls specifically into group 2. In the end, the last comparison of the third indicator of the complexity and load of the ground infrastructure with the average value comes, on which the belonging of the field to the subgroup a or b depends. This approach allows us to correlate and classify fields according to further recommendations for the use of integrated asset modeling tools.

Based on this methodology, it is proposed to define a number of criteria for the selection of configurations of integrated models at various facilities, taking into account the characteristics of fields. At the same time, it should be understood that the proposed methodological approach allows us to obtain estimates based on numerical indicators characterizing a particular asset, which are a good "zero approximation" and should be verified at the expert level.

Fig. 1 Selection of criteria and selection of weight coefficients

References

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WELL COMPLETION OPTIMIZATION USING THE «FISHBONE» TECHNOLOGY UNDER CONDITIONS OF FACIES HETEROGENEITY OF THE MESSOYAKHA TYPE RESERVOIR

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On the modern stage of oil industry, the part of hard-to-extract reserves is growing every year. Such category of reserves incudes reservoirs with transition and continental genesis. These deposits are characterized by the high degree of uncertainty, small sizes of sand bodies and great shale content. The main ways how to produce oil from such complex objects are drilling horizontal wells (which intersect as more sand bodies as possible) with multi-stage fracking. However, sometimes such methods of enhanced oil recovery are not effective due to geological and technological limitations. For example, hydraulic fracturing (HF) is not recommended in the reservoir where water saturated horizons are close to horizontal wellbore due to the risk of fracture to penetrate them and cause water coning.

Vostochno-Messoyakhskoe field is a complex reservoir which is characterized by a few significant features:

1. High degree of facial heterogeneity.
2. Many faults, different levels of water oil contact (WOC) and gas-oil contact (GOC).
3. Unconsolidated rocks.
4. Gas cap with abnormal properties.
5. 65 % hydrocarbon reserves are in zone with bad poroperm properties (middle and top part of the reservoir).

Drilling a long horizontal wellbore is limited by risk of well collapse and low production build-up. On the other hand, HF is also unrecommended due to presence of gas cap and necessity to keep it unproduced in order to avoid sharp reservoir pressure decline.

Thus, more effective completion decision has to be made which takes into account all features and geological characteristics of the target reservoir – formation $PK_{1\text{-}3}$. The goal of this research is to suggest recommendations for well completion optimization using the «Fishbone» well design under conditions of facies heterogeneity of the Messoyakha type reservoir.

First of all, object of research has to be described. Vostochno-Messoyakhskoe oil gas condensate field is located at Yamal-Nenets Autonomous District and consists of eight petroleum plays. The main object is formation $PK_{1\text{-}3}$ – Pokurskoe suite which is deposited at relatively small depth (around 800 m). This formation is divided into three cyclites [1]. Each of them is characterized by its own sedimentary environment.

– Cyclite C (the deepest): deltaic channels.
– Cyclite B: tidal sandy flat.
– Cyclite A: tidal shaly-sandy flat.

After considering the properties in each cyclite it can be said that trends of characteristics from bottom to top of formation is following:

1. Degree of rock consolidation decreases
2. Reduction of sand content
3. Higher reservoir compartmentalization
4. Worse poroperm properties
5. Transition from deltaic to tidal flat environment
6. Sand bodies orientation: S-W (channels) → S-E (flats)

According to the field development experience optimal length of horizontal section in wells is 1000 m. For production from cyclite C most optimal case is using horizontal and multilateral wells for zones with good properties and shale zones