

PERFORMANCE CAPABILITY OF ADVANCED COMPLEX LOGGING WHILE DRILLING DATA INTERPRETATION IN HORIZONTAL WELLS FOR RESERVOIR ESTIMATION AND RIG COST OPTIMIZATION

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The number of horizontal wells drilled by operators is increasing from year to year with the purpose to increase the production rate by placing the well inside target reservoir with the maximum exposure.

First horizontal wells were drilled according to pre-defined plan geometrically, with known geology and relatively large targets to avoid and reduce the costs of mistakes. Later, the technique of geological steering, based on logging while drilling formation evaluation data was developed to ensure higher rates of success in reaching smaller and less defined targets. The expanding of the logging while drilling portfolio of the service companies enables advanced geological, petrophysical, geomechanical and other types of evaluation in real time while drilling.

Any interpretation of logging data in vertical wells is based on coaxial-cylinder model and utilization of this approach in horizontal wells may lead to wrong estimation of the reserves. The reason of it is the fact that logging methods have different depth of investigation, and the change of formation properties affects the data in the complex way. In this case, the measurements will be affected not only by the formation properties, but also by the distance to this formation. This needs to be considered for any petrophysical formation properties evaluation for the wells with the inclination different from vertical.

The new approach of 3D petrophysical interpretation for horizontal wells is forward modeling in three-dimensional space. The first step of this interpretation is to define the most probable geological model based on logging while drilling data in different scales, involving all data types with different depth of investigation: image data, geosteering tools inversion results, logs and local geological knowledge of the reservoir. Then the properties of each layer are defined to be able to run forward modelling for the certain geological model, taking into consideration logging while drilling tools specifications.

The process of quality control of this inversion is based on comparing the obtain synthetic curves with the real measurements, acquired while drilling. Precise correlation is the subject of well defined petrophysical properties of all the layers and geological model. The results of this forward modeling should be used for the proper formation evaluation in horizontal wells.

3D data interpretation approach, based on advanced logging while drilling data allows complete exclusion of any wireline logging, which is the fact of rig cost optimization, specifically for offshore rigs.