NHF17

Proposed Workflow for Tight Gas Reservoirs

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SUMMARY

Tight and ultra tight gas reservoirs are recognised as providing significant opportunities for oil companies worldwide to add producible reserves to their portfolios. However, it is commonly perceived that wells in such reservoirs may suffer from low productivity and possibly unstable rates below the economic threshold.

Massive hydraulic fracturing treatments are considered to be the most effective operations to improve well productivities and achieve economic flow rates in these environments. These operations can sometimes be complex and expensive actions where costs can sometimes be in the order of millions of US\$. Exploiting tight reservoirs through such stimulation treatments may thus only be attractive in a promising hydrocarbon price scenario.

Inarguably, conventionally acquired well data such as cores, logs, wireline and testing etc. do assist in driving decisions whether or not to fracture, but usually fall short of providing reliable information about the most likely dynamic reservoir and fluid response.

In this respect, especially during the exploration and appraisal phases, a clear strategy has to be planned a priori to determine the most suitable approach that maximises the value of information about the reservoir dynamic behaviour and indicates whether an expensive fracturing treatment may be beneficial or not.

Introduction

Tight and ultra tight gas reservoirs are recognised as providing significant opportunities for oil companies worldwide to add producible reserves to their portfolios. However, it is commonly perceived that wells in such reservoirs may suffer from low productivity and possibly unstable rates below the economic threshold.

According to the tight gas reservoir common definition, in the 1970s, the United States Government defined as tight gas a reservoir where the expected gas permeability value is less than 0.1 mD. This was a political definition to determine which wells would receive tax credits for producing gas from tight reservoirs.

With the general technical definition, tight gas are reservoirs that cannot be produced at economic flow rates or that do not produce economic volumes of gas without assistance from massive stimulation treatments.

Those definitions are quite general and not conclusive because well productivity is a function not only of the formation permeability but also of the net producing pay (Figure 1).

Discussion

Massive hydraulic fracturing treatments are considered to be the most effective operations to improve well productivities and achieve economic flow rates in these environments. These operations can sometimes be complex and expensive actions where costs can sometimes be in the order of millions of US\$. Exploiting tight reservoirs through such stimulation treatments may thus only be attractive in a promising hydrocarbon price scenario.

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A general workflow will be presented with the aim of facilitating the decision making process (Figure 2).

Conclusions

From the proposed workflow to be adopted for tight gas reservoirs, a Pre frac test resulted mandatory in any exploration/appraisal scenario in order to:

- Assess the nature of movable fluids and verify the presence of hydrocarbon
- Estimate the main reservoir parameters
- Calibrate the fracture geometry in the Post frac test
- Measure the real gain in productivity and achieve important lessons learned to optimise future stimulation treatments

However long clean up phase must be accounted for to capture a reliable post frac productivity. Different economical & technical drivers should be considered before going with massive fracturing operations.

Figure 1 - Well deliverability as a function of permeability thickness product.

Figure 2 - Proposed workflow.