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Technology-Driven Approach to Develop Shale Gas in Saudi Arabia

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SUMMARY

The “Technology-Driven” approach and the customized workflow applied in this project have minimized the time required to understand the reservoir and apply technologies appropriate for the reservoir. This workflow has been utilized and calibrated so far with single well analysis. As sufficient amount of data, especially 3D seismic data which is currently being shot in Saudi Arabia becomes available, this workflow can be further enhanced and calibrated with a three dimensional regional model. A well calibrated workflow based on the pilot hole data, learnings from local pilot holes, and industry experience from North American shale plays whose reservoir and completion quality match with Saudi Arabian play can substantially shorten the learning curve in Saudi Arabia.

This paper is aimed at demonstrating the customized workflow developed for Saudi Arabian shale gas play and sharing the preliminary results of this project.

Introduction

Around 1980s, efforts started to develop the famous Barnett Shale. It required 20+ years of drilling and completion innovations to make it commercially viable. This was the starting point to develop other plays in North America such as Fayetteville, Haynesville, Marcellus, Woodford, Antrim and New Albany. It is important to note this has been the result of years of work of many companies (mostly small independent operators) drilling thousands of wells, learning from each other, ultimately developing the so called factory approach to shale gas drilling and completions.

Unlike in the US we do not have luxury of having thousands of penetrations through the shale gas plays in Saudi Arabia, particularly critical in the absence of other operators to share experiences and risks. Therefore, Saudi Aramco decided to explore its shale gas resources in the Kingdom adopting a “Technology Driven” approach against the US-based “Factory”: or “Statistical” approach.

The “Technology-Driven” approach and the customized workflow applied in this project have minimized the time required to understand the reservoir and apply technologies appropriate for the reservoir. This workflow has been utilized and calibrated so far with single well analysis. As sufficient amount of data, especially 3D seismic data which is currently being shot in Saudi Arabia becomes available, this workflow can be further enhanced and calibrated with a three dimensional regional model. A well calibrated workflow based on the pilot hole data, learnings from local pilot holes, and industry experience from North American shale plays whose reservoir and completion quality match with Saudi Arabian play can substantially shorten the learning curve in Saudi Arabia.

This paper is aimed at demonstrating the customized workflow developed for Saudi Arabian shale gas play and sharing the preliminary results of this project.

Results

The multidisciplinary Unconventional Resources Team performed initial screening and identified area A as the most promising area for Unconventional play exploration Saudi Arabia. Following URT recommendation, the first shale lateral was successfully drilled using real-time geomechanics and geo-steering using ensuring lateral stayed in the zone of interest without major drilling issues.

From an execution perspective, all twelve stages were successfully completed using Plug N Perf technique, with the last eight stages completed within five total days. Initial breakdowns and pressure drop from acid confirmed good hydraulic isolation behind pipe, setting new cementing standards for horizontal wells in Saudi Arabia.

Post-Frac production log shows all stages contributing gas, demonstrating good completion strategy (staging and perforation placement) using the Completion Advisor integrating all lateral measurements. Highly conductive (Conventional and Channel Fracs) treatments showed higher initial gas production, lower WGR when compared to Slickwater and Hybrid treatments. In addition, Microseismic results showed that higher water production came from planar looking Fracs in the toe half of the well.