Khalid R. AlNoaimi,
Petroleum Engineer,
EXPEC Advanced
Research Center,
Saudi Aramco,
Saudi Arabia

COMPETING RESOURCES: UNCONVENTIONALS AND THE ROLE OF TECHNOLOGY

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After the successful experience of hydrocarbon production from shale sediments in North America, many countries around the world have attempted to "frac" these ultra-low permeability reservoirs. Thanks to the combination of hydraulic fracturing and horizontal drilling, hydrocarbon production from shale became technically possible and economical. Innovation keeps growing in this sub-sector of energy, driven by the necessity to unlock every possible hydrocarbon resource we have.

Effective exploration, development, and production of these unconventional resources require a strong understanding of the rock's mechanical properties, in-situ map of stresses, and rock flow and storage capacities. This improves the solutions to all the technical and economic challenges and facilitates breakthroughs. Hydraulic fracturing and horizontal drilling are two examples of innovation in the petroleum industry.

The hydraulic fracturing technology relies on pumping a "fracking fluid" into the subsurface at a pressure great enough to penetrate the near wellbore region and establish communication between the created fractures and the matrix. It requires a sufficient understanding of the earth's geo-stress in terms of magnitude, orientation, and direction, to control the fracture initiation and propagation in the targeted zone. The created fractures would close as the injected fluid is set to flow back during production, i.e. at decreased pore pressure. Proppants in this case are used to keep the fractures open. They are solid materials that are made in different shapes and sizes, and can be made of ceramics, sands or resin-coated sands. The fracking fluid carries them along the fractures. This fluid usually contains

water mixed with some chemical additives (slick water) to increase the fluid viscosity, improve formation compatibility, reduce fluid loss, and thus, increase fluid flow. Sufficient fluid viscosity is required to hold the proppant and ensure its delivery into the fractured zone.

Even with our existing technical knowledge, the main challenge remains of how to optimise the number of frac stages, to maximise production and well performance. This is possible through innovative improvements to solve problems related to the operational challenges of hydraulic fracturing, drilling, and well completion.

The pool of challenges associated with hydraulic fracturing mainly revolves around the development of improved fracking fluid rheology, reduced pumping volume, and the manufacturing of effective proppants with reduced volume requirement. Nevertheless, innovative solutions may expand in different directions. For example, increasing the density of in-situ fractures through altering the stress fields around the wellbore, and therefore, increasing production. This is done via "zipper fracking" in which two concurrent and parallel wells are drilled horizontally close to each other. The two wellbores are perforated and fractured at alternative, opposite intervals. The cost can be a challenge to this technology. Innovation, however, keeps driving more advanced techniques. Alternating sequence fracturing technique, for example, was developed to do exactly what zipper fracking does but with a single wellbore. This is done through placing the stages in an alternating order of frac stages.

Despite the current economic environment in the petroleum industry, innovation keeps growing and smart solutions to reduce capital and operating costs are being implemented.

Despite the challenging economic environment, technical innovation continues to advance