Shale Resource Development: From Exploration to Rejuvenation

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Introduction

No two shale reservoirs are the same; however, deployment of a sound life cycle approach to shale gas development can lead to incremental return on investment. In the **exploration** phase some of the critical issues to address include the use of seismic attributes to identify potential high TOC (total organic content) and levels of Vitrinite reflectance. Acoustic impedance has been correlated to levels of TOC. During the **appraisal** phase, typically the operator focuses on reservoir assessment, trial investigation and sometimes consolidating land positions. Initial reservoir assessment and trial investigation is very important to define the resource base and exploitation strategy and as such logging, coring and testing becomes important. Two items that define shale gas **development** phase are horizontal wells and hydraulic fracturing to maximize reservoir contact. Geo-mechanical modeling plays a key role in defining the azimuth, orientation and length of laterals plus the size and stages of hydraulic fracture treatment. Optimization of the fracture treatments are then aided by real time micro-seismic monitoring. Addressing all these technical issues will ultimately have to make economic sense. During the **production** phase where full scale production is ongoing, some of the key challenges include corrosion / scaling wellbore and equipment, lift optimization (in case there is some fluid production), perforation plugging to name a few. Hence, some of the key solutions to address here include microbial control, scale and corrosion inhibition, friction reduction, H₂S scavengers, lift system monitoring and optimization. The production phase comes to a point where the field needs to be rejuvenated (the **rejuvenation** phase) to enhance the recovery. Some of the key challenges include refinement of reservoir assessment and deployment of techniques to exploit additional reserves. Potential deployment solutions include intervention, remediation, re-fracturing and refine well placement (this may very well include reducing well spacing). Specific challenges and associated solutions will be different for different shale plays at all of the five life cycle phases. Hence, clearly understanding and recognizing these specific challenges and associated solutions are keys to incremental return on investment.

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