

Case study: Southwest China

Longest horizontal shale gas wells drilled in record time, surpassed customer expectation by 7 days

An operator in southwest China has four wells in the same block and faces mud loss and wellbore stability in all of them. Many offset wells encountered significant loss problems, and a narrow mud window (0.05 sg) created wellbore stability challenges. The operator needed a method to prevent loss of circulation while mitigating wellbore instability, specifically to complete a 2,624-ft (800-m) buildup section and a 9,842-ft (3000-m) horizontal section.

The experienced Drilling and Completions Fluids team devised a fluid regimen combining wellbore strengthening material and conventional oil-based mud (OBM) formula. Due to the narrow mud window and fearing a loss, strengthening the wellbore was tasked at the beginning of the drilling.

The wellbore strengthening (WBS) material was introduced right after opening new formation. The **BRIDGEFORM™ single-sack wellbore strengthening system**, and the **LC-LUBE™ sized, synthetic graphite particulate** were mixed into the mud to bridge the wellbore to reduce pore pressure transmission. The LC-LUBE particulate is specially formulated to control circulation loss and partial seepage losses of drilling fluids. The size, shape, and durable nature of the LC-LUBE particulate makes it ideal for pre-emptive use in highly depleted reservoirs and depleted, high-pressure/high-temperature (HP/HT) wells. It is also able to function as a solid lubricant in the majority of drilling fluids.

The team anticipated a small fault, approximately 656 ft (200 m) before the landing point, that was predicted to incur losses. Consequently, the mud was pre-treated with an increased concentration of WBS material. Although the loss still happened while opening up a new formation when drilling through a fault, the WBS and lost-circulation material in the drilling fluid quickly cured the loss without any re-occurrence. This also had the added benefit of proving the design accuracy and the effectiveness of WBS technology on solving micro-fractures in shale gas.

Field personnel reached total depth (TD) at 18,700 ft (5700 m) in 17 days, seven days ahead of the operator's target, itself a very aggressive plan. In two runs with a single bit, Baker Hughes drilled 12,365 ft (3769 m) with an average rate of penetration (ROP) of 51.7 ft/hr (15.78 m/hr), a 40% increase over the offset wells. The average daily distance drilled was 941 ft (287 m), also a 40% improvement versus the offset wells.

With this operation, Baker Hughes set a record for fastest well to complete a 9,842-ft (3000-m) horizontal section, a task made much easier with the loss risk significantly reduced because of the proprietary Baker Hughes WBS technology applied. In addition to a lowered risk of wellbore instability and the associated cost savings, the operator saved 7 days of rig time, over \$200,000 USD.

Challenges

- Complete 2,624-ft (800-m) buildup section and a 9,842-ft (3000-m) horizontal section
- Avoid circulation losses while managing wellbore stability within a narrow mud window

Results

- Reached TD 7 days ahead of customer's expectation
- Drilled longest horizontal well with a single bit
- Improved ROP by 40% vs. offset wells
- Drilled fastest horizontal 8 ½-in. section (17 days) in this Chinese shale gas field
- Saved \$200,000 and significantly reduced loss risk
- Experienced no health, safety and environmental (HSE) issues or nonproductive time (NPT)