Advanced Logging Technology Reveals the Most Productive Zones in Woodford Shale Wells

Integration of LWD and production logging measurements identifies the most productive zones of the shale reservoir in Oklahoma

**Challenge**
Optimize placement and production from future wells in the Woodford Shale by identifying and perforating the most prolific reservoir rock.

**Solution**
Integrate LWD along the lateral with neutron, density, and resistivity data from a vertical offset well to identify the most productive reservoir intervals. Refine mapping of reservoir zones using LWD and identify sweet spots using Flow Scanner* horizontal and deviated well production logging system.

**Results**
Integration of EcoScope* multifunction LWD service,* Platform Express* integrated wireline logging tool, and Flow Scanner data determined that 90% of gas came from perforations placed in zones identified as most productive.

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Geochemical analysis used to identify drilling and production sweet spots in the Woodford Shale. Two consecutive stages show 19% vs. 10% gas contribution. Proper measurements and completion procedures are necessary for understanding reservoir performance and optimizing future wells.

**Mapping reservoir intervals**
An operator performed an LWD operation on a 4,000-ft [1,220-m] lateral in the Woodford Shale. The measurements were run to understand how the formation dip changes laterally and how the reservoir properties vary across the vertical layers. Working with engineers from Schlumberger, the operator integrated offset vertical triple-combo neutron, density, and resistivity measurements with measurements obtained with the EcoScope multifunction LWD service to map nine distinct layers in the Woodford Shale with a thickness of 220 ft [67 m].

**Integrating measurements to identify high-quality reservoir intervals**
After the well was put on production, the Flow Scanner multiprimer production logging tool was run, and data from it was integrated with maps of reservoir zones to identify the most prolific zones within the Woodford Shale. Measurements from the Flow Scanner system determined that more than 90% of the gas was produced from perforations located in three of the nine mapped zones.
CASE STUDY: Integration of LWD and production logging measurements identifies the most productive zones of the shale reservoir in Oklahoma

Production from highly productive zones in the Woodford Shale can be 6 times greater than less-productive zones, so operators use advanced logging technology such as the EcoScope service to optimize well placement.

These three highly productive layers were adjacent to one another and within 82 ft (25 m) of each other. Furthermore, interpretations derived from the data of EcoScope service and Flow Scanner system showed that perforation clusters placed across higher free gas, lower clay content, and lower calcite volume produced more gas.

Optimizing future wells
Lateral measurements are crucial to place wells in the most productive layers within the Woodford Shale. Placing perforation clusters across zones with the most favorable rock properties should result in stronger performance from all the perforation clusters, ultimately increasing the total well production. The operator will apply lessons learned from this well to optimize future operations. This approach of integrating measurements from vertical logging data, lateral LWD data, and production logs is essential to understand how to optimize production from other heterogeneous shale plays.