

Optimal Horizontal Well Placement: Formation Boundary Mapping While Drilling

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Summary

In Western Canada several oil and gas producers are seeing the benefit of developing their field by drilling horizontal production wells. The success of horizontal wells depends on the ability to stay in the target formation while drilling the lateral section. In the past the data that could be collected while drilling has been limited. Cuttings analysis and logging while drilling (LWD) allowed operators to identify when the well bore leaves the zone of interest. However, because traditional LWD measurement have had a shallow depth of investigation geosteering horizontal wells has been reactive. Typically the well has to drill out of the zone of interest before a problem is identified.

New technology introduced by Schlumberger in 2003 takes a proactive rather than a reactive approach to geosteering horizontal wells. Deep reading and directional sensitive resistivity measurements allow formation resistivity contacts to be mapped in real time. These measurements have a depth of investigation of up to 5 meters. With the ability to see formation contacts from this distance well bores can be placed relative to the formation contacts, reducing the risk of exiting the reservoir and allowing for more productive horizontal wells. This technology was first brought to Western Canada in 2006 and had a significant impact on how horizontal wells were placed in different environments in 2007.

Theory and/or Method

In order to be successful while drilling horizontal wells a method is need to keep the lateral section in the reservoir. This is not easy in complex geology where sub-seismic features will make it difficult to know where exactly to place the well. The ability to map formation contacts in real time, without exiting the reservoir reduce this sub-seismic uncertainty. Using Directional-Deep Resistivity Logging While Drilling (DDR-LWD) allow for this real time boundary mapping and enables operators to drill better horizontal wells.

Examples

Deep-Directional Resistivity Logging While Drilling has been employed in Western Canada while drilling unconventional gas (Coal Bed Methane) as well as more conventional yet challenging gas plays in the Foothills.

Conclusions

By using Directional-Deep Resistivity Logging While Drilling horizontal well bores can be kept in the reservoir minimizing both drilling and geological risks. This will enable better horizontal wells to be drilled.

References

Christensen, E. et al. 2007, Proactive Geosteering with Directional Deep Resistivity and Rotary Steerable Tool in Thin Coalbed Methane (CBM) Reservoirs: AADE-07-NTCE-13.