



Operator Identifies Bypassed Pay and Increases Pay Zone by 50% in Water-flooded Reservoir

EARTHSTAR™ ULTRA-DEEP RESISTIVITY SERVICE MAXIMIZES ASSET VALUE IN MATURE CARBONATE FIELD

NORTH SEA

CHALLENGE

Exploit remaining oil reserves in a mature carbonate field characterized by:

- » Uneven water-flooding
- » Bypassed, hard-to-predict hydrocarbon deposits

SOLUTION

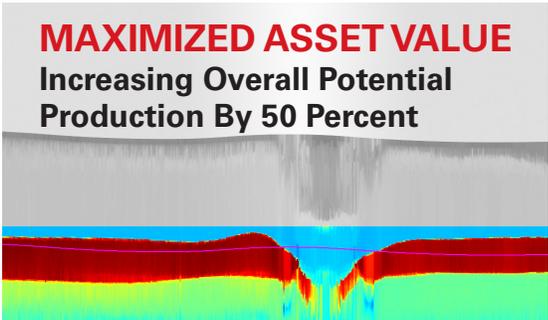
- » EarthStar™ ultra-deep resistivity service, which detects and maps reservoir and fluid boundaries over 200 feet (61 meters) from the wellbore, combined with RoxC™ geosteering software for improved reservoir insight and optimized well placement

RESULTS

- » Enhanced reservoir understanding, enabling the operator to continue drilling and to target a second oil zone
- » Maximized the mature asset's value by increasing the overall productive length of the well by approximately 50 percent
- » Geomapping enhanced reservoir understanding and successfully allowed the operator to penetrate a large, bypassed hydrocarbon-bearing zone, thus improving field production
- » Geosteering provided accurate well placement and helped the operator improve decision making based on real-time LWD data

IDENTIFYING BYPASSED PAY, INCREASING PRODUCTION

In a mature carbonate field in the North Sea, an operator was seeking to intersect remaining lobes of oil within a partially water-flooded reservoir. The reservoir had been producing under water-flood conditions for many years. Uneven flooding had resulted in many areas of bypassed hydrocarbon deposits, which were distributed in ways that were hard to predict. This made the placement of new wells, intended to exploit the remaining reserves, very challenging. The operator sought to improve the reliability with



Model illustrating the use of EarthStar™ real-time data to identify and contact a secondary oil-bearing target after entering a large water-bearing zone.

which they could target and produce residual reserves, while lowering development costs and maximizing overall recovery from the field. Halliburton Sperry Drilling recommended the EarthStar™ ultra-deep resistivity service to detect and map the location of the remaining oil, enabling critical geosteering decisions and helping the operator maximize asset value by increasing the overall productive length of the well.

ENHANCED RESERVOIR UNDERSTANDING THROUGH GEOMAPPING

Geomapping helps operators map the volume of hydrocarbons in place and understand fluid movements that have occurred due to production or water injection. In one well, the EarthStar service successfully mapped a large hydrocarbon-bearing zone. Real-time reservoir data, delivered through the proprietary RoxC™ geosteering software, indicated that, after drilling about 1,000 feet (305 meters) measured depth (MD) in the oil zone, the well drilled into a zone of injected water that continued for over 400 feet (122 meters) MD. At this point, the operator had to decide either to continue drilling, or to stop drilling and complete the well.

ACCURATE WELL PLACEMENT THROUGH GEOSTEERING

The real-time visualization of the EarthStar service data, provided by Halliburton Sperry Drilling geosteering experts, indicated that the logging-while-drilling (LWD) drill string was moving toward a second oil lobe approximately 50 feet (15 meters) true vertical depth (TVD) below the well. None of the other sensors in the LWD string indicated anything other than water, but,

based on the real-time data from the EarthStar service, the geosteering team recommended that the operator continue drilling to target the second oil zone. Through precise geosteering, the well successfully intersected the second zone, and remained within it for approximately 500 feet (152 meters).

ADDITIONAL PAY MAXIMIZES ASSET VALUE

By landing in the second sweet spot, the operator was able to increase the overall productive length of the well by approximately 50 percent, dramatically increasing potential production and maximizing the value of the mature asset. The geomapping capability of the EarthStar service led to the discovery of additional pay; without it, the additional reserves would have very likely remained untapped.

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