

PEMEX Outperforms Directional Plan in High-Temperature Reservoir with High Mud Weight

PowerDrive ICE RSS achieves directional objective by building required curve in high-temperature environment of up to 358 degF [181 degC]

CHALLENGE

Precisely drill a trajectory with a 25° curve in heavy mud-weight conditions to reach a geological target in a reservoir with temperatures expected to reach 374 degF [190 degC].

SOLUTIONS

- Achieve curve using the PowerDrive ICE* ultraHT RSS, the first fully rotating rotary steerable system rated to 392 degF [200 degC]; pair with TeleScope* high-speed telemetry-while-drilling service to transmit measurements from arcVISION* array resistivity compensated service.
- Optimize ROP with SHARC* high-abrasion-resistance PDC drill bit, which was selected through modeling bit-rock interaction with IDEAS* integrated drillbit design platform.

RESULTS

- Drilled 26.3° curve to secure the first geological target, enabling PEMEX to reach the second geological target.
- Logged 304 operating hours with the PowerDrive ICE RSS in bottomhole temperatures of up to 358 degF.



Drill complex well profile in HT reservoir

As part of a new campaign in the Sureste basin offshore Mexico, PEMEX was drilling an exploratory well targeting a reservoir with a bottomhole temperature expected to exceed 374 degF. To reach the geological target, the well plan called for a J-shaped well profile. Drilling this complex trajectory would require precise inclination control to achieve the 25° inclination as originally planned.

The temperature just above the 8½-in section was measured at 338 degF [170 degC], which is close to the 350-degF [175-degC] rating of most HT-rated rotary steerable systems. PEMEX needed a fully rotating system that was capable of performing reliably in conditions with reservoir temperatures exceeding 356 degF [180 degC] and heavy mud weight of up to 17 ppg.

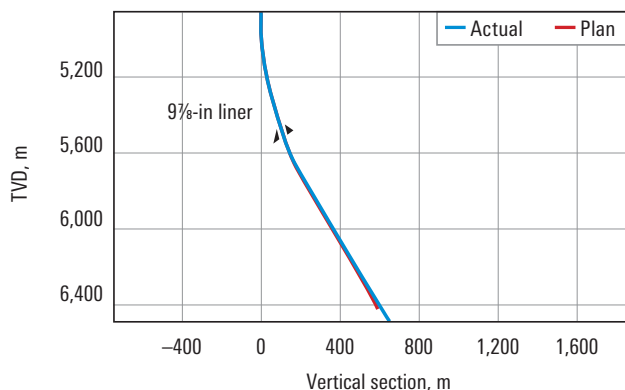
Precisely reach geological target with unique ultraHT RSS

To reliably achieve the required 25° inclination in HT conditions, Schlumberger recommended using the PowerDrive ICE ultraHT RSS with the objective of drilling the most possible footage in ultraHT environments (greater than 390 degF). The suggested BHA also contained the TeleScope and arcVISION services to transmit real-time resistivity, gamma ray, inclination, and annular pressure-while-drilling data for improved reservoir evaluation. Using the IDEAS integrated drillbit design platform, Schlumberger modeled the bit-rock interaction and determined that a SHARC bit from Smith Bits, a Schlumberger company, would provide the greatest ROP when combined with the BHA.

Correct directional trajectory and reach geological objective

Using the integrated BHA, PEMEX built a curve from 17.5° to 26.3° and then maintained a tangent to achieve the planned trajectory with an estimated static temperature of 358 degF at the end of the last run. The BHA managed to achieve a dogleg severity of up to 2.94°/30 m. A downhole motor BHA was also tried during the 8½-in section with no success in terms of directional control as it proved difficult to slide at the 19,904-ft [6,067-m] true vertical depth.

Throughout the 304 hours operating in temperatures between 338 degF and 358 degF, the PowerDrive ICE RSS reliably performed. The metal-to-metal seals in the RSS withstood the heavy mud weight and high solids content. As a result of this success, PEMEX plans to use the PowerDrive ICE RSS as the standard for developing upcoming exploratory wells targeting the same HT reservoir.



The PowerDrive ICE RSS built the inclination of the well from 17.5° to 26.3° and maintained the tangent in automatic hold mode, making it possible to reach both intended targets in the HT reservoir.