Vankorneft Moves to a Lightweight Casing Design and Saves 7 Days on Well Construction

The operator improved ROP by as much as 21% in one section and achieved an average time saving of 28% versus AFE.

CHALLENGE
Switch to a lightweight two-casing well design and maintain desired ROP and steerability with minimal torque and drag in a complex formation onshore Russia.

SOLUTION
Design and deploy a BHA that includes a motorized rotary steerable systems (RSS), application-specific drill bits, and shale-optimized drilling fluid.

RESULTS
- Reduced well construction time by 7 days and drilled into the target formation.
- Recorded an average time savings of 28% versus AFE.
- Improved ROP by 21% and 7% in two sections.

Introducing lightweight well design in soft formation
In a geologically complex field in eastern Siberia, Vankorneft sought to improve drilling performance and reduce well construction time by switching from a three-casing well design to a two-casing well design. The decision to alter the well design came while drilling in the targeted Yakovlevsky producing formation, where the operator noted that time and expenditures on intermediate casing could be reduced. In 2013, the scope of drilling at the eastern Siberia oil field included more than 110 wells, more than half of which were drilled in the Yakovlevsky Formation.

The previous three-casing design at the field typically consisted of the following openhole sections:
- A 15½-in section for the surface casing from an average MD of 0 to 625 m, where roller cone bits were used to drill the gravel interval, at an average 200-m thickness.
- An 11¾-in section for the intermediate casing, an 8¾-in section for the production casing, and a 6-in liner section where PDC bits were used typically.

In 2014, Vankorneft set a goal of switching to a lightweight design for wells drilling in the Yakovlevsky Formation with production sections under 2,500 m in length. With these increased production section lengths, the operator wanted to avoid issues related to increased torque and drag while maintaining desired ROP.

Optimizing drilling in extended production sections
Schlumberger coordinated internally to find a solution for the operator’s emerging well construction needs. The drilling optimization plan for this campaign included the PowerDrive X6 vortexX* motorized RSS; drill bits from Smith Bits, a Schlumberger company; and POLY-PLUS* high-molecular-weight anionic polymer mud system from M-I SWACO, a Schlumberger company.

Integrated offerings from Schlumberger enabled the operator to improve performance compared with prior wells and the drilling plan, saving 7 days of well construction time across the project.
In the new two-casing design, the 15½-in section was eliminated, so the gravel interval was moved to the 11⅝-in section and Xplorer Expanded* soft-formation milled tooth drill bits were chosen to drill the section. In the 8⅝-in section and the 6-in liner section, application-specific PDC bits (MDi516) with high-speed cutting structures were deployed.

Vankorneft chose to drill with the water-base POLY-PLUS system for enhanced cutting encapsulation and stabilization in the shale formation. The salt-free system has a pH of 8 and maintains required rheology for improved hole cleaning. With a fluid that helps mitigate swelling or washout issues, the PowerDrive X6 vortex RSS further enhanced wellbore quality by fully rotating while drilling.

Reducing well construction time while increasing ROP with novel BHA design

The integrated approach to the two-casing well design while drilling in the Yakovlevsky Formation enabled improved drilling performance and reduced well construction time. Vankorneft successfully drilled into the target horizon and

- reduced average well construction time by 7 days, compared with a three-casing well design
- recorded an average time saving versus AFE of 28%
- improved average ROP 21% in the 11⅝-in section and 7% in the 8⅝-in section
- drilled a maximum-length section of 2,380-m in 5 days in one run.

Drilling optimization was applied in real time across 22 wells with the new well design. In this campaign, improved drilling and reaming practices were developed and implemented to ensure maximum RSS performance (3.5°/30 m to 4.5°/30 m). Well trajectories and BHAs were also optimized for the new lightweight design. Vankorneft used a modified downhole drilling motor designed specifically for use with the PowerDrive X6 vortex RSS to drill the maximum-length section of 2,380 m in a single run with no wear of the bearing block.

The bit design was also modified to improve the average and recorded ROP, the steering capability during directional drilling, and the drilling torque stability. Combined with a PowerDrive X6 vortex RSS in the BHA, the bits maintained stabilization and enabled Vankorneft to achieve the desired dogleg severity (DLS).

At the increased drilling rates and section lengths that were achieved, the encapsulated drilling fluid systems ensured effective wellbore cleanout and stability.

The well construction design was changed for wells with production lengths under 2,500 m.

In 2014, Vankorneft was able to drill into the target production horizon with an improvement in ROP as high as 21% in one section.