First deepwater Mediterranean horizontal payzone drilled successfully 10 days ahead of plan with optimized fluids and modeling

Location: Offshore Egypt, Mediterranean Sea

Challenge
Burullus Gas Company/Rashid Petroleum Company planned to drill in an Egyptian offshore field. The reservoir surveys indicated that the gas was contained in a very narrow target zone, only 15-m thick, and production would require a horizontal well. Not only was this the first horizontal well for Burullus, but it was also the first well of this type in Egyptian waters. Based on the long horizontal section, the nature of the formation, and the planned gravel-pack completion, several challenges were anticipated. These included mitigating expected losses, ensuring good hole cleaning while avoiding sand erosion, controlling high torque, and minimizing formation damage. Drilling the well with a horizontal section over 500-m long and successfully installing and gravel-packing a slotted liner would be difficult. The planned well was four times the length of previous wells drilled by Burullus, and good hole integrity was critical for reaching target depth with the gravel-pack screens.

Solution
Although its local experience with deepwater horizontal drilling was limited, Baroid has extensive expertise in developing fluids and programs for successful horizontal drilling and completion. During Baroid’s systematic Technical and Black Book design processes, the importance and challenging nature of this well were highlighted. As a result, the Baroid Critical First Well Execution Process was initiated. This ensured the involvement of experienced engineers and advisors in order to properly identify and address all of the challenges.

*Drill-in reservoir fluid formulation.* Baroid proposed BARADRIL-N® reservoir drilling fluid for the horizontal section. Selected for its non-damaging characteristics, BARADRIL-N water-based fluid provides effective fluid-loss control and reliable wellbore and formation stability. The particle size distribution of the BARACARB® size-graded ground-marble bridging agent was optimized in order to obtain filtrate control without solids invasion. TORQ-TRIM® II PLUS lubricant was added to the fluid, and the concentration was optimized to control and minimize torque in the horizontal section. TORQ-TRIM II PLUS lubricant is based on a modified vegetable oil and provides lubrication with an excellent compatibility profile. The customized BARADRIL-N fluid formulation was tested extensively, using core samples to confirm and optimize its non-damaging nature.

<table>
<thead>
<tr>
<th>CHALLENGE</th>
<th>SOLUTION</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcoming the difficulties of drilling a 500-m-long horizontal section, and then installing and gravel-packing a slotted liner</td>
<td>Provided engineered drill-in and completion fluids, coupled with DFG™ hydraulics modeling, to help protect the reservoir from damage and ensure wellbore stability while drilling and completing the well</td>
<td>With Baroid’s optimized fluids and modeling, the well was delivered 10 days earlier than planned without compromising well productivity, resulting in formal commendations from customer</td>
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</tbody>
</table>
Modeling for drilling optimization. The complicated well trajectory and narrow target zone would require regular surveys, which would result in regular circulation shutdowns. Drilling conditions were simulated using Baroid's Drilling Fluid Graphics (DFG™) proprietary drilling hydraulics and cuttings transport software package. Using DFG modeling, the survey plan was optimized to allow one pump shutdown per stand. DFG modeling was also used to optimize the running speed of the lower completion. Issues associated with hole cleaning, cuttings accumulation, and high equivalent circulating density (ECD) were anticipated and avoided.

Engineered completion fluid. The well was drilled in approximately 500 m of water depth with a low mudline temperature. Selection of a completion fluid required the crystallization, hydrate-formation and shale behaviors to be completely understood and optimized. A mixture of calcium chloride and bromide brines provided the desired properties, and the addition of CLAYSEAL® shale stabilizer ensured the stability of the interbedded shales in the openhole section. As with the drilling fluid, the completion brine was tested in order to minimize the potential for formation damage. The well was drilled to target depth, well surveys were completed and normal ECD values were observed throughout the interval. During completion, the screens were run to depth and gravel-packed successfully. As a result of anticipating and identifying the technical challenges presented by this well, and then customizing optimal solutions, construction was completed ahead of the planned schedule.

Economic value created
The reservoir was drilled successfully and the gravel-pack operation was conducted without any problems. By avoiding drilling issues and optimizing the fluid performance, the well was delivered 10 days earlier than planned without compromising the productivity of the well.
The Baroid Egypt team received this official commendation from the Rashid Petroleum Company/Burullus Gas Company, and continues to work closely with the company.