

Underbalanced Drilling Program Revives Mature Field in Middle East

Custom-built flowback system increased well production up to 1,000%

All targeted deadlines were achieved, with one site experiencing the fastest mobilization ever. Choke tests across 10 wells showed an average 278% improvement when compared with preintervention benchmarks.

Production enhancement in mature reservoirs

The Middle East petroleum industry encompasses nearly a century's worth of exploration and production history across its vast range of oil fields, with many mature and aging wells. One long-time operator wanted to enhance production performance in its Middle Eastern reservoirs, especially for mature wells not being drained effectively by the original wellbores.

One way to increase productivity is by reentering previously drilled wells to add laterals and new zones. But conventional methods require killing the well, which can interrupt production for months. While recognizing the potential for performance enhancements, one major Middle Eastern operator needed to execute the operation as fast and reliably as possible with minimal disruption to ongoing operations.

As far back as 2016, the company's engineers had decided that the fastest, most productive way would be to drill the well using underbalanced drilling (UBD) through coiled tubing (CT). With UBD, hydrocarbon recovery continues even as drilling progresses, allowing the operators to evaluate reservoir production in real time while maintaining a revenue stream from the produced condensate. Due to the presence of hydrogen sulfide (H₂S), however, fluids emerging while drilling can also pose significant HSE challenges.

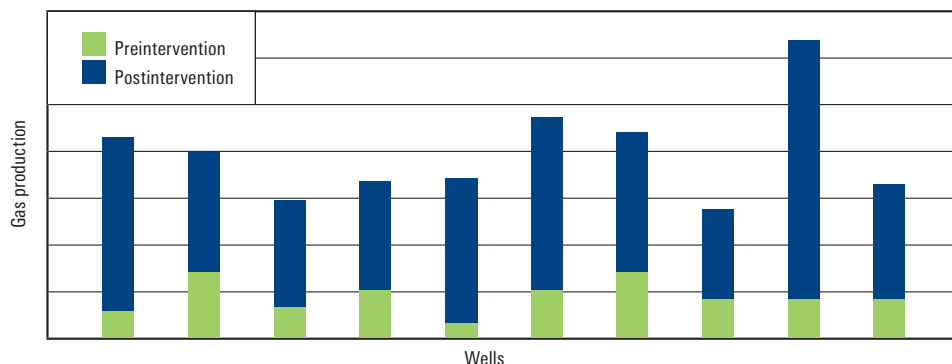


Figure 1. Choke test flow rates for 10 different wells compared with preintervention rates. Most wells showed an average 278% flow rate improvement when tested with a 32/64-in choke.

Unique flowback system handled both production and drilling needs simultaneously

The operator chose Schlumberger as a service partner because of its reputation for handling complex operations reliably. Projects like these are typical for Schlumberger's Production ExPRESS* rapid production response solutions, which provide custom-built solutions to help underperforming fields maximize production in ways that are practical, modular, and rapid.

Due to its long experience in the Middle East, Schlumberger had the expertise to design, manufacture, and mobilize an in-country solution to address all of the site's requirements. The CT approach required a surface flowback package to process both the effluent and large amount of cuttings that would be received at surface, which could not be handled by conventional shale shakers. Because the well would flow during drilling

operations, there was a need for a reliable fluids-management system that could operate in a high-H₂S environment without undue personnel exposure.

Improved response and HSE compliance through remote control and PLC

The solution that emerged had several unique features. The choke manifold was remotely controlled—not just for safety but also for faster response to CT pressure control requirements. Solution automation included sophisticated programmable logic controllers (PLC) that enabled all critical parts of the package to be integrated with a dedicated safety system that could shut down and isolate the well in case of an emergency.



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The solution simplified the well life cycle by combining both the drilling and fluid preconditioning in one swift operation. Thus, all targeted deadlines were achieved, with one well executed in less than a month from rig-up to rig-down and with the fastest release-to-spud time ever (5.2 days from when the crew finished one location to startup at another, including the deployment of eight trailers of equipment and erection of a 90-ft flare stack, along with all the requisite testing involved). The results were consistently outstanding, as shown in Figure 1, which compares choke-test flow rates at 10 wells, with an average 278% improvement over preintervention flows, with one well topping out at 1,000%.

Using these solutions, the operator can now regularly reenter existing wellbores using the Production ExPRESS solutions UBD package to boost hydrocarbon recovery. Successful UBD operations were running since 2016, but the operator started assigning the most complex wells to Schlumberger because of the increased confidence in the quality of its services. In 1 year, 10 wells were drilled and put into production using the UBD packages. In 2019, a second set of trailers was manufactured to process new wells being added to the customer's goals, and today Schlumberger is preparing to deploy a third set in response to the increasing demand.



A view of the complex custom-built flowback system deployed to the operator's site within 5.2 days.



Wellhead choke manifolds and solids management trailer.



Separator trailer pictured at the operator's site.

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