

Manara System Controls Extended-Reach Multizonal Well, Enabling 47% Incremental Oil

Optimizing flow control valves in real time maximizes oil production from extended-reach multizone well—and prevents oil bypass in two damaged zones

CHALLENGE

Optimize cleanup and production in all zones of an extended-reach horizontal well through four reservoir segments with different permeability properties.

SOLUTION

- Complete well with Manara* production and reservoir management system, which enables selective, real-time flow measurement and electric control of each zone.
- Optimize flow control valve settings using WellWatcher Advisor* real-time intelligent completion software.

RESULTS

- Delivered a 47% oil increment by managing flow during cleanup to enable production from two damaged zones that would not have been possible to produce conventionally.
- Increased oil production an additional 25% by optimizing flow control valve settings, compared with fully opening the valves for all six zones.
- Saved at least 2 days to clean up the zones and optimize production compared with slower, hydraulically actuated flow control valves.

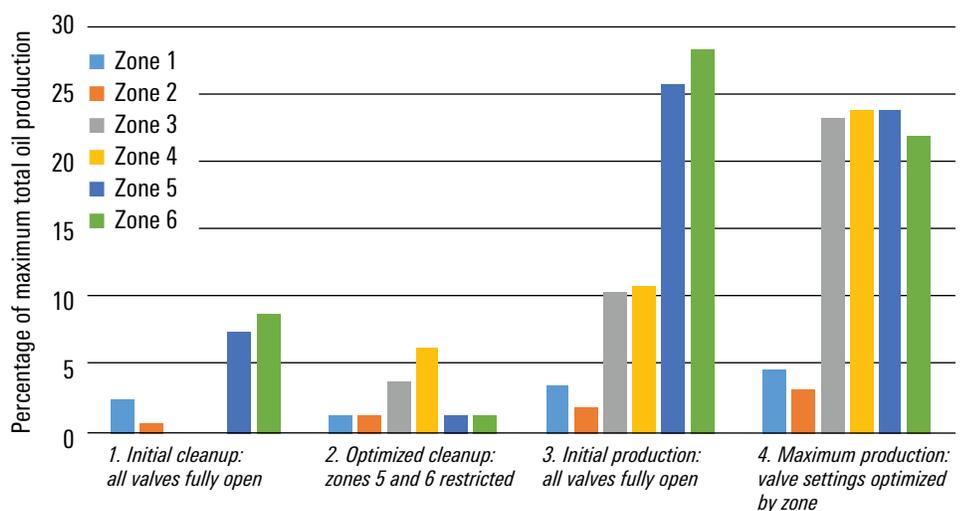
Continuously optimize oil production without intervention

Extended-reach drilling (ERD) enables reservoir access with lower overall well construction costs and significant reduction of surface infrastructure costs and footprint. For example, drilling an extremely long horizontal well from a location on land reduces costs by eliminating the much higher costs of building offshore platforms and subsequent logistics.

Along with infrastructure complexities, extended-reach wells bring additional difficulties. In long, horizontal multizone wells that produce from multiple reservoirs with different properties, uneven drawdown can hinder production and promote early gas or water breakthrough. In addition, high friction in the long horizontal causes a heel-to-toe pressure loss effect that exacerbates reservoir pressure differences.

For a new extended-reach well, an operator needed a way to optimize production from six productive zones in four reservoirs with dissimilar permeabilities and pressures. Earlier in the project, the operator used conventional extended-reach completions composed of screens and passive inflow control devices (ICDs). Although the ICDs and nozzles were engineered for the expected reservoir conditions, uncertainty in estimated reservoir properties resulted in the wells experiencing early gas breakthrough. Because the wells did not have a monitoring system to enable better understanding of flow potential, the wells required multiple interventions to manage the production uncertainty.

For the new well, the operator wanted to address the uncertainties with active flow control and measurements to better characterize zone potential and to drain oil without gas breakthrough. This would only be possible with a completion that could be installed to the full depth of the long horizontal well and deliver zonal measurements and control from surface in real time.



On initial cleanup (1), zones 3 and 4 contributed no oil production. To clean up those zones (2), the engineers choked back zones 5 and 6. After the damaged zones started to flow (3), all valves were opened fully to determine initial production. Finally (4), optimizing the valve settings maximized recovery, resulting in 25% higher production compared with production when opening all valves fully.

Control and monitor zones with all-electric intelligent completion

Schlumberger recommended the Manara system, an all-electric intelligent completion that can be deployed at extended distances in one or two trips to cover multiple structural plays from one onshore drillsite. Powered and controlled by a single electric umbilical combined with the inductive coupler downhole connector, the technology enables real-time downhole zonal intelligence and control.

The onboard production-monitoring suite with infinite choking capability enables effective zonal cleanup, productivity assessment and optimization, and early identification and management of future production challenges. Digital-ready by design, the Manara system delivers health data to a centralized production database, enabling continuous monitoring for operations integrity. WellWatcher Advisor software can then be used to monitor and manage drainage through production and reservoir workflows in real time—all without intervention!

Manage drilling damage and reservoir uncertainties in real time

At the initial well kickoff, engineers fully opened the flow control valves for all six zones and measured oil production, with significant contributions from zones 5 and 6, less from zones 1 and 2, and no flow from zones 3 and 4. Reservoir analysis indicated that zones 3 and 4 should be significant producers, so the operator believed the permeability was damaged with drilling mud. With a conventional completion, cleaning the tight zones would have been impossible.

With the Manara system in the well, the engineering team choked zones 5 and 6 to increase drawdown in the damaged zones. The pressure change induced flow that cleaned up the permeability damage without further intervention. After the zones stabilized, the engineers reopened all the flow control valves and measured overall production, with contributions from all zones, including the two previously damaged zones.

To maximize well production, the engineers then used WellWatcher Advisor software to calculate the optimal setting for the flow control valve in each zone. The result was a production increase of 25% compared with the production when all valves were fully open—including 47% from the two damaged zones that would not have produced at all without the real-time drawdown control.

Using the all-electric completion system for the cleanup and optimization process saved the operator approximately 2 days compared with using slower hydraulically actuated valves.

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