Case study: Middle East

MultiNode all-electric system optimized production in multilateral well, cut operating costs and risks

An operator in the Middle East faced complications while designing both extended-reach openhole horizontal completions and cased-hole multilateral wells in mature fields. When determining the best means of reservoir management and optimization, the operator confronted a dilemma: whether to use passive inflow control devices (ICD) for high resolution, or use active hydraulic interval control valves (ICV) but with lower resolution because of the limited number of laterals/zones/intervals.

To help overcome this dilemma, the operator worked with Baker Hughes to complete a dual lateral horizontal cased-hole intelligent, oil producing, completion where both laterals targeted the same reservoir. Baker Hughes recommended the **MultiNode™ all-electric intelligent well system** that enables selective production control in the two laterals.

The MultiNode system is a remote-controlled, electric system comprising of electric flow control valves (eFCV) which combine the benefits of both ICDs and hydraulic ICVs. It enables the precise and active management of a reservoir by selective remote interventionless surface control of up to 27 valves, each with multiple and customizable position choking and shutoff, on a single tubing-encased conductor (TEC). This facilitates the efficient control/delay of water/gas production while optimizing oil production. It also provides greater flexibility for reacting to uncertainties from the reservoir, quickly and reliably, reducing operational expenses (OPEX) and accelerating production, prolonging the life of the well, and maximizing ultimate recovery.

Each lateral comprised of the following: a MultiNode eFCV, an **InForce™ HCM™-A hydraulic adjustable ICV**, a **SureSENS™ P/T tubing/annulus dual gauge**, and a **Premier™ feedthrough packer**, which isolated each lateral for production.

The eFCVs were deployed as the primary means of controlling the flow of production, while the InForce ICVs provided redundancy, minimizing the risks associated with new technology qualification. The SureSENS dual gauges were positioned to provide real-time downhole pressure and temperature monitoring helping determine the productivity of each lateral. Two SureSENS gauges were placed above the production packer for characterizing the produced fluid.

This completely integrated solution helps optimize production while reducing operating costs, rig time, operational risk, and the carbon footprint.

A system integration test (SIT) was conducted and all equipment and installation kits were inspected and tested upon arrival to the rig site to ensure complete job readiness. Prior to deploying the intelligent completion, stringent cleanup operations were performed to ensure the completion could be deployed to depth without any complications. TEC resistance software was used during deployment to enable continuous health and status monitoring of the TEC. The

Challenges

- Horizontal multilateral land well expected to produce unevenly over time
- Passive devices rendered less efficient for the life of the well
- Limited number of zones can be controlled due to limited number of lines that can pass through a wellhead

Results

- Achieved high-resolutionremote selective zonal flow control
- Simplified, more reliable system cut installation time by 50%, saving $2.8 million per year
- Achieved flexibility to remotely react to well uncertainties over the life of the well, eliminating need for future well intervention and reducing costs and health, safety and environmental (HSE) risks
- Optimized reservoir performance

eFCVs were successfully operated during deployment and flowback operations.

Baker Hughes worked meticulously with the operator through a long and rigorous technical review process before approval was obtained and a candidate land well was assigned. Local field personnel along with product line management and engineering team subject matter experts collaborated to ensure the flawless execution of this intelligent completion.

This successful installation is another step towards the realization of real-time interventionless full wellbore monitoring, control, and flow profiling for the entire life of the well. It paves the way for potentially having up to 27 eFCVs in a single well, even in multi-trip completions when deployed with the Baker Hughes **SureCONNECT™ downhole intelligent wet-connect system**. This will enable the operator to efficiently manage and control extended reach horizontal openhole intelligent completions by segmenting the openhole into numerous intervals for higher resolution as well as cased-hole multilateral wells with a large number of laterals, or indeed a combination of both. Either way, the operator, solely by reducing deployment and valve actuating time, is expected to save an estimated $2.8 million per year going forward.

These milestones, once achieved, will result in unprecedented monitoring capabilities where real-time data across the entire wellbore is obtained, easily understood and acted upon by selective remote zonal flow control, quickly, and without unnecessarily halting production.

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