Baker Hughes

Case study: Texas

Production Solution improves daily oil production 34%, mitigates nonproductive time

An operator in the Eagle Ford shale in Texas was installing rod lift systems in four wells completed with 5½-in., 20-lb casing that were no longer free flowing. However, after three installations, it was clear that the rod lift systems were not effectively drawing down the wells, which limited production. Fluid levels in the three wells on rod lift remained at just 600 to 1,110 ft (182 to 335 m) below the surface. Plus, the three wells were experiencing repeated rod-wear failures due to the deviated wellbore geometry. The wells averaged 9,200 ft (2804 m) total vertical depth (TVD) and 17,000 ft (5181 m) total measured depth. Additionally, this area suffered from severe scale and corrosion issues which dramatically impacted downhole pumping performance.

To achieve greater drawdown, a multi-disciplined team of Baker Hughes engineers analyzed the reservoir fluids and well challenges before recommending the slimline **CENesis™ PHASE multiphase encapsulated electrical submersible pumping (ESP) system** in concert with a chemical treatment program using a capillary line to prevent scale buildup in the ESP system. The slimline CENesis PHASE technology is designed to fit wells with smaller casing sizes and to naturally separate the high levels of gas typical in the Eagle Ford before it can enter the pump and potentially create gas locking conditions. Based on calculations from the Baker Hughes **AutographPC™ sizing and simulation software**, free gas in the fluid steam was approximately 85%.

The CENesis PHASE system was also chosen as the best technical solution due to the low water cuts and high API gravity of the oil in the Eagle Ford. This combination causes the oil and gas to foam up instead of cleanly separating and can cause the ESP system motor to overheat. The CENesis PHASE design mitigated this concern by diverting fluid past the motor to keep it cool.

Because of the known scale and corrosion issues, Baker Hughes scientists performed an analysis of the produced water in the area—including a kinetic turbidity test and dynamic tube block test. Based on the results, a proprietary scale and corrosion inhibitor was selected as the most effective chemical treatment. The chemical treatment was injected at the pump intake using a capillary line. This was a critical part of the solution due to the severe scale and corrosion issues experienced in this area of the Eagle Ford shale, which can lead to pump inefficiencies and premature failures. Eliminating any scale buildup or corrosion was doubly important in the smaller flow paths of the slimline ESP system. Delivering the combination inhibitor directly to the intake of the pump helped ensure effective treatment. The **ProductionLink™ virtual pressure meter** was deployed to optimize the operation of the ESP system during the first several weeks when downhole conditions tend to be more erratic.

Following installation of this **Baker Hughes Production Solution**, the operator immediately measured fluid levels in the well at 3,200 ft (975 m) from the surface, which resulted in 80 BOPD

Challenges

- Unable to adequately draw down the fluid level in the well to maximize production
- Repeated rod failures due to deviated wellbores
- Severe scale and corrosion issues dramatically impacted downhole pumping system performance
- 5½-in., 20-lb casing limited artificial lift options
- High gas content in the fluid stream

Results

- Increased production by 80 BOPD by improving fluid drawdown in the well
- Mitigated gas interference in the ESP system while producing 184 Mcf/D
- Experienced no production system down time due to issues related to high gas content and oil composition
- Prevented scale buildup in the ESP system

(12.7 m^3/d) incremental production. The CENesis PHASE ESP system effectively managed the gas in the fluid stream; data from ProductionLink monitoring services indicated there was no gas interference in the pump and the operator was also able to capture production of 184 Mcf/D—substantially more gas than the three wells on rod lift were producing—providing a secondary revenue stream from the well. The ESP-based solution also mitigated the issues related to wellbore deviations, eliminating the downtime and lost production associated with rod-wear failures. Plus, the CENesis PHASE system design alleviated any potential motor heating concerns.

By deploying a Production Solution that combined the ESP system with scale and corrosion treatment via a capillary tube, the operator and Baker Hughes were able to design a commercial model that included an environmental warranty, which expands the coverage on the ESP system to issues related to scale buildup or corrosion. With a properly designed capillary tube and chemical program, the warranty also was expanded to include any plugging, cracking, or stress to the capillary tube due to incompatible chemicals. This commercial approach, which can only be offered if Baker Hughes production experts are providing the ESP system and the chemical treatment program as a total solution, gave the operator greater confidence in the challenging conditions associated with producing from the Eagle Ford shale.

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