Baker Hughes

Case study: Europe

Advanced ESP Predictive Failure Analytics reliably predicts failures, slashes downtime, saves $8.9 million

A customer in Europe operates high producing onshore and offshore wells, producing over 2,000 B/D (318 m^3/D), and experiences electrical submersible pump (ESP) failures due to scale deposition, broken shafts, and electrical causes. Every unplanned ESP failure results in a downtime of four to six weeks—due to lack of rig availability, procurement of services, delivery times and planning of operations—all resulting in deferred production.

The logistics of replacing an ESP is a complex and lengthy process and can affect well production and overall field economics. The ability to accurately detect the damaging events and anomalies that limit ESP run life is very helpful in making proactive operational decisions, workover scheduling and prioritization, and reduce revenue loss. The customer approached the Baker Hughes artificial lift team for assistance.

The Baker Hughes solution

The Baker Hughes **ProductionLink™ artificial lift monitoring solution** is an integrated production optimization platform that enables engineers to effectively and efficiently monitor their artificial lift wells and maximize lift performance. By coupling predictive capabilities with wellsite automation, it is possible to enhance the remote monitoring workflow to identify, predict, and avoid potential system faults and minimize equipment damage.

Knowing the pain points of the customer, the Baker Hughes artificial lift team offered to demonstrate the capabilities of the **ProductionLink Advanced ESP Predictive Failure Analytics (PFA) solution**. The PFA features an innovative analytics approach that combines advanced AI models with reliability engineering and physics-based models to provide insights to probable causes of ESP failures. It provides a high degree of accuracy on historical ESP failures during the pump-off controller (POC) phase.

The customer agreed to use the PFA and shared their historical production, surface, and downhole sensor data from two fields. Baker Hughes data scientists used this data to fine-tune AI models to predict ESP failures and remaining useful life (RUL). Weibull models were created to estimate the mean-time-to-failure (MTBF). Damage events were detected using physics, heuristics analysis, and combined with AI-driven time series forecasting. These models were able to identify short-term events—which led to immediate failure, such as broken shafts, short-circuit/high-currents, or motor overheating—as well as long-term events, such as scale/deposition and tubing leak, that build up over time.

The PFA achieved 80% precision and 60% recall on historical failures, and 85% true negative rates (15% false alarms) for the running ESPs in two fields. It accurately detected the cause of failure for 62% historical failures due to broken or fractured shafts and electrical short circuits (the top failure causes for the customer). It was able

Challenges

- Identify critical events that damage ESPs
- Predict ESP failure in advance to plan field operations and minimize downtime

Results

- Accurately predicted electrical failures of 8 ESPs
- Enabled customer to proactively schedule workover operations
- Avoided nonproductive time (NPT)
- Saved $8.9 million USD

to distinguish scale and deposition six to eight months ahead from when the chemical treatment was applied. The customer corroborated the results, confirming that four out of the five wells in which the PFA detected scale or deposition were scheduled for chemical treatments.

The results of the PFA solution were used to schedule workover rigs more effectively and reduce downtime.

Based on the average production rate in two fields, the customer saved an estimated $8.9 million USD by correctly predicting ESP failures and eliminating the possibility of deferred production.