

Title: -

Cloud based Real-Time Monitoring of Tight oil field by applications of edge gateway device, automatic fluid level analyzer and analytical dashboards

Objective

Data-monitoring & field-optimization in tight oil fields is a challenging task without innovative technologies and digital-analytical platforms. In SRP wells, real-time dyna-card and continuous fluid-level data are valuable to understand downhole pump-performance and well-issues. The conventional echo-shot survey provides only 1-2 shots in a week/month, which is insufficient for pump & well-monitoring. Real-time dyna-card requires 256 data points/minute frequency which is possible only by IOT edge-gateway devices. The lack of real-time monitoring results in well-downtime and production-loss. The combination of IOT, Cloud-Computing and Machine-learning implementation shifted our approach from reactive to proactive which assisted in ALS-Optimization and production loss reduction. A smart real-time cloud-based dashboards were built as they are the key to integrate-data to get a big picture of the actual field-conditions. These reliable analytics assisted in faster business decisions to enhance/optimize oil production

Method, procedure & process

The process of data-analytics at web-based portals & PowerBI is done after it is transmitted to company's cloud-server. All the variables relevant to monitor pump and well parameters were mapped with the help of SCADA-system via Modbus address protocols. Various algorithms were made including automated dyna-card classification using computer-driven pattern recognition methods and machine learning which uses old classified dynacards. Several informative dashboards are developed which provided quick analysis of ALS-performance. After collecting 2 years of data and analytical-dashboards using domain-knowledge, these gained insights were used for ALS-optimization.

The automatic fluid-level analyzer can listen to the well-noise wave-frequencies and accordingly sends distinct frequency waves to detect correct fluid level peaks in real-time. This technology has eliminated the dilemma of sound velocity in annulus by its calibration box application which has increased accuracy of liquid-level data

Results, observations & Conclusion

Smart-Alarms are generated using statistics-based settings which sends e-mail alerts if an abnormal well behavior or erratic dyna-card is detected. Wells are auto ramp-up/ramp-down to optimize pump-performance and well-production. The major problems related to correct liquid-level and foam column-length due to high gas-rate are rectified by the fluid-level technology. The device provides automatic, continuous, unmanned electrical/digital high frequency data of bottomhole flowing pressure as-well-as shut-in pressure.

The integration of domain-knowledge and digitalization enabled to take effective-decisions in more than 47 horizontal-producers remotely. This has prevented many pump & rods-failures, resulting in saving workover jobs and well-downtime losses.

Novel/Additive Information

This project has delivered an innovative approach for field monitoring in a very challenging tight oil field along with many learnings & solutions adopted. A few challenges for example are - high GOR (upto 4000scf/bbl), high sand-production, reservoir-pressure depletion, wellbore cleanout challenges in horizontal wells, high CO₂ (40-90 mole %), etc