

KAIZEN intelligent drilling optimizer saves drilling contractor \$112,554 USD

Interbedded formations are as distinct as a fingerprint; one may be similar to a neighboring formation yet still have a unique disposition. Drilling operations often encounter drilling dysfunction due to varying formations, and optimal setpoints are required to identify and proactively mitigate dysfunction, saving time and money for the operation.

A drilling contractor in the U.S. northeastern region sought a solution to complete each hole section in a single bit run while improving the rate of penetration (ROP) and reducing drilling time with less damage to the bit. The target formation showed shale with interbedded limestone beds as well as concentrations of iron pyrite and siderite, making for a challenging well.

Our KAIZEN™ intelligent drilling optimizer is a next-generation application that has continuous learning capabilities, enabling it to provide proactive drilling dysfunction mitigation while maximizing ROP and mechanical specific energy optimization. Employing artificial intelligence, machine learning algorithms, and digital twin models, the system continuously evaluates drilling performance based on current wellbore conditions, compares it to offset well data, and detects environmental changes. This approach enables the KAIZEN system to instantly respond to changing conditions and provide optimal weight-on-bit and revolutions-per-minute set points. Other drilling optimizers are available today; however, none offer the extensive combination of features provided by our KAIZEN system.

The use of KAIZEN control mode on our NOVOS™ reflexive drilling system showed immediate improvements. All three wells that used the KAIZEN system were compared against the customer-provided baseline well, and the KAIZEN system collectively saved the customer 38.6 drilling hours. The cumulative hourly savings translate to an average of \$37,518 per well for a total savings of \$112,554 over the three wells, based on a \$70K/day spread rate.

Case study facts

Challenges

- Hole sections required multiple bit runs and often resulted in drill bits damaged beyond repair
- Interbedded formations required the driller to actively manage drilling parameters to achieve the maximum ROP in each lithology
- Improve ROP and reduce drilling time while reducing drill bit damage

Well Information

Location: Marcellus Shale, United States

Client: Domestic operator

Well: Vertical hole section and lateral legs

Time frame: November 2019

Solutions and Results

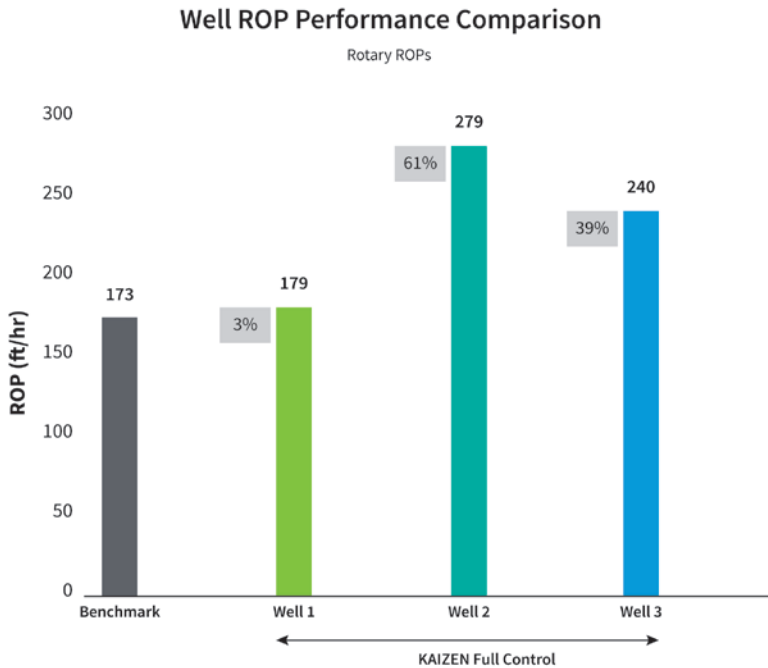
- KAIZEN drilling optimizer in control mode on the NOVOS platform
- Completed each hole section in a single bit run
- Improved ROP and reduced drilling time compared to baseline well with less damage to the bit
- Included in operator's top 10% of wells drilled within a database of 775 wells
- Reduced drilling time by 38.6 hours
- Saved an average of \$37,518 per well, resulting in \$112,554 savings over three wells



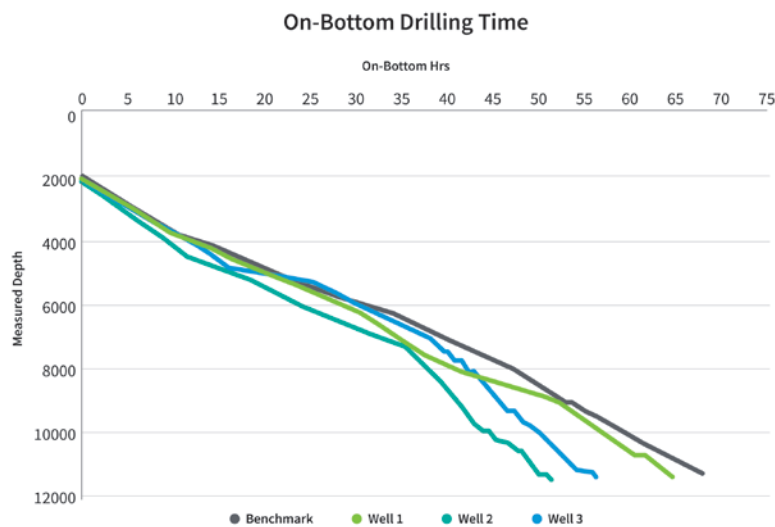
Case Study

The drilling supervisor was pleased with KAIZEN system's performance, stating, "During the drilling operations, I had the opportunity to take part and witness KAIZEN in full control mode. I'm pleased to note, that even with my 28 years (of) experience, this system truly improved our overall performance in ways I don't think we would have done. Not that we couldn't, but just that we don't realize the right changes needed sometimes."

Contact an M/D Totco™ representative to learn how our KAIZEN intelligent drilling optimizer can improve your drilling performance.



*Percentages are relative to ROP baseline



The KAIZEN system was assessed over a three-well span against a benchmark. On the first well, the customer held RPM static. On the second and third wells, the KAIZEN system was given a window in which to perform optimization functions. An ROP improvement of 61% and 39%, respectively, was observed in Wells 2 and 3 versus the benchmark. The customer allowed the largest parameter window for optimization in Well 2, and therefore the highest performance gains were achieved in that well.

The three Marcellus Shale wells that were drilled using the KAIZEN system's full-control mode showed performance improvements over the benchmark well in the vertical and lateral sections. The KAIZEN-drilled wells targeted the same formation as the benchmark well and implemented the same crew and equipment except for the absence of mud motors in the lateral section of Well 1. The benchmark well recorded 68 hours of on-bottom time, while Well 2 reached the same measured depth in 51 hours, which is a 25% improvement in drilling performance.