

# Comprehensive ESP surface monitoring solution for high-temperature geothermal wells

## Key highlights

- + Advanced electrical monitoring through Power Analyzer 2.0 capturing over 80 electrical parameters with real-time sampling at 5kHz frequency for comprehensive ESP performance analysis
- + Seamless PMM motor integration utilizing the INSTRUCT E30 VSD's native compatibility with permanent magnet motors, eliminating hardware modifications and simplifying setup procedures
- + Cloud-based visualization platform leveraging AVALON cloud technology for real-time data interpretation and remote monitoring capabilities accessible to end-user teams

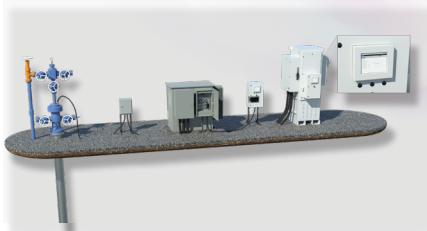
*A smart solution for monitoring electric submersible pumps (ESPs) in high-temperature geothermal wells, where traditional downhole sensors fail. Using the INSTRUCT Power Analyzer 2.0 and E30 VSD, the system tracks over 80 electrical parameters from the surface, offering deep insights into pump performance. Data is sent to the AVALON cloud platform for easy access and analysis. This setup avoids complex hardware changes, improves reliability, and helps teams monitor and optimize operations remotely. The result is better efficiency, fewer failures, and smarter maintenance in tough geothermal conditions.*

## Challenges

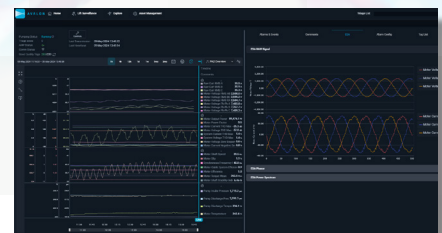
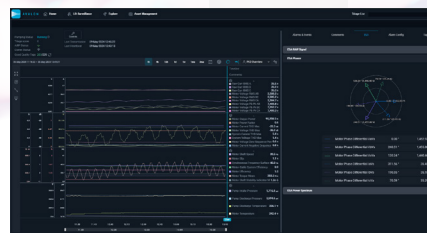
- + **Extreme downhole temperatures** prevented the use of traditional downhole gauges, leaving operators without critical real-time visibility into ESP performance and operating conditions
- + **Limited monitoring capabilities** restricting oversight to surface-level measurements such as wellhead pressure, temperature, and casing pressure which provided insufficient data for optimal system management
- + **High-temperature environment risks** posed significant threats to ESP component reliability, including seals, motors, and electrical cables, requiring specialized equipment and monitoring solutions
- + **Operational blind spots** created uncertainty around downhole equipment performance, making it difficult to optimize efficiency and prevent costly failures in demanding geothermal conditions

## Solution

The project implemented a comprehensive surface-based monitoring solution used commonly in oil field applications which is also suited to the high-temperature Geothermal installations. The INSTRUCT Power Analyzer 2.0 served as the primary monitoring system, capturing extensive electrical parameters that provide detailed visibility into ESP performance without requiring downhole instrumentation. The SENSIA INSTRUCT E30 VSD was selected for its native permanent magnet motor compatibility, enabling seamless integration with the downhole equipment while maintaining operational simplicity. The system architecture incorporated real-time electrical measurements sampled at 5kHz, providing unprecedented insight into electrical efficiencies and system performance. All collected data was transmitted through the HCC2 unit within the Power Analyzer 2.0 to the AVALON cloud platform, creating a centralized visualization and interpretation system accessible to end-user personnel for continuous monitoring and optimization.



Power Analyzer 2.0 common installation



Avalon - Power Analyzer 2.0 screens



E30 Variable Speed Drive



Instruct Controller



HCC2 - Hyper-converged Edge Controller

## Results

The implementation successfully addressed the critical monitoring challenges inherent in high-temperature geothermal ESP applications. By utilizing surface-based electrical parameter monitoring, the solution provided comprehensive visibility into downhole equipment performance without the limitations imposed by extreme temperature conditions. The Power Analyzer 2.0's extensive data collection capabilities enabled real-time assessment of ESP electrical efficiencies and operational status, effectively compensating for the lack of a traditional downhole gauge functionality. The integration of the INSTRUCT E30 VSD with permanent magnet motor compatibility ensured reliable operation while minimizing setup complexity and hardware requirements. The AVALON cloud platform facilitated enhanced collaboration between end-user teams through shared access to real-time performance data and analytics. This comprehensive approach not only maintained operational visibility in challenging geothermal conditions but also established a foundation for proactive maintenance strategies and performance optimization, ultimately supporting sustained production efficiency in demanding high-temperature environments