SENSIA
Rockwell Automation + SLB

+ CASE STUDY

Power Analyzer helped to optimize power energy consumption and reduce carbon footprint

Challenges

+ **Harmonic distortion in ESP systems** increases electrical stress on downhole motors, leading to overheating, insulation breakdown, and reduced motor lifespan.
+ **System efficiency dropped** due to additional power losses caused by harmonics, resulting in higher energy consumption and less cost-effective operations.
+ **Data quality and availability are limited,** with downhole and surface measurements often being sporadic, incomplete, or fragmented across different acquisition systems.
+ **Lack of real-time data processing and validation** hinders the ability to assess the true power delivered to the pump and its correlation with ESP system performance.

An oil field operator faced energy waste and equipment problems due to unstable electrical currents. By installing Power Analyzer 2.0, a real-time diagnostic tool, hidden inefficiencies in the pumping systems were identified, which were increasing electricity consumption and damaging motors. Guided by the tool's data, simple adjustments were made that reduced harmful electrical distortions by 84%, significantly improving system reliability. These improvements led to a 4% reduction in energy use per well and lowered CO_2 emissions, demonstrating that smarter power management can drive both operational efficiency and environmental sustainability.

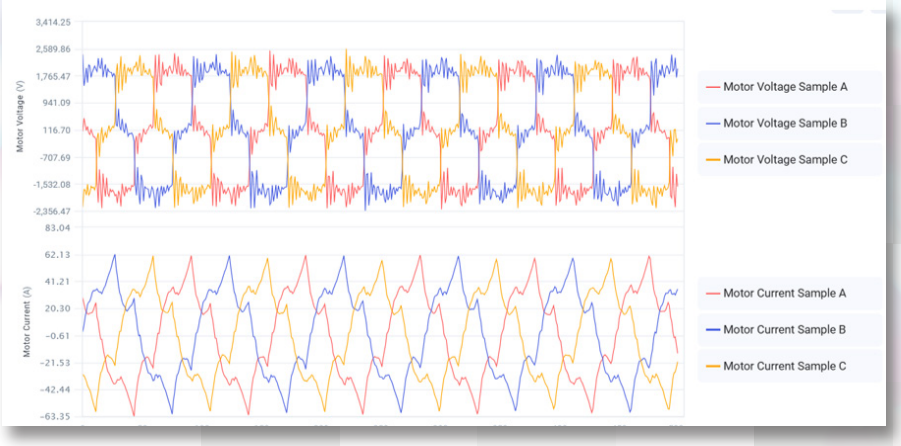
Solution

From a technical standpoint, some actions can be taken to reduce or optimize the load harmonic distortion, and the effectiveness of those, relies on the accuracy and frequency of the measurements. Having accurate measures in real-time is now possible and can be scaled cost effectively across entire ESP clusters and fields. Power Analyzer 2.0 uses high-speed electrical signature analysis technology to monitor and process high-frequency motor electrical data. This allows for the extraction of performance and diagnostic data for the complete system.

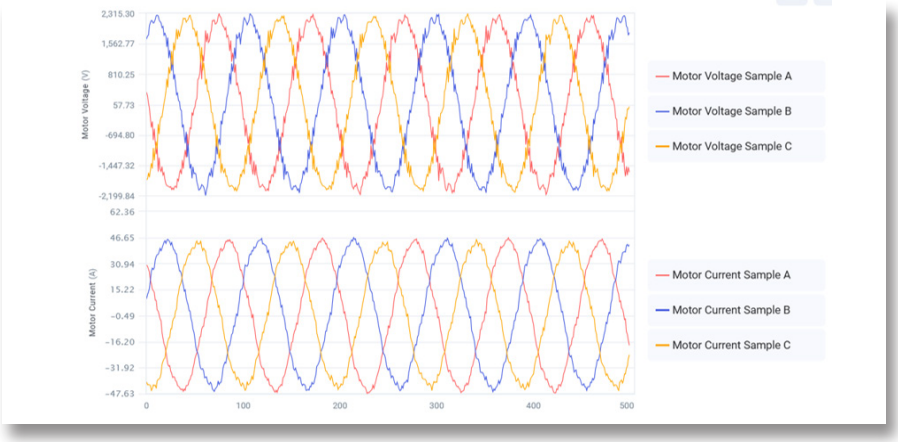
The system performs power quality monitoring by reading three-phase voltage and current measurements. These measurements are obtained by a PowerDAQ module, which enables synchronous acquisitions of three-phase voltage and current measurements at a high-sampling rate. The data is transmitted to the Sensia QRATE™ Hyper Converged Controller (HCC2), which performs various functions to yield results in both frequency and time domains. This approach leverages analytics and high-resolution electrical analysis to facilitate intelligent actions in digital field operations.

Result

The actionable insights provided by Power Analyzer 2.0 (PA 2.0) enabled the operator to make well-informed decisions that helped improve power consumption for the well where it was installed. After analyzing key PA 2.0 outputs parameters such as voltage, current, power factor, and harmonics, they were able to identify the impact of the harmonic distortion on power consumption and efficiency.



After few operational actions were taken, the harmonics distortion was reduced by 84%, which immediately showed an important effect over the quality of the power delivered to the motor. The change was easily identified visually in the electrical signal waveforms, and the power efficiency indicators generated by the PA 2.0.



As a result, energy consumption in the well was reduced by 4%, which translates to an estimated 1.9 kg/h reduction in CO_2 emissions (estimation based of emissions data & statistics of the U.S Environmental Protection Agency).

Parameter	Before	After
VFD Frequency	51.9 Hz	51.9 Hz
Motor Output Power	86.96 KW	85.5 KW
Surface Apparent Power	145 KVA	139.5 KVA
Surface Effective Power	110.62 KVA	107.32 KVA
Motor Voltage THD	25.6%	3.9%