Schlumberger

Permanent Magnet Motor Saves Cepsa 21% on Power Requirements for ESP-Lifted Well

Efficient motor significantly reduces surface electrical power cost in a field where some wells rely on diesel generators, Colombia

CHALLENGE

Reduce lifting costs without reducing oil production in wells with ESPs.

SOLUTION

Replace conventional AC induction motors with energy-efficient permanent magnet motors (PMMs).

RESULTS

- Reduced surface apparent power (kilovolt amperage) requirements by at least 21%.
- Increased motor power factor from 78% for an AC induction motor to at least 96%.
- Reduced reactive power by 65%.

Power generation increases lifting costs

To achieve economic production, operators around the world have been looking for new and different technologies to help them save on lifting costs—in particular, electrical power costs. Cepsa Colombia had a particular economic concern in fields that required diesel generators to deliver power for wells with ESPs. The company asked Schlumberger for help or new technology to reduce power consumption and fuel transportation costs.

Permanent magnet motors improve power efficiency

Schlumberger recommended replacing the conventional AC induction motors in the ESP systems with PMM technology. Proved over decades in Russian oil fields, these efficient motors typically produce 30% to 40% more power density compared with similar-sized AC asynchronous motors. This means using a PMM can facilitate design, installation, and retrieval because it is smaller and lighter than a comparable inductive motor.

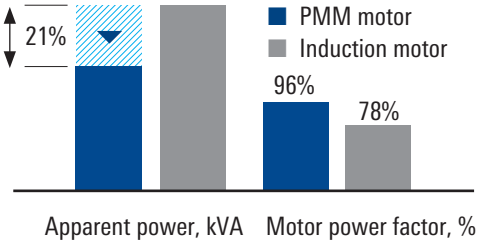
In addition, a PMM can improve ESP performance in low-flow and deviated wells with wider load and frequency range compared with an inductive motor. High power factor and efficiency are intrinsic to the PMM design. PMM motors have a very flat efficiency and power curve as a function of motor load factor, so power factor correction and voltage optimization are not required, unlike induction motors.

PMMs are compatible with legacy protectors, pumps and gauges, so field inventory does not need to be changed—except for the motors—to gain the efficiency advantages of using these motors.

Power required for ESPs drops by 21%

To assess the merit of the technology, Cepsa installed a PMM-powered ESP in its Jaguar 1T HD well. The ESP was fitted with a downhole gauge to measure intake and discharge pressure in real time. This instrumentation, combined with test separator measurements and pump factory test curves, enabled direct calculation of the pump absorbed power, which was found to be 126 kW (169 bhp). Surface power measurements showed that the apparent power required was 152 kVA, which enabled confirmation that the PMM power factor and efficiency were 96.0% and 88.5%, respectively.

In comparison, an equivalent induction motor (same diameter and total winding temperature for the same pump load) would have 21% higher surface power requirements even after voltage optimization. Without optimization, the induction motor power requirement would be even higher.



By installing a permanent magnet motor instead of a conventional AC induction motor to operate an ESP, Cepsa Colombia reduced surface power requirements by at least 21%.

The PMM has met Cepsa expectations for performance and reliability. As a result, its engineers have identified additional candidates for new PMM installations to be completed as ESPs need replacements, with a potential to save up to USD 950,000 per year in fields with high electrical costs because of diesel generators.

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Artificial Lift