BORETS

Case Study

Permanent Magnet Motors Help Reduce ESP Energy Consumption by 46%

Power consumption analysis for 16 unconventional wells in Permian Basin shows that Borets ESPs, using Permanent Magnet Motors (PMMs), consumed 46% less power than ESPs using Induction Motors

Customer Challenge

Reduce Lease Operating Expenses (LOE) for unconventional well production using Electric Submersible Pumps (ESPs).

Borets Solution

Install ESPs utilizing Borets' industry-leading PMMs to reduce ESP power consumption and overall LOE.

Resulting Benefit

Six wells with Borets PMM-ESP systems on average consumed 46% less electricity per barrel of fluid lifted when compared to ESP systems installed with conventional induction motors (IM) operating in nearby wells.

Packet pump performance plus vector control of the downhole motor contribute to enhanced overall system efficiency yielding energy savings that far exceed the typical 10% – 20% from the PMM alone.

For a single well, the resulting cost savings is estimated at over $28,000 annually.

Major Permian Basin operator looks to lower effective operating expenses

A major operator in the Permian Basin using ESPs to produce their Unconventional Shale assets, sought ways to lower LOE without compromising production rates. Well-proven outside US oilfields, ESPs using permanent magnet motors instead of conventional induction motors have shown to reduce electrical energy consumption compared to ESPs using induction motors.

Making the decision to explore the use of permanent magnet motor technology for unconventional production, this operator called upon Borets, the global leader in PMM technology for ESPs.

IM vs. PMM ESP system power consumption analyzed

The operator set out to evaluate total system efficiency by measuring and comparing the real power demand of 16 unconventional development wells against the total production over one month.

All the subject wells were produced using new ESP equipment from three different service providers. Provider A utilized new ESP equipment designed with tandem induction motors (322 hp total) in 7 wells and produced an average of 55.9 thousand barrels of fluid per month per well (MBFPM). Provider B utilized new ESP equipment designed with a single induction motor section (270 hp) in 3 wells and produced an average of 50.2 MBFPM per well.

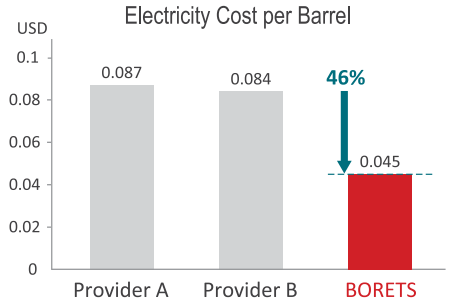
Borets employed new ESP systems designed with single section PMM technology; 3 wells each using a 320 hp PMM and 3 wells using single section 400 hp PMMs. Average production for Borets' 6 wells over the identical duration was 74.4 MBFPM per well. Power demand was determined by measuring the daily VSD input voltage and motor current draw.

Measurement was made at this point to determine real demand power while eliminating variables such as differing power factors for the motor and drive pairs.

Reduced energy consumption through total system efficiency

The operator measured their electricity cost and total production rates for one month and determined that Provider A's cost averaged $0.087 per barrel of fluid produced; Provider B's cost averaged $0.084 per barrel of fluid produced while Borets' ESP electricity cost averaged $0.045 per barrel of fluid produced.

Borets PMM-ESP systems produced fluid at an average cost that was 46% lower than the second best performing ESP system using induction motors.



Unconventional wells produced using Borets PMM-ESP systems, consumed 46% less electricity than with ESPs using induction motors.

Benefiting from more than just improved motor efficiency

Unlike induction motors, PMMs induce no electrical current in the rotor. This minimizes electrical losses and heat rise and increases electrical efficiency in the motor by up to 10%.

Reductions in power consumption beyond the theoretically typical 10% - 20% from the PMM alone are achieved through improvements in overall system efficiency which include contributions from other factors such as pump design, selection and operating conditions.

To address the anticipated decline often seen in the first month of unconventional well production, ESP systems are routinely designed where the peak flow rate will be higher than the best efficiency point which results in the pump experiencing upthrust for a limited time.

The Borets Packet Pump was specified by the Applications team as part of the ESP system design. With its extended normal operating range, the Packet Pump performs well and loses little to no efficiency even when operating in upthrust, contributing to the comparative reduction in energy consumption.

ESPs operating in unconventional wells exposed to rapid decline, gas-prone or unstable flow will also experience changing load conditions on the motor. Under such variable load conditions, precision control of the PMM also helps deliver more operating efficiency.

Borets' PMMs employ a vector control algorithm in the Axiom II Variable Speed Drive at surface to achieve superior operational performance and efficiency. Vector control of PMMs enables dynamic motor control and optimized energy consumption across the entire load range typically experienced under normal operating conditions for unconventional wells.

A subsequent ESP and production optimization study for this operator's Permian Basin wells uncovered opportunity for even further power savings improvement and efficiency gains.

Upon review of actual production data, it was determined that the Borets ESP design could be modified to make use of a lower horsepower motor and still achieve the same or better production rate. A lower horsepower motor for this application results in further optimized power consumption, while potentially reducing equipment investment CAPEX through utilization of a smaller motor, smaller surface drive size and potentially a smaller gauge ESP cable.

The global leader in PMM technology, Borets has shipped, sold or installed more than 18,500 PMMs since first commercializing PMM technology in 2006. In December 2018, Borets achieved the milestone of 250 PMMs installed in the Permian Basin.

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