JANUARY 2016
PUMPSANDSYSTEMS.COM

PUMPS & SYSTEMS

The Leading Magazine for Pump Users Worldwide

STATE OF THE INDUSTRY. GLOBAL OUTLOOK.

Pump Market Insights for 2016

Municipal Utility District Reduces Energy Demand Penalties & Implements Condition-Based Monitoring Program

Instrumentation led these users to more informed decisions.

By Mike Bjorkman, ALL-TEST Pro, LLC
& Stephen Hogue, Less Watts Inc.

Unlike residential consumers, industrial and commercial companies pay for the reactive kilovolt-amps (kVA) demand power they use along with the active kilowatt (kW) energy they consume.

Each electrical power provider supplies reactive kVA that produces the magnetic field in the motor that turns the rotor. The rotor converts electrical energy into mechanical energy that drives connected rotating equipment. The kVA electrical power is not consumed like the active kW energy.

Utility providers use a demand meter to determine how efficiently a customer is using the supplied kVA energy. The efficiency is measured as percentage below 1.0 or unity.

Power factor (PF) below 95 percent has a penalty charge applied to each billing cycle. The monthly electric demand charges can be the major electrical cost for larger motors operating with low PFs.

Companies who have optimized PF and avoid PF penalties often achieve a return on investment (ROI) within two years.

Case Study

In 2008, a municipal utility district (MUD) in Texas began working with a company that specializes in motor reliability and power quality testing for the water/wastewater industry. At a MUD board of directors meeting, Stephen Hogue, president of the motor reliability and power quality testing company, discussed potential opportunities to improve rotating equipment operating efficiency and lower electrical costs. In 2009, capacitors were installed on eight of the larger district motors. Power quality monitoring for one lift station during 2009 showed major reductions. By the end of 2009, the kVA billed was reduced by 50 percent, and kW was reduced by 25 percent.

The 400-horsepower (HP) well motor with four 60-HP booster pumps did not indicate any energy cost reductions even though the PF had been increased to 98 percent efficiency. Hogue then contracted a third-party motor testing company to perform energized and de-energized testing at the well

Image 1. Deep well vertical pump and 400-HP motor at the well pumping facility (Images courtesy of ALL-TEST Pro)

facility. The testing revealed that two of the six underground motor cables that connected the well to the motor control center had been close to grounding out.

Immediate action was taken to re-trench and replace the 100-foot lead cables that ran underground from the pump motor to the motor control center. At that point, Hogue knew it would be essential to collect and trend data on all the motors so he could better understand the health of the motors and show the MUD how the condition of their motors and other rotating equipment affected the MUD's ability to achieve energy savings.

After extensive research of motor testing equipment, the motor reliability and power quality testing company purchased both a handheld energized testing instrument and a handheld troubleshooting instrument. Both are ideal for condition-based monitoring and trending. The company chose these user-friendly motor-testing instruments for the following reasons:

- The handheld energized testing instrument is used in energized conditions for both electric signature analysis (ESA) and power quality (PQ) analysis. In ESA mode, the instrument evaluates the condition of incoming power, the control circuit, the motor and the driven load. When in PQ mode, it can be used for energy data logging for an array of data points that include harmonic analysis, voltage and current charting, viewing waveforms, waveform capture of sags and swells, and transient event capture.
- The troubleshooting instrument, which is used for de-energized testing, is specifically designed for troubleshooting motors and commissioning new and rebuilt motors before installation. This instrument enables the operator to identify motor conditions that include winding contamination, stator and rotor unbalance, changes in rotor and stator condition, resistance in windings, contamination and insulation to ground. This de-energized motor testing instrument reveals actual motor conditions and enables the scheduling of remedial work to prevent serious damage and even avoid catastrophic failure.

The instrument manufacturer provided extensive training and support for the motor reliability company. Hogue quickly learned how to use the motor testing instruments and immediately began trending data for the MUD motors. The troubleshooting instrument proved to be instrumental in 2012 when the district's 400-HP well pump motor was sent to a motor repair shop to be reconditioned.

"It is important to commission new and reconditioned motors. Without motor commissioning, there is no confirmation that the motor is going to operate as designed," Hogue said. "By commissioning the motor, the chance that a motor will have operational issues that appear after installation can be reduced. The owner is better off having a motor commissioned before paying for delivery and installation, then finding out there is a problem. Finding issues after motor installation often leads to the owner having to fight for warranty satisfaction."

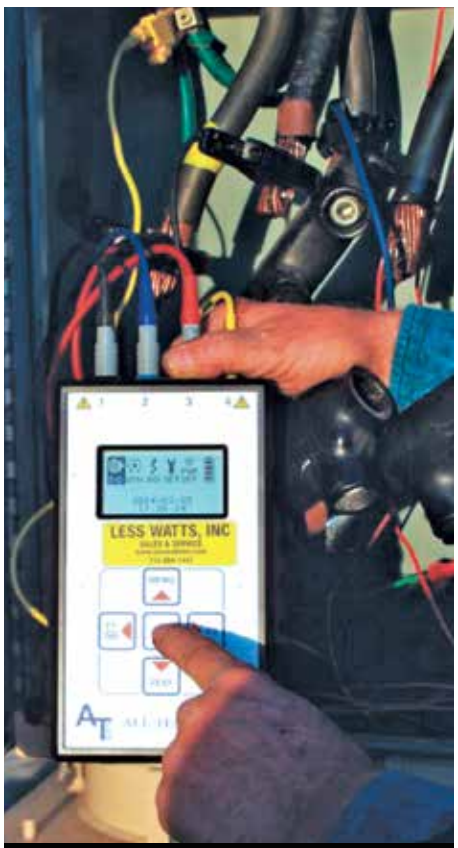

Image 2. Well pump motor tested with the troubleshooting instrument

Commissioning Issues

When Hogue went to the motor repair shop to commission the reconditioned motor, the energized testing instrument tests indicated poor insulation-to-ground results, showing a reading of 6.01 megaohms (Mohm). A healthy reading for a reconditioned motor should have been between 500 and 999 Mohm. The motor repair shop agreed to correct the issue.

Hogue returned three days later to repeat the commissioning tests. Using the troubleshooting instrument, the test results indicated an insulation-to-ground reading of 551 Mohm. Hogue issued his approval for the pump motor to be shipped back to the lift station. Once the rebuilt vertical pump and reconditioned motor were installed, Hogue returned to the lift station to perform motor tests with the instruments. This time, all tests yielded positive results, completing Hogue's commissioning process. Today, the MUD's well pump motor is operating efficiently, with an insulation-to-ground reading at 999 Mohm and a PF of 98 percent efficiency.

This MUD's approach to motor reliability demonstrates that a change is occurring in the industry.

Equipment owners and operating service companies are improving their reactive maintenance strategies and are now embracing more condition-based monitoring programs. This growing proactive change is increasing the benefits related to reduced downtime, energy savings and extended equipment life cycles, which are becoming more important for daily operations.

While providing dedicated personnel to monitor and trend collected electric motor data is difficult for many businesses, third-party professionals support the industry with condition-based technologies and services.

These instruments give end users the data they need to understand the health of their equipment and to make informed decisions. ■

Mike Bjorkman is vice president of BJM Corp. and has more than 30 years of industry experience. He is director of marketing and IT for BJM Pumps LLC and ALL-TEST Pro LLC, both subsidiaries of BJM Corp. Bjorkman may be reached at 860-399-5937. ALL-TEST Pro provides instruments for troubleshooting, quality control and predictive maintenance of electric motors, transformers and generators.

Stephen Hogue is president and founder of Less Watts Inc. since 2007. Hogue may be reached at stephen@lesswattsinc.com or 832-428-6890. Less Watts Inc. provides dynamic electric motor reliability and power quality testing services in Texas.