SOLUTIONS

- Solution provider
  - Rockwell Automation

- Medium voltage motor and variable frequency drive
  - 4160V, 750hp
    PowerFlex® 7000 drive
  - Active front end (AFE) rectifier contributes to low line harmonics, high power factor and commonality of parts
  - SGCT (Symmetrical Gate Commutated Thyristor) technology
  - Integral isolation transformer saves space in control room

RESULTS

- Operations impact
  - Drive has run flawlessly since May 2003 installation
  - 700 hp motor now runs more consistently, but at a lower speed

- Power system impact
  - Increased energy efficiency (system uses 230 kW less than before MV drive installation)

- Financial impact
  - Savings of US $23,000 annually through reduction in energy use and demand charges
  - US $17,500 government rebate
  - 3-year investment payback on drive

BACKGROUND

Peak demand electricity pricing increases energy costs, and has water utilities looking for more efficient technologies to run the large motors and pumps used in their systems. Once the water pumping system’s electrical consumption exceeds a pre-set limit, energy companies must charge ‘peak prices’ for the full month’s billing period, even if the peak demand period only totaled half an hour during that month. This peak demand cost can contribute significantly to the total operating cost of the facility.

Variable frequency drives (VFDs) are a proven method of automatically controlling the speed of the pump motor. This enables it to run at full horsepower only when necessary and at lower speeds during non-peak times. The Monroe County Water Authority (MCWA), in Rochester, New York, invested in...
a VFD for one of its centrifugal pumps and achieved annual energy savings of over $23,000, plus a $17,500 government rebate.

One of the 80 largest water suppliers in the U.S., the MCWA produces an average of 62 million gallons of drinking water every day for counties surrounding Rochester. The water is piped from Lake Ontario to two treatment plants, and the system has a storage capacity in excess of 130 million gallons of water, or enough to meet up to three days usage. The Lee Road Pump Station pumps an average of 19 million gallons per day of purified water to customers and storage tanks.

**CHALLENGE**

The original system at the Lee Road Pump Station had five medium voltage motors, ranging from 400 hp to 700 hp, and all were started across-the-line.

The water authority uses a combination of pumps to achieve a flow rate of 10,000 to 20,000 gallons-per-minute to fill water storage tanks for use during high demand times. But often the combination of motors either pumped too much or too little, so they cycled the motors and pumps several times a day to produce the needed volume.

"During any given day, the water consumption can be more than 20,000 gallons per minute at peak times, like early morning," says Dale Sherwood, Electrical Supervisor at MCWA. "People are getting ready for work and consume more water, and the rate can peak at 24,000 gallons per minute."

The challenge for the MCWA was in trying to manually calculate the proper combination of the pumps and determine the best time of day to use them, based on the varying flow requirements. They would frequently have to run the 700 hp motor at peak times of the day. This resulted in an accumulation of peak demand charges over several billing cycles as well as stress on the motor and equipment.

The need to reduce these energy costs and a New York state incentive program motivated the MCWA to upgrade its 700 hp centrifugal pump and motor with a variable frequency drive. The New York State Energy Research and Development Authority (NYSERDA) program gives a rebate to companies applying energy efficient technology.

**SOLUTION**

MCWA plant managers knew that they were financially penalized when they started their large horsepower motors across-the-line, especially during the peak times of the day when electrical rates increased. They realized that a variable frequency drive offers inherent energy savings and flow control capability, and took bids from drive manufacturers to find the best solution.

Rockwell Automation recommended its Allen-Bradley® PowerFlex® 7000 750hp 4160V medium voltage VFD with active front end (AFE) rectifier.

The MCWA analyzed the benefits of the PowerFlex 7000 "A" Frame configuration, which included high reliability and efficiency, a simple design, low component count, compact size for minimal space requirements, low harmonics generation and availability of technical support.

"Because of the small footprint, we didn’t have to create any additional buildings or expand to house the drive," says Dale Sherwood. "The general design and the component layout, and particularly the PowerCage™, make it maintenance friendly and easy to work on."

The innovative design of the PowerFlex 7000’s patented PowerCage™ uses Symmetrical Gate Commutated Thyristor (SGCT) technology and few components to
make future device replacement simple to do in less than 5 minutes, without the need for special tools.

Along with the compact size of the drive (95 inches wide and 39.9 inches deep and 104 inches high), the integral isolation transformer saved space in the control room and was key in retrofitting the existing motor, saving the cost of a new motor and installation.

The active front end rectifier contributes to low line harmonics, high power factor and commonality of parts. The PowerFlex 7000 achieves low line current harmonics of less than 5% total harmonic distortion (THD), which meets IEEE 519 harmonic guidelines. PowerFlex 7000 sinusoidal output waveforms result in no additional motor heating or voltage stress to motor insulation.

An additional benefit is Rockwell Automation’s technical support for the complete life cycle of the product. Rockwell Automation’s GMS (Global Manufacturing Solutions) group provided start-up assistance.

"The GMS people were great. They helped us get the drive set up so it was right the first time," says Dale. "They also keep records of everything, so the information is there if we have any questions in the future."

The contract also included a one-week GMS Drive maintenance and troubleshooting school at the Rockwell Automation headquarters in Cambridge, Ontario, which four MCWA employees attended.

**RESULTS**

The MCWA has proven and justified that a variable frequency drive has a great return on investment. The MCWA now runs the 700 hp motor more consistently, but at a lower speed to achieve the needed volume that two pumps in combination used to provide. The new MV VFD smoothly ramps up the motor to prevent motor wear and allows the motor and pump to run only when necessary, saving thousands of dollars a year in energy costs.

Prior to the VFD installation, the system used 590 kW per month, with electrical costs of $278,000 annually. After installation, the system used only 360 kW monthly, at a cost of $255,000 annually. NYSERDA also rebated the MCWA $17,500 for their energy savings solution.

"The PowerFlex 7000 solution has saved us approximately $23,000 annually through reduction in energy use and demand charges," says Dale. "We expect payback in about 3 years. Along with the added motor life and reduced maintenance, it's a good deal."

The drive has run flawlessly since the May 2003 installation, says Dale. Due to the success of this first Allen-Bradley medium voltage drive installation, MCWA has selected PowerFlex 7000 as the preferred MV drive, and awarded Rockwell Automation a second phase contract for a 1250 hp PowerFlex 7000 drive on a centrifugal pump at the main treatment plant.

The results mentioned above are specific to Monroe County Water Authority’s use of Rockwell Automation products in conjunction with other products. Specific results may vary for other customers.