Optimizing Pump Systems at a Chemical Plant

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Project Summary

Staff at Kodak's plant in Rochester, New York, significantly improved the energy efficiency of its two lake-water pumping stations in December 2003. To identify areas for efficiency improvements, Dr. Barry Erickson of Flowserve Corporation, a U.S. Department of Energy (DOE) Allied Partner, used the DOE Pumping System Assessment Tool (PSAT) to conduct a pumping system assessment at the plant. Flowserve then proposed a system-level project to increase the pumps' energy efficiency.

The project team established a baseline for the performance and energy consumption of both stations' pumps. The evaluation indicated the most energy-efficient pump combinations, as well as other non-capital-intensive energy efficiency measures, that would save energy while pumping the required volume of water. Plant personnel then implemented several energy efficiency measures that improved system performance and yielded important energy savings at the Rochester plant.

Plant / Project Background

The Rochester plant is home to Kodak's corporate headquarters; it is also the company's largest U.S. manufacturing operation, its corporate services office, and a research and development facility. Several years ago, the plant's management realized that many motor and process systems installed in the 1950s were not operating efficiently. This was occurring because the motor and process systems were being used to support newer production equipment, and the new equipment is less energy-intensive (i.e., it needs less energy to operate) than the 1950s-era production equipment.

The plant's lake-water pumping system includes two pumping stations served by 12 pumps with an aggregate horsepower (hp) of 7,450 hp. Flowserve found that many of the pumps had a low ratio of flow rate to input power, expressed as gallons per minute per kilowatt (gpm/kW). There were also some unnecessary flow restrictions, and some pumps were operating during peak hours that could operate more economically off peak. The improvement project included trimming impellers, replacing valves, and reconfiguring piping. Plant staff then selected and combined pumps that could achieve the highest gpm/kW ratio.

In addition to improving the pumping systems, Kodak is also using DOE's MotorMaster+ software tool in its recommissioning program to evaluate the performance of motors and processes throughout the Rochester plant. Since the program's inception, the plant has retrofitted more than 600 motors (with a total of 11,000 hp) with energy-efficient motors. These actions are yielding annual energy savings of more than 7 million kWh and energy cost savings of approximately $500,000 per year.

Results

Modifications made to the plant's lake-water pumping system improved its efficiency and performance, yielding significant energy savings. The improvements allow the pumps to maintain their combined flow rate even though fewer units are operating at any one time. As a result, energy consumption and maintenance needs have declined. This improved

efficiency has yielded annual energy savings of 1,092,000 kWh and energy cost savings of $52,000. Because the pumps are being used more optimally and during off-peak hours, the plant has reduced annual demand charges by an additional $48,000. With total project costs of $25,000, the project had a 3-month simple payback.

Lessons Learned

Using aging and improperly configured industrial pumping systems can waste energy and increase maintenance and operating costs. Over time, industrial plants acquire more efficient manufacturing processes and equipment, and these can reduce the loads on supporting systems. Recognizing these evolutions and reconfiguring industrial motor systems in response to changing demand patterns can save energy and improve productivity. In the case of Kodak's Rochester plant, selecting efficient pump combinations and reconfiguring some of the pumps greatly improved the efficiency of two pumping stations. Optimizing the lake-water pumping system in this manner resulted in significant energy and cost savings; therefore, Kodak is now evaluating pumping systems at other plants for similar opportunities. Projects such as this one can be implemented in virtually all industrial facilities that require lake or river water to meet production and process cooling needs.

Project Partners

- Eastman Kodak Company, Rochester, NY
- Flowserve Corporation, Kalamazoo, MI

Partner Profile

Dr. Barry Erickson is a mechanical engineer serving as a Key Account Manager for Flowserve Corporation, a DOE Allied Partner. He has more than 33 years of experience with industrial pumping systems. He has presented papers at technical conferences in the United States and Europe, written articles for numerous journals, and holds two patents. Currently, he is based at Eastman Kodak's plant in Rochester, NY.

Allied Partners

DOE's Industrial Technologies Program (ITP) offers many opportunities for partnering, such as BestPractices Allied Partnerships. Allied Partners are manufacturers, trade associations, industrial service and equipment providers, utilities, and other organizations that agree to help promote increased energy efficiency and productivity for industries that participate in ITP's Industries of the Future strategy. DOE also provides helpful tools for industry to use in achieving greater efficiency. One is the Pumping System Assessment Tool (PSAT), which uses data on pump and motor performance to calculate potential energy and cost savings.

For information, visit the BestPractices Partnership section.

Applications

Lake-water pumping systems that provide process-cooling water for industrial plants can consume a significant amount of energy. Optimizing inefficient pumping systems can save energy, reduce water consumption, and minimize the need for chemical treatment of the lake water.

Benefits

- Saves $100,000 annually
- Reduces annual energy consumption by nearly 1.1 million kWh
- Improves performance
- Achieves a 3-month simple payback