GLASS

BestPractices
Project Case Study

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Millwater Pumping System Optimization Improves Efficiency and Saves Energy at an Automotive Glass Plant

Benefits

- Saves $280,000 annually
- Reduces annual energy consumption by 3.2 million kWh
- Reduces water consumption
- Improves system performance
- Reduces purchases of water treatment chemicals
- Yields a simple payback of 15 months

Applications

Mill or river water pumping systems provide process-cooling water for industrial plants and can consume significant quantities of energy. Optimizing aging and inefficient mill or river water pumping systems can reduce energy consumption, water use, and chemical treatment of river water.

Summary

In 2001, Visteon Corporation's automotive glass plant in Nashville, Tennessee, renovated its millwater pumping system. Over time, technological advances had improved the plant's manufacturing efficiency, which lowered demand for process cooling water. However, because of its size and configuration, the pumping system was providing more water than necessary. The renovation project involved retrofitting the system's large, aging pumps with smaller units fitted with Variable Speed Drives (VSDs) to more effectively match the system's output to the plant's demand. The completed project greatly improved the system's efficiency and reduced the plant's water use, saving substantial amounts of energy and water treatment chemicals. In addition, the project improved plant safety by eliminating an electrical hazard on the pump barge. The project's total cost was $350,000 and the total annual savings were $280,000, yielding a simple payback of 15 months.

Plant Background

Visteon is an automotive parts manufacturer that was spun off from Ford Motor Corporation in 2000. With 81,000 employees and more than 130 technical,

The Barge Pumping System at Visteon's Nashville Plant

manufacturing, sales, and service facilities in 23 countries, Visteon produces a wide range of automotive components for manufacturers all over the world. The company's three main business segments are Dynamics and Energy Conversion; Comfort, Communication and Safety; and Automotive Glass.

The Visteon Nashville glass plant opened in 1956 and has since undergone 10 expansions that have doubled its floor space and production output. It is the world's largest complete automotive glass production plant with more than 2 million square feet of work and storage space. The plant produces windshields, backlights, and door glass. The millwater pumping system is important because it provides water for the process cooling applications. Prior to project completion, the plant was served by three 350-horsepower (hp) centrifugal pumps mounted on a barge in the Cumberland River. Two of the pumps were constantly operated in parallel to pump water from the river to a clarifier where the water was chemically treated. The third pump was kept for back up use.

Project Overview

Working with Tencarva Machinery Company, plant personnel reviewed the pumping system in relation to the plant's process cooling water needs. The review team began by assessing of the plant's water demand, which allowed Tencarva to determine the optimal size and type of pumping system.

The existing pumps were installed in 1968 when the plant's load was approximately 5,200 gallons per minute (gpm). Since then, increases in manufacturing efficiency and reduced need for cooling water by the compressed air system had significantly reduced the plant's load. The assessment indicated that under normal operating conditions, the plant could operate effectively with 3,125 gpm. Although plant personnel knew that the flow rate of 5,200 gpm was excessive before the review, the rate could not be adjusted because of the pump system design. The pumps had an on/off control system and because one pump's output was insufficient, two pumps were required to operate at full load. Running both pumps this way consumed excess energy. Furthermore, the excess water was passed through the clarifier before being returned to the river, which consumed more water treatment chemicals than necessary.

The review also revealed that the pumping system's controls were antiquated and did not have remote monitoring capability. Therefore, two powerhouse operators had to go to the barge twice a day to perform the required system checks manually. In addition, the pumps' controls and electrical substation, located on the barge, created an electrocution hazard when the deck of the barge flooded. The barge's deck gets flooded periodically when storms allow debris to get wedged in the wheels that allow the barge to rise and fall with the river level. The debris prevents the barge from rising, which allows water to flood the barge deck.

Project Implementation

The plant personnel decided to retrofit the millwater pumping system based on Tencarva's system review and recommendations. The project centered on replacing the existing 350-hp pumps with two 250-hp pumps, each fitted with a VSD. The proposed system design called for one pump to operate continuously while the second one would be brought online in a trim capacity to maintain the appropriate clarifier tank levels. The project was implemented without interrupting the plant's water supply, so production was unaffected. Existing bypass piping was utilized to isolate each pump as it was being replaced. In addition, the clarifier tank was filled with enough water to buffer the system while the new pumps were activated.

One of the Two New 250-HP VSD-Controlled Barge Pumps

In addition to being smaller, the new pumps possess remote monitoring capability, which eliminates the need for powerhouse operators to check the system manually. Finally, the pump controls and the electrical substation that serves the barge were relocated on land to eliminate the electrocution hazard.

Results

The Nashville plant's pumping system project has yielded important energy savings and has improved the system's performance. Before project completion, the plant operated two of its three 350-hp centrifugal pumps at full load, which moved 5,200 gpm. The VSDs are now able to vary the pumps' output capacity to accurately match the plant's load and provide better tank level control of the clarifier. With the new system in place, the system's flow rate averages 3,125 gpm, a 40% reduction. Because the plant is able to meet its load by operating one pump at a time, plant personnel alternate each pump to share the load equally, thus preventing excess wear of either pump. The reduced flow rate has saved 3.2 million kilowatt-hours (kWh) and $98,000 per year.

In addition to energy savings, the project has allowed the plant to reduce its purchases of water treatment chemicals, saving $116,000 annually. The plant also saves $66,000 per year by checking the pumping system remotely. This new functionality precludes the need for the powerhouse operators from going onto the barge to manually check the pumps. The total project savings are thus $280,000 per year and, with a total project cost of $350,000, the simple payback is just 15 months. Also, plant safety was improved by the eliminating the electrical hazard posed by the controls being located on the pump barge. Finally, the more efficient utilization and reduced use of Cumberland River water is important because policies under review by the Tennessee Valley Authority (TVA) indicate that additional surcharges may be forthcoming for the use of TVA-controlled inland water.

Lessons Learned

Aging and improperly configured industrial pumping systems can waste energy and incur high maintenance or operating costs. As industrial plants evolve over time and manufacturing processes become more efficient, demand requirements will also shift. Recognizing and adjusting the output capacities of industrial motor systems in response to changing demand patterns saves energy and improves productivity. In the case of the Nashville Glass Plant, replacing aging, fixed-output pumps with smaller units fitted with VSDs created an optimally sized pumping system that can effectively vary output in response to demand. Such reconfiguring leads to important savings in energy, maintenance, and water treatment chemicals.

Industry of the Future—Glass

In April 1996, several organizations representing the glass industry signed a compact with the Department of Energy (DOE) in an effort to encourage technological innovations that will reduce energy consumption, pollution, and production costs in the industry. The glass industry published a report entitled ***Glass: A Clear Vision for a Bright Future,*** *which articulated the industry's vision of its future. This compact set the foundation for collaborative efforts between the industry and the Federal government. Signed by both key industry players and Department of Energy officials, it was a formal commitment to align DOE's limited resources to meet the challenges identified in the vision.*

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BestPractices is part of the Office of Industrial Technologies Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and best energy-management practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

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