Performance Spotlight
Proven Tools and Practices to Increase Industrial System Energy Efficiency

Industrial Technologies Program

Onondaga County Department of Water Environment Protection:
Process Optimization Saves Energy at Metropolitan Syracuse Wastewater Treatment Plant

Project Summary
To improve the efficiency of the plant’s wastewater treatment process, engineers at the Metropolitan Syracuse Wastewater Treatment Plant (Metro WWTP) in Onondaga County, New York, upgraded several processes beginning in 2004. The process pumps and motors were evaluated by Thomas Devine, an employee of Stearns & Wheler LLC and a Qualified Pump System Specialist. His assessment led to a system-level project that improved the plant’s energy efficiency and validated the pump maintenance program. The project involved retrofitting motors, changing the process operating strategy, and upgrading impellers. These measures significantly improved process efficiency, yielding annual electricity savings of about 2.81 million kWh and natural gas savings of 270 MMBtu. Resulting annual cost savings are $207,500. At a total cost of $233,000, these measures achieved a 13-month simple payback. The New York State Energy Research and Development Authority (NYSERDA) provided grant funding for the project’s feasibility study.

Plant/Project Background
Metro WWTP provides wastewater treatment for 270,000 people and many industrial and commercial customers in the city of Syracuse and other areas in Onondaga County. The plant treats an average of 80 million gallons of wastewater daily. The wastewater treatment process includes a waste-activated sludge process served by six 25-horsepower (hp) pumps, eight aeration tanks served by thirty-two 100-hp blowers, and a low-lift pumping station that includes five 600-hp pumps.

Two U.S. Department of Energy (DOE) BestPractices tools, the Pumping System Assessment Tool (PSAT) and MotorMaster+, were used to evaluate the pumps and motors in the wastewater treatment process. One opportunity to save energy discovered by using MotorMaster+ was to retrofit the motors on waste-activated sludge pumps with more efficient units having variable-frequency drives (VFDs). Another was to modify the process control of the secondary treatment activated sludge process to stop wastewater nitrification in the aeration tanks. This was made possible by a recently installed biological aeration filtration system that provides wastewater nitrification year-round. Also, some low-lift impellers were more than 25 years old and worn from abrasion. The PSAT revealed the potential efficiency gains that would result from replacing the impellers instead of repairing them. In addition, the waste gas burner controls needed adjustment.

Benefits
- Saves $207,500 annually
- Saves about 2.81 million kWh per year
- Reduces natural gas purchases by 270 MMBtu annually
- Achieves a 13-month simple payback

Applications
Wastewater treatment plants are good candidates for process optimization projects. Treatment process systems can consume a significant amount of the energy used by wastewater plants. Optimizing these systems can save energy and improve system efficiency.

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Metro WWTP engineers began implementing the recommendations that came out of
the analysis by removing the throttling valves and replacing motors on the waste-
activated sludge pumps with premium-efficiency motors fitted with VFDs. Next, the
operating strategy of the activated sludge process was changed to stop wastewater
nitrification in the aeration tanks, reducing the number of 100-hp blowers required
to operate from 21 to 13. Then, the impellers on some of the low-lift pumps were
repaired and others were replaced. Finally, plant engineers recalibrated the waste
gas burner controls to maximize waste gas usage.

**Results**

These modifications improved the efficiency of the plant’s wastewater treatment
process and yielded important energy savings. Replacing the waste-activated sludge
pump motors with VFD-fitted premium-efficiency units, shutting down the aeration
blowers, and improving the efficiency of the low-lift pumps lowered the plant’s
annual energy consumption by 2,810,000 kWh, for a cost savings of $207,500. In
addition, better control of the waste gas reduced natural gas purchases by 270
MMBtu per year, for a cost saving of $1,500. Total implementation costs were
$233,000, for a simple payback of 13 months.

**Lesson Learned**

Changes in technologies and processes often represent significant opportunities for
energy savings in wastewater treatment and other industrial plants. Realizing when
such evolutions occur and remodeling motor and process systems in response to
new parameters can save energy and improve productivity. At the Onondaga County
plant, an analysis that made use of the PSAT and MotorMaster+ tools helped plant
engineers decide how to optimize the wastewater treatment process. Using VFDs,
more efficient pumps, and a new filtration system, plant aeration requirements were
reduced from 21 large blowers down to 13. Projects and methodologies such as
these can be applied at virtually all wastewater treatment and industrial facilities
that require water for process needs.