City of St. Cloud

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Company Background

The St. Cloud Wastewater Treatment Facility (WWTF) was established in 1976 to prevent pollution of the Mississippi River. The WWTF treats the industrial, commercial, and residential wastewater from the six-city, 110,000 population area of St. Cloud, St. Joseph, Sartell, Sauk Rapids, St. Augusta, and Waite Park. The treatment process includes bar screen, grit removal, activated sludge biological nutrient removal, primary and secondary clarifiers, ultraviolet (UV) light disinfection, and anaerobic digestion of the solids. The St. Cloud WWTF is dedicated to continuous improvement and meets and exceeds permitted discharge regulations set by the Environmental Protection Agency and Minnesota Pollution Control Agency.

CITY OF ST.CLOUD MINNESOTA
PUBLIC SERVICES SECTION

"Working on a collaborative team with maintenance technicians, managers, and operators enabled me to understand the unique operating characteristics of the plant, which was essential to the successful outcome of the new control strategy we implemented."

Project Background

Electrical energy is St. Cloud WWTF's largest operating expense, and the three 600-horsepower aeration blowers are the most electric energy-intensive equipment at the facility. The aeration blowers provide airflow to membrane disc fine bubble diffusers at the bottom of biological nutrient removal (BNR) tanks. Each zone of the BNR tank has a dedicated air valve which is automatically throttled to control the airflow rate to each basin to a specified dissolved oxygen (DO) setpoint. The process control scheme manipulates the blower airflow discharge and throttling valve positions to meet a DO concentration of 2 mg/L while simultaneously providing sufficient airflow to maintain minimum mixing in the BNR tanks.

Incentives To Change

The St. Cloud Wastewater Treatment Facility has declared a commitment to resource recovery and energy efficiency. Increasing aeration blower efficiency would save significant energy because one-third of the plant's total electrical energy consumption is attributable to the aeration blowers.

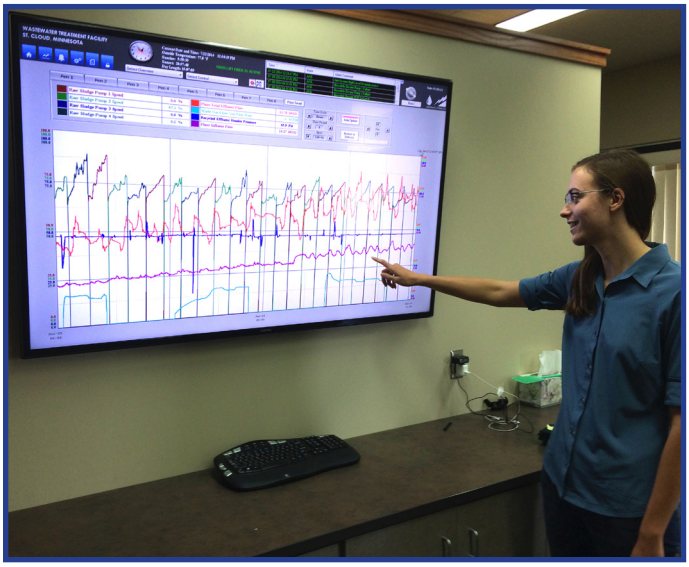
Recently the St. Cloud WWTF has committed to a Resource Recovery and Energy Efficiency Master Plan. This includes recycling biosolids, converting biogas into electricity, utilizing methane digester gas for boiler fuel,

lighting upgrades, and equipment efficiency upgrades. Xcel Energy, the WWTF's energy provider, offers custom rebates of up to 60% of the capital investment for energy efficient upgrades. In addition to the price per kWh of energy consumed, the facility is charged a "firm demand charge" based on the peak monthly power demand. Increasing blower efficiency would reduce costs because one-third of the plant's energy consumption is from the aeration blowers.

Solutions

Most-Open Valve Control Strategy

The most-open-valve control strategy reduced the blower discharge pressure by opening downstream air throttling valves to a mostly-open position to reduce pressure drop. Taking advantage of the fan affinity laws, the reduction in blower pressure enabled the blower to operate at its minimum power capacity, thereby saving power. In addition, the most-open-valve control strategy also eliminated blower surging problems caused by the previously higher pressure due to the less-open valve positions. Adopting this strategy reduced energy use by 392,000 kWh per year, with a savings of $27,000.



Master Control Panel

The Turblex master control panel includes logic programming for most-open valve control, pressure control, and dissolved oxygen control. The master control panel would simplify most-open valve control by automating the optimal valve position. The savings associated with the master control panel are due to decreased blower pressure and better dissolved oxygen control. Installing a master control panel could save 766,000 kWh per year and $54,000.

Recommendation	Reduction	Annual Savings	Status
Most-open valve control strategy	392,000 kWh/yr	$27,000	Implemented
Install master control panel	766,000 kWh/yr	$54,000	Recommended