Energy Savings Opportunities for Waste Water Treatment Facility

The **Industrial Assessment Center** at **West Virginia University** (IAC-WVU) has developed opportunities to decrease energy usage and operating cost for the County of Shenandoah's Waste Water Treatment Plant (WWTP) located in Woodstock, Virginia. The assessment team focused on the waste water treatment processes as well as the energy utilities feeding them. This assessment was done at the recommendation of the US EPA. The recommendations at this facility may serve as a template for potential savings at similar facilities.

Clarifiers and chlorination and de-chlorination processes.
North Fork WWTP, Shenandoah County, Virginia.

Company Background

The North Fork WWTP facility is located in Woodstock, Virginia. The facility provides water treatment services to the Shenandoah County in Virginia.

Summary

As a result of the assessment, energy efficiency recommendations were made for improvement. Opportunities for saving energy were identified with respect to installation of dissolved oxygen based VFD control system, replacement of coarse pore diffusers system with fine pore aeration system, performing vibration analysis on motors, replacement of existing T12 fluorescent lamps with T8 fluorescent lamps, replacement of High Pressure Sodium (HPS) lamps with T5 fluorescent lamps, establishment of repair/replace decision making policy using an effective motor management system, effective pump refurbishment and coating, and reduction of air compressor pressure set point.

Five of the eight recommendations made by the team were implemented, resulting in the reduction of energy consumption by 365,399 kWh of electricity (28% of the annual electricity consumption) and an annual cost saving of $27,281 (25% of the annual electricity cost).

Energy Conservation Analysis

In general, the management and employees at the facility are "energy conservation" oriented, and follow many good practices to save energy. For example, the plant uses cogged belts on the motor drives, low pressure UV lamps to disinfect pathogens in water, and practiced good housekeeping. The assessment team was pleased with the level of energy efficiency awareness amongst plant personnel.

The recommendations identified by the team were discussed with the plant personnel on the assessment day. The plant personnel were encouraged to contact and interface with IAC-WVU for further discussion and/or clarification required with respect to the implementation of the assessment recommendations.

Benefits at a Glance

The implemented measures will result in annual electricity savings of 365,399 Kwh and annual cost savings of $27,281.
Average Payback is 33 months.
Implemented recommendations will reduce carbon dioxide emissions by 800,224 pounds.

Lighting Replacements

The assessment team suggested T8 and T5 fluorescent lamps in the place of T12 lamps, and HPS lamps. The plant personnel appreciated the value in the efficient use of occupancy sensors for lighting. The light levels are estimated to be better than those currently utilized and hence are expected to contribute towards a productive workforce, while simultaneously saving energy.

Upgrading lighting with electronic ballasts, reflectors, and occupancy sensors in the facility areas has increased the efficiency of the lighting system. In effect, these suggestions have significantly reduced energy usage.

Process Equipment

Variable frequency drive (VFD) allow efficient control of processes based on the process demands while reducing costs for energy and equipment maintenance. The assessment team recommended the installation of a dissolved oxygen sensor based VFD control system to control the blowers and the aerators for development of energy savings. Replacing the coarse pore diffusers with fine pore diffusers improve oxygen transfer efficiency and the reduced the load on the aeration blower. The implementation of these suggestions yielded significant energy savings.

Preventive Maintenance Savings

Electrical motors are widely used equipment in waste water treatment facilities. The assessment team recommended vibration analysis on the motors as a preventive maintenance procedure. By performing vibration analysis regularly, the motor efficiency can be improved, thereby reducing the energy usage of the motors.

Assessment Savings Tabulated

The following Table presents the annual cost savings that has resulted at the County of Shenandoah due to the implemented recommendations. The energy conservation opportunities that were identified in the assessment and were implemented will reduce annual electric usage by 365,399 kWh per year. This translates into an annual cost savings of $27,281 and an annual reduction in CO_2 emissions of 800,224 pounds.

Implemented Recommendations

Assessment Recommendations	Annual Resource Savings	Total Annual Savings	Capital Costs	Simple Payback
Install Dissolved Oxygen Based VFD Control System	119,722 kWh/yr	$10,902	$82,500	7.57 years
Replace Coarse Pore Aeration System with fine pore aeration system	132,134 kWh/yr	$8,800	$31,000	3.52 years
Perform Vibration Analysis on Equipment	60,314 kWh/yr	$3,788	$1,000	0.26 years
Replace the Existing T12 Fluorescent Bulbs with T8 Fluorescent Bulbs	26,034 kWh/yr	$1,983	$2,015	1.02 years
Replace the HPS with T5 Fluorescent Bulbs	27,195 kWh/yr	$1,808	$2,250	1.24 years
Total	**365,399 kWh/yr**	**$27,281**	**$118,765**	**2.72 years**