



City of Columbia

In the Heart of Tennessee



Overview

One of the most effective ways for cities to reduce their costs and improve environmental performance is to improve their energy efficiency. Many cities have implemented energy saving initiatives for their public buildings, street lighting programs, and municipal vehicles. Ironically, the largest energy users in most cities are often overlooked when energy efficiency is pursued - their drinking water and wastewater treatment systems, which typically use 30-40% of the total city's energy demand. Because about half the electricity used in the Southeast comes from coal-fired power plants, energy efficiency can reduce the emission of air pollutants as well as save money.

During the spring of 2011, the U.S. Environmental Protection Agency, Region 4 - Atlanta (EPA R4), and the Tennessee Department of Environment & Conservation (TDEC) assembled a team to conduct an Energy Management Initiative (EMI) for Tennessee Water and Wastewater Utilities. The team consisted of EPA R4, TDEC, the TN Department of Economic and Community Development, the Tennessee Valley Authority (TVA) - electrical power provider for the entire state, University of Memphis - Civil Engineering Department, University of Tennessee - Municipal Technical Advisory Service, University of North Carolina - Environmental Finance Center, and Schneider Electric. The EMI process involved an initial energy assessment and

benchmarking stage, followed by a series of four workshops that were based on the 'Plan-Do-Check-Act' (PDCA) management framework. PDCA is designed to help water/wastewater utilities better understand their energy consumption, identify opportunities for improvement, prioritize projects for potential funding, measure success, reduce or avoid energy costs, and reduce greenhouse gas emissions.

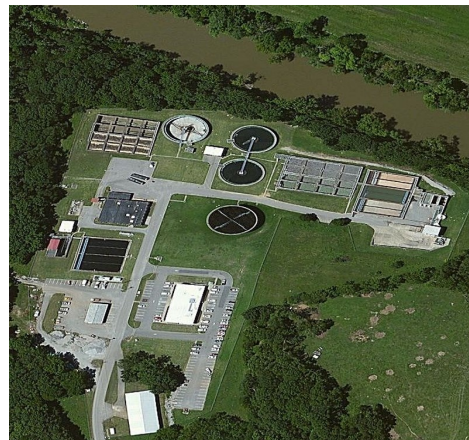
In August 2011 Columbia, TN Mayor Dean Dickey accepted the invitation to be one of the seven utilities to participate in the EMI.

About the City of Columbia

Columbia is a city of approximately 36,000 people about 45 miles south of Nashville and is the County Seat of Maury County. The economic health of Columbia and Maury County was growing in the 1990's and early 2000's, but has gone through a challenging period since 2005-2007, when the large area employer, the Saturn automobile plant in nearby Spring Hill shut down, which depressed incomes and population growth. Manufacturing jobs have begun to return to the area and the City has been actively pursuing redevelopment plans to encourage economic development. The City has also received HUD Sustainable Communities Initiative funding to support those efforts.

Columbia Wastewater Plant

The Columbia Wastewater Treatment Plant (WWTP) was expanded and upgraded in 2000 to a 14 mgd design flow, 28 mgd peak flow, with fine screens and grit



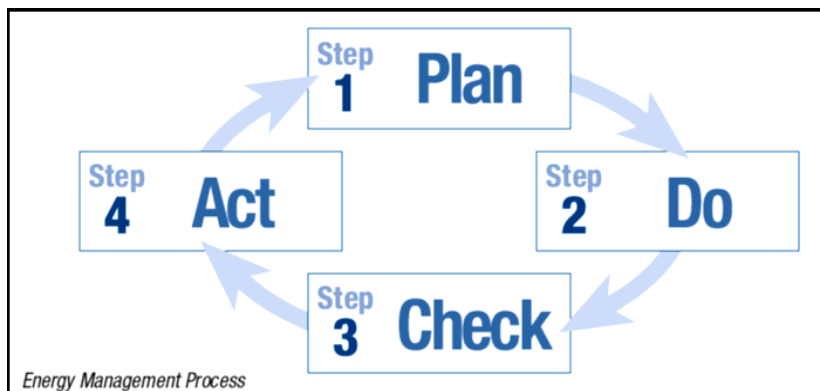
Columbia Wastewater Treatment Plant

removal, primary clarifiers, conventional activated sludge, secondary clarifiers, plastic media nitrification bioreactor, final clarifiers, UV disinfection, aerobic digesters, gravity belt thickeners, and belt filter presses. Due in part to the economic slowdown in the area, the WWTP is underloaded, with an actual flow averaging 4.5 mgd monthly, although peak daily flows have exceeded 20 mgd. Effluent

“Another result of participation in the EMI has been to encourage a shift in the mindset of personnel.”

Mark Williams - Columbia Wastewater Dept. Director

quality is high, average monthly BOD usually less than 4.0 mg/l, average ammonia less than 1.0 mg/l; permit limits are 30 mg/l BOD and 5.0 mg/l ammonia for discharge to the Duck River. The largest energy demand of the plant is aeration for the four 625,000 gal activated sludge basins with fine bubble ceramic aerators and the four 380,000 gal aerobic digesters using coarse bubble aerators. Only two of the activated sludge basins and two of the aerobic digester tanks are normally in use. Air supply is provided by three 450Hp turblux blowers, one



Energy Conservation Measures- Columbia Wastewater Plant

Action	Project Cost	Annual Energy Savings	Annual Cost Savings	Overall Energy Reduction
Reduced aeration and modified UV control	\$0	1,900,000 kWh	\$160,000	24%

Columbia Energy Savings Reduce CO₂ Emissions by 1,880 Tons per Year

of which ran 24 hrs/day and one ran 12 hrs/day. The aeration control system was an alkalinity based approach that was difficult for the operational staff to effectively use, resulting in manual aeration control using DO measurements.

The EMI team conducted a preliminary energy assessment of the Columbia WWTP in October, 2011, to identify opportunities to save energy and costs. Mike Anderson, Columbia Public Works Director, Mark Williams, WWTP Superintendent, and Hal Haywood, Assistant Superintendent worked with our team during the assessment.

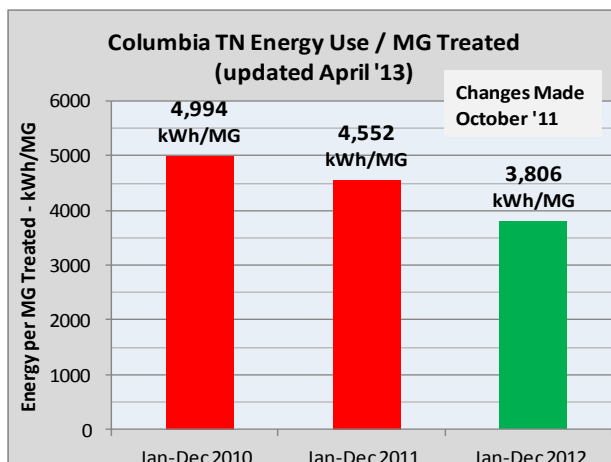
Optimizing Operations - Energy Savings

The EMI team worked with the plant staff to evaluate the plant loadings and oxygen demand in the aeration basins. That analysis showed that a single 450 hp would provide adequate oxygen to the fine bubble system for the actual plant loading during all normal conditions, with additional aeration possibly needed if high peak flows occurred for extended periods. Also, due to problems with the turbidimetric controls in the UV system the plant had to operate with

produced total measured energy savings of almost 2 million kWh per year, compared to the two previous years of energy use. On a energy use per million gallons (MG) treated basis, the WWTP has reduced their energy use by over 20%, and have saved over \$150,000 per year in the cost of energy.

Next Steps

The present level of plant



Columbia WWTP - Nitrification Tower

excessive UV lamp usage to assure adequate disinfection. The plant staff was able to shut down the second 450 hp blower (previously operated 12 hours/day), producing an immediate energy savings of approximately 120,000 kWh per month. The plant also completed repairs to the UV control system to significantly reduce UV lamp usage. Those improvements

energy use per MG, 3806 kWh/MG is still high, but the underloaded conditions in the plant limit the efficiency of the treatment processes. During the workshop phase of the EMI, the Columbia WWTP staff identified a number of energy conservation measures to be evaluated that can build on the dramatic energy savings already achieved. Those possible energy conservation measures include:

- Purchase/installation of luminescent DO probes that will allow the blower vanes on the Turblex blowers to be manually adjusted based on basin DO levels. The real time basin DO information will allow improved management of the aeration system and is expected to allow additional energy savings.
- Integration of the luminescent DO probes into the existing SCADA system at the WWTP which will allow continuous adjustment of aeration based on basin DO levels. Automated control of the aeration system should provide additional energy savings as the aeration is coupled on a real time basis with the basin DO levels.
- Upgrading the administration building lighting and HVAC systems to optimize energy efficiency. Upgrading the lighting systems in other plant buildings and outside lighting will also be evaluated.
- Continuing to evaluate all of the higher energy using processes and equipment to identify opportunities to optimize or improve the energy efficiency of the WWTP.

Columbia WWTP Contacts

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EPA Reg. 4 Contacts

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TDEC Contact

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Nashville Recognition Ceremony - October 11, 2012

City of Columbia Presentation
(from left)

- Hal Haywood - WWTP Superintendent
- Robert Martineau - Commissioner-TDEC
- Mike Anderson - Columbia Wastewater Dept. Director (Retired)
- Mark Williams - Wastewater Department - Director
- Gwen Keyes Fleming - Regional Administrator - Region 4 EPA