

# STEPPING UP TO SMART AERATION

**New options for automating DO control present energy-saving opportunities for WWTPs.**

According to the U.S. EPA, municipal water and wastewater treatment systems account for 30 to 40 percent of the total energy used by municipalities in the United States (Source: EPA.gov). In wastewater treatment, the biggest chunk of this energy consumption comes from aeration. Within a typical WWTP, the aeration equipment used to maintain the required dissolved oxygen (DO) levels in the activated sludge process can account for as much as 60 percent of the total plant energy use (Source: EPA.gov).

As municipalities and plant operators look for ways to minimize energy use and contain operating costs, aeration is a natural area of focus. The EPA recommends optimizing DO control set points as a means of lowering energy costs, greenhouse gas emissions, and nitrogen levels in plant effluent. A 2013 study by the Water Research Foundation and the Electric Power Research Institute (EPRI) found that advanced aeration monitoring and controls designed to maintain set DO levels, prevent over-aeration, and curb excessive power use could save municipalities across the United States a combined 3.6 terawatt hours (TWh) per year, based on the assumption that aeration accounts for 25-60 percent of total electricity use at WWTPs (Sources: EPA.gov; Water Research Foundation). But optimizing DO concentrations has historically been easier said than done. Process demand within a single WWTP can fluctuate widely by season, day of the week, and time of day. All too often, plant operators manage these fluctuations by running blowers at a constant airflow sufficient to handle peak load conditions that exist only for a short window on any given day. This results in energy wasting over-aeration for the remaining lowdemand periods of the day.

Even as manual blower operation has been supplemented by automated controls, plant operators have had to contend with complex, piecemeal solutions. Most of the DO controls on the market incorporate proportional-integral-derivative (PID) controllers tuned by a manufacturer's control technician to match "on-site conditions" at the WWTP. However, as demand, basin temperature, and microbial composition fluctuate throughout the normal course of operations at the faci-



lity, the PID tuning settings become unstable or obsolete, resulting in poor DO control system performance and lack of confidence in the control technology. Rather than frequently retuning the systems, which may require bringing the control technician back on-site for several days, facilities often ride out poor characteristics through an off-season or loading event with the expectation that as conditions swing back to the original tuning point, their control will be useful again.

A new generation of DO control systems seeks to eliminate these issues with smart, self-tuning products that respond in real time to fluctuating plant conditions and vary the process airflow accordingly, achieving significant energy savings throughout periods of lower demand. These solutions encapsulate the collective knowledge and expertise of blower and aeration experts in control form, creating an engineered solution that incorporates blowers, instruments, and control tech into one easy-to-operate package.

Aerzen's AERprocess Dissolved Oxygen Control represents an integrated solution for controlling the DO concentration in the activated sludge treatment process and the blowers used to generate the process airflow requirement. A plant operator simply selects the desired DO set point, and the AERprocess automatically calculates the process' airflow requirements, generating airflow set points for each control zone and a total airflow target for the blower system. AERprocess then sequen-

ces the blowers and accurately adjusts valves using a 'most-open-valve' header pressure reduction algorithm to distribute the airflow as required to meet the actual oxygen requirements of the process. Simply switching from a traditional pressure-based control strategy to a flowbased, most-open-valve control strategy can, as documented in a case study performed at the Bucklin Point WWTP, result in an average reduction in energy consumption of 12 percent. (Source: EPA. gov).

Maintaining an optimal DO level at high loading conditions in a given WWTP may require an airflow of 1,200 standard cubic feet per minute, while low loading conditions in the same plant may require only 200 SCFM. Because the amount of energy consumed is directly related to the amount of aeration utilized, the ability to quickly and automatically respond to fluctuations in demand represents significant potential for reducing energy use, operational expenses, and greenhouse gas emissions. The manufacturer estimates that WWTPs switching to the AERprocess system could realistically achieve energy savings between 20 and 40 percent. The smart, efficient control strategy also gives plant operators confidence that their DO control system will maintain the required DO set point throughout the facility, allowing operators to optimize their biological nutrient removal (BNR) systems and more easily maintain effluent within permit levels. For further optimization of the biological process, Aerzen also applies their inherent knowledge of blower performance to enhance the efficiency of the blowers at the supply end and minimize electrical demand. Whether blended technologies or multiple size machines are applied, optimizing the machine or machines at peak performance points or ranges will further reduce electrical consumption as process demands change.

For plants that are concerned with effluent limits other than BOD, ammonia feedback can be used to optimize the system's DO set points and subsequent ammonia treatment rate to achieve a user-defined effluent ammonia level. As biological nutrient removal goals become more stringent, cascaded ammonia-based aeration controls (ABAC), like the one offered by the AERprocess, represent a significant opportunity for improvement over operating at constant user-defined DO set points.

In addition to biological and blower optimization, the AERprocess also provides both localized and optional remote support of the blower systems. Maintenance schedules and preventative measures are included in the overall control strategy. The customer is prompted to perform system maintenance based on run time or condition monitoring. Optional remote support is provided using a customer controlled 2048-bit encrypted LAN or cellular data connection.

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