Energy represents a significant expense across all processes at wastewater treatment systems, after operations and maintenance costs. The most energy-intensive processes or equipment in wastewater treatment systems include aeration, pumping systems, and blowers, accounting for 30% or more of a plant’s annual operating budget. Therefore, identifying opportunities to reduce energy use is essential to reduce operational costs, increase plant efficiency, and reduce resource use. Some energy reduction strategies can be costly, but many no- to low-cost opportunities exist that can optimize plant operations and reduce energy use. As a result, plants can lower the cost of wastewater treatment – from resource use to labor.

In wastewater treatment, the term optimization is a process whereby plant operators apply their skills and knowledge to identify opportunities to use existing plant structures to achieve greater energy efficiency, reduced chemical usage, efficient biological nutrient removal, and better operational control. All plants have opportunities for optimization, and not only do these best practices improve plant performance and reduce costs, but they also demonstrate how facilities are using public tax dollars wisely. Small operational changes can yield significant annual cost savings!

**Baseline Energy Use**

Before no to low-cost solutions can be identified, energy baselining is an effective and convenient approach to tracking and analyzing energy use of a wastewater treatment plant (WWTP) over time. An energy baseline provides treatment plants with a picture of how much energy the facility consumes annually. It is important to track energy use simply because it is hard to manage – and improve – processes that are not measured. Interior tracking of performance can be used to show progress toward efficiency goals, the impact of projects and operational changes, and reveal when systems are drifting away from design operation. It also helps justify future, sometimes more cost-intensive, energy efficiency projects if municipal boards or management can see utility cost reductions over time. For more information on baselining and benchmarking utility use, please visit our publication on the topic. Once a wastewater plant has a clear picture of how much energy they use, and where it is used, no- to low-cost energy efficiency solutions can be explored.

**No-Cost and Low-Cost Energy Efficiency Solutions**

**Add Variable Frequency Drives**

One no- to low-cost strategy is adding variable frequency drives (VFDs) to blower and pump motors to vary the frequency of motor use so they can operate at a variety of speeds. Often, WWTPs have oversized pumps to ensure maximum flow can always be handled; however, most plants aren’t operating at maximum flows. VFDs can control the flow by varying pump speed based on the actual system flow as well as extend the life of a pump or motor, while offering greater control of the treatment process. Implementing VFDs, depending on the motor, can be more costly, but they have a short payback period for most applications.

If VFDs are already in place, make sure they are not in manual override or set to a fixed speed. Both settings would defeat the purpose and benefits of VFDs. To increase the efficiency of an installed VFD, plant operators can analyze the specific energy consumption of pumps and specific staging conditions to further dial in energy and pumping efficiency. Plants may not need to bring one pump fully to 100% before bringing another pump online. Two or more pumps may be able to be staged at a lower pumping frequency to maximize pump and energy efficiency. Manufacturers offer newer, smart VFD technologies that automatically program pump curves to optimize the staging process for pumps.
Aeration System Improvements

An additional no- to low-cost solution is improvements to aeration. Aeration uses 50-60% of total energy use at most WWTPs. There are several ways to control aeration: setting dissolved oxygen (DO) setpoints, controlling blower and/or aeration speed, cycling aeration on and off, using timers, and more. With all aeration improvements, it is important to monitor DO in the aeration basins, both during peak organic load and off-peak times. Monitoring DO can help you identify possible solutions listed above that will increase aeration efficiency and reduce energy use.

Adjust Aeration Diffusers/Install Baffles

Adjusting aeration diffusers for lagoons with sludge build up, or short circuiting can break up those short circuit pathways, help mix the sludge up and break up channeling that might happen in a lagoon. This increases aeration energy efficiency and lowers utility costs. Similarly, installing baffles in those lagoons can help improve the treatment quality for that process.

Adding Wet Well Level Controls

Wet well levels often have conservative settings, but incrementally raising level settings for pumps can save energy. The higher the water level in that basin, the more assisting head it gives to the pump and the less horsepower it takes to pump the same amount of water. This is due to the additional weight of water on top of the inlet to that pump, which helps push water through the basin. Adjusting wet levels is a no-cost measure that increases efficiency over time. Over a long period of time, especially for pumps that have a longer run time, facilities can realize significant savings.

Add Time Clocks for Blowers

Another low-cost and quick energy conservation measure is to add a time clock to the blowers that serve aeration equipment. Installing timer-based control for aeration systems is an affordable and simple option that will save energy, while also reducing labor costs for manual blower control. The trial-and-error process allows operators to test different timer settings to ensure DO levels are maintained. Slowly increase the off time of the blower to increase savings, but make sure to monitor the process so the effluent quality is not impacted.

These timers are also helpful with lagoon aeration systems. Many lagoons benefit from algae during the day, which produces DO in the water, so plants don’t need as much aeration in the daytime. However, overnight loading drops off, algae start to die, so maybe aeration is needed overnight. Cycle timers on/off to meet those loading and changing conditions in the lagoon as an easy way to implement some control and reduce utility costs.
Manage Thermostat Settings

A simple no-cost measure to reduce energy consumption is setting all the thermostats to regulated set points. In addition, you can further reduce consumption by installing programmable thermostats in office spaces and labs. For spaces with small gas or electric unit heaters that have analog dial thermostats, set these to reasonable set points. For instance, a storage bay is used to store dry chemicals or non-hazardous materials that don’t have any specific temperature requirement, a plant may not need to heat that bay to 70 degrees, but rather 55 degrees may be acceptable. By lowering thermostat setpoints, plants will reduce heating and cooling energy use over time, which is a good way to save energy at no cost.

Install LED Lighting

Upgrading to LED lighting is an easy way to lower energy use, while implementing a project with a noticeable and quick return on investment. LED lighting not only increases the brightness of spaces, but bulbs can last 10x longer than traditional incandescent lights, reducing replacement labor over time. Check with local utilities to identify programs that can provide incentives to cover the cost of equipment, and sometimes labor, to replace lighting with LEDs.

Add Lighting Controls

Another common low-cost energy efficiency recommendation is to install lighting controls. Usually, water or wastewater facilities are secured, fenced in facilities, but they have outdoor lighting on all night, usually over the basins. Lighting over basins may not need to be on all night but may benefit from controls where lighting turns on only when individuals approach the space. Wall pack lighting on the exterior of buildings, especially if the facility is not running 24/7, can be placed on timers or local access switches to reduce lighting use when not needed. Reducing the amount of time lighting is in use can add up to significant cost savings.

Conclusion

SEDAC encourages wastewater plants to experiment with small no- to low-cost incremental changes to increase operational efficiency and reduce utility costs. Making minor changes, such as turning a blower off for an hour a day to reduce aeration energy use, can test some of the strategies above without disrupting treatment quality for long periods of time if the strategy is not effective for treatment. While we encourage plants to experiment, we don’t recommend making multiple operational changes at once. For instance, we don’t advise a lagoon that runs aeration 24/7 to reduce aeration use to half the day all at once. Small changes are much less likely to cause an upset, an error, or an issue in your treatment process.

Contact SEDAC to schedule a free assessment of your public wastewater facility to identify unique no- to low-cost opportunities for your plant.

Learn more about the program and apply now for your no-cost energy assessment now!
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