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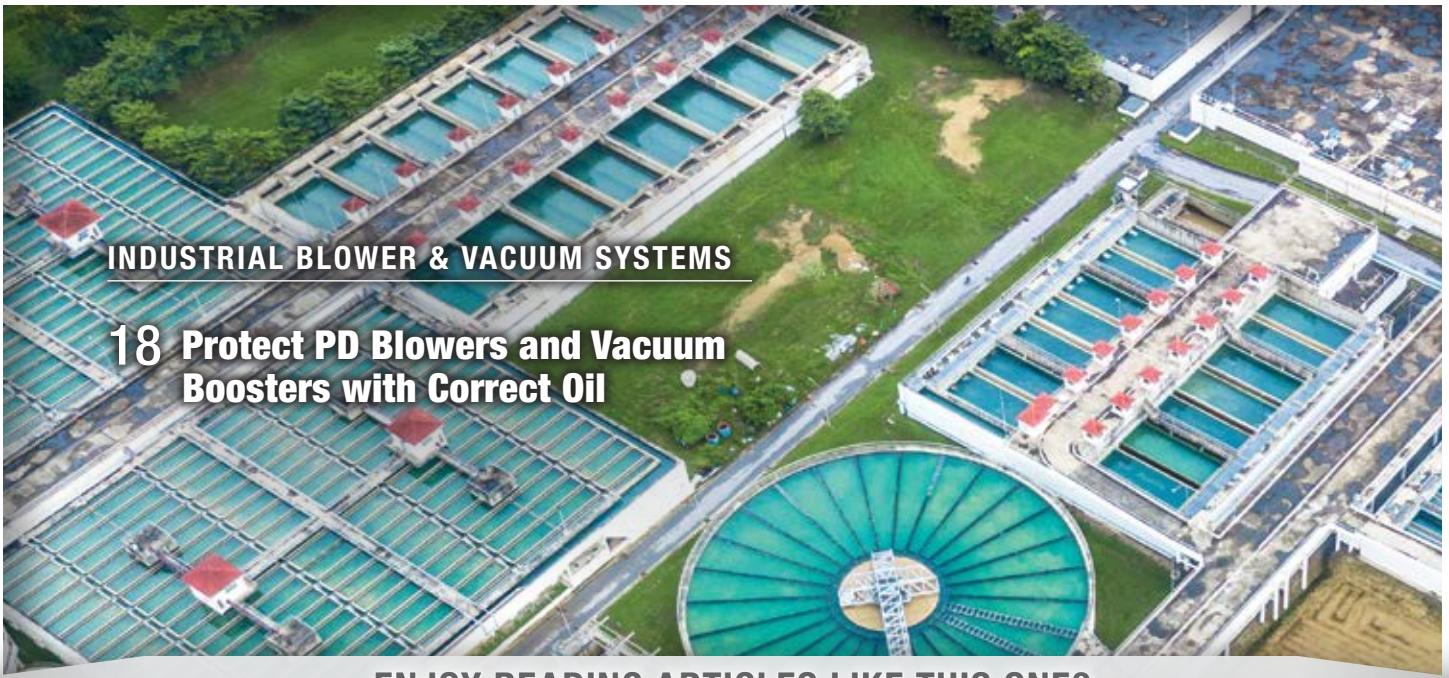

INDUSTRIAL BLOWER & VACUUM SYSTEMS

AERATION BLOWER SYSTEMS

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Three Different Sized Wastewater Treatment Plants SAVE ENERGY AND MAINTENANCE COSTS with Aeration Blower Inlet Filter Upgrades

By Rob Geyer and Joe DiFederico, Endustra Filter Manufacturers

Energy efficiency and energy consumption are common terms in today's wastewater treatment industry. Along with pumping, running blowers for aeration is the most energy consumptive part of the treatment process.

To reduce aeration energy costs, operators and engineers adopt better maintenance practices, consult with energy-use specialists, and quite commonly upgrade technologies and facilities. Among the most popular means of achieving better energy efficiencies is upgrading to modern or relatively new technologies like high-speed turbo blowers. However, many plants across the country find that upgrading aeration blowers isn't always feasible. New blowers can have price tags in the hundreds-of-thousands, not including the cost of engineering and construction. Often overlooked, however, is a simple means of significantly reducing energy consumption: upgrading blower intake filters.

Optimized intake filters can save thousands of dollars annually in energy savings and may not require construction crews, engineering bids, or grant applications. The benefits can

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— Rob Geyer and Joe DiFederico, Endustra Filter Manufacturers

also be realized for treatment plants of all sizes. Described below are examples of three wastewater treatment plants that upgraded filters and came out ahead: a small rural operation with positive displacement (PD) blowers, a suburban plant using multi-stage blowers and a large urban plant that had already upgraded to airfoil bearing high-speed turbo blowers.

Small Plant Saves Thousands in Energy Annually

A wastewater treatment plant in the Midwest serves a population of just over 2,000. The plant uses PD blowers to aerate their activated sludge. While they meet their effluent requirements, they found their blowers were becoming expensive to run.

The installed PD blowers are not variable speed machines: they run at full power until dissolved oxygen (DO) requirements are met and are shut down pending demand. Using a throttle or control system to increase or decrease speed based on DO levels are not options. Near-constant machine operation leads to increased power consumption, and for small rural communities, expensive plant upgrades are not realistic options.

In 2017, the plant discussed blower filter options with Endustra Filter Manufacturers and installed Endustra Tri-Vent® Series intake filters and filter silencers on all nine of its PD blowers. The patented design of the Endustra filter reduces inlet restriction without compromising filter efficiency, allowing the plant's PD blowers to produce the required DO with less runtime. And while all blower intake filters act as silencers to an extent, filter silencers have a reactive chamber designed into the filter for baffling sound. Endustra filters and filter silencers incorporate conical cartridge filter elements with proprietary self-supporting synthetic filter media to protect against particulate ingress without excessive restriction of airflow. The elements can be used interchangeably with intake filters or

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intake filter silencers which provide additional noise suppression.

According to plant operators, reaching required DO levels took less time, about 15-25 minutes less per machine. Additionally, less blower runtime led to an approximate power savings of nine dollars per day, adding up to over $3,000 dollars a year, a significant amount of savings for a rural wastewater treatment operation, and more than the total cost of their investment. In addition, the filter elements have only needed to be replaced once, saving on maintenance.

An Endustra Tri-Vent® Series intake filter on a typical PD Blower.

Mid-size Plant Cuts Blower Power Consumption

The Wastewater Department of St. Charles, Illinois, serves approximately 35,000 residents. The department's two treatment plants and eight full-time employees maintain sixteen intermediate pumping stations and can process up to 20 million gallons of wastewater per day.

The single greatest expense of the department's West-side treatment plant was the power required to operate two multi-stage blowers. While not inefficient by design, multi-stage blowers will consume more power than necessary when improperly accessorized.

The general consensus among multi-stage blower engineers is that the most efficient way to regulate blower flow and pressure on multi-stage blowers is with inlet throttling. Multi-stage blower output is regulated via properly balanced throttle settings, and thus multi-stage machines are sensitive to inlet restriction. With excessive inlet air restriction, throttles must be adjusted, and blowers use more horsepower and more electricity. When high restrictions are maintained or final filter restrictions are reached too frequently, blowers more often reach maximum energy consumption for extended periods of time.

The treatment plant knew upgrading blower technology would reduce power consumption, but also realized upgrades require engineering, grant assistance, bond initiatives, and years of planning. In addition, the plant wanted to address maintenance and noise issues related to its existing blower filters.

Chris Rebone, at the time the St. Charles Wastewater Department Assistant manager, encountered challenges with servicing the filters, including issues with safety concerns. Servicing one of the filters required roof access and the other filter, being over 10-feet in the air, required ladders. They also required cleaning or changing almost monthly, and the higher-than-necessary inlet restriction caused excess motor heat, bearing wear, and constant power demands of more than fifty amps. Further, noise levels were elevated to the point that conversation in the blower room was impossible, and blower vibration was knocking the blower valves out of adjustment.

The St. Charles wastewater treatment plant reduced its energy costs and addressed safety and noise concerns by replacing the original blower inlet filter (left) for its multistage blowers with a new inlet filter silencer (right).

In early 2019, Rebone decided to replace existing blower inlet filters silencers on the two multi-stage blowers with Endustra intake filter silencers. After installation, the plant throttled the blower inlet valve to achieve optimal output pressures and power consumption decreased by 19 amps. As a result, it reduced initial blower power demand by 50%.

One filter silencer was mounted directly to the blower inlet, eliminating the need for roof access. The other was, a top-outlet filter-silencer that can be serviced without ladders or tools. Noise in the blower room decreased to levels that allowed conversation even at the filter inlet, and vibrations also decreased enough that the throttle didn't have to be regularly reset. To date, the filter elements have yet to be replaced, filter cleaning has been eliminated, and the filter silencer upgrade paid for itself via power savings in 114 days.

Large Plant Saves Thousands of Dollars Per Year in Maintenance and Energy

The wastewater treatment plant for the City of Eugene, Oregon, has an average daily flow of 34 million gallons per day (MGD) with a peak flow of 277 MGD. Aeration for the plant's secondary treatment process is provided by a number of multi-stage blowers and a recently acquired airfoil bearing high-speed turbo blower originally supplied with washable tuck-in polyester filter pads.

An advantage of high-speed turbo blowers like the one at the City of Eugene treatment plant is the potential for energy efficiency. However, these machines can be sensitive to dust ingress and filtration is crucial. Tight tolerances, high RPMs, exposed electronics, and carefully machined aluminum impellers are what make the blowers efficient yet they also make them sensitive to dust. Without optimized inlet filtration, wear on the machines can be accelerated.

At the City of Eugene's treatment plant, dust ingress on the high-speed turbo blower required vacuuming and scrubbing the blower enclosure. According to Jon Diller, City of Eugene Equipment/Pump Station Maintenance

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The City of Eugene installed an Endustra outlet manifold intake filter silencer at its wastewater treatment plant.

Supervisor, plant personnel changed and cleaned the filter pads monthly, and once a quarter, needed to open up the blower enclosure to vacuum and clean the machine interior with a solvent cleaner.

In addition to dust ingress, Diller said the cost of filter pads was mounting. A set of pads cost $1,300 and the plant was spending nearly $10,000 a year on replacements. The pads' inherent lack of dust-holding capacity led to excessive restriction alarms on a monthly basis. Unfortunately, the cost for maintenance eroded the benefit of the anticipated energy savings.

In 2017, the core on the blower failed due to dust ingress and needed to be replaced, which led to the plant installing a 24-inch outlet manifold intake filter silencer from Endustra Filter Manufacturers to better protect the blower. In total, it took the plant less than two days to install the filter and new piping needed for the upgrade.

With the new filter in place since 2019, the city has not needed to clean the blower enclosure and there have been no tripped alarms. Maintenance has also been simplified because changing the filter element does not require ladders, manlifts, or even tools. In addition, the plant experienced unanticipated power savings due to the optimized filter's lower restriction. Based on the positive results of the high-speed turbo blower filter upgrade, the plant began the process of upgrading filters on its remaining blowers.

Scalable and Cost-Effective Solution

Regardless of plant size – small, medium, or large – optimizing intake filters protects equipment and reduces energy consumption. Whether it's an on-or-off PD blower, a throttle controlled multi-stage centrifugal blower, or an energy-efficient variable high-speed turbo blower, best-practice inlet filtration keeps wastewater treatment plants operating efficiently while reducing costs. Upgrading intake filters is a scalable, cost-effective plant upgrade. BP

About the Authors

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About Endustra Filters Manufacturers

Endustra Filter Manufacturers, Inc., a family-owned company in Schererville, Indiana, designs and manufacturers Tri-Vent® Intake Filters and Filter Silencers that not only protect equipment but reduce power consumption enough for a first-year payback. Endustra has been in operation for over 50 years and has helped installations all over the country protect their investments and save thousands of dollars in energy costs. Learn more at www.endustra.com.

All photos courtesy of Endustra Filters.

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