Untapped Savings

By Wojtek Wyczalkowski

U.S. manufacturers and industrial wastewater processing plants, already battered by a volatile global economy, are facing some additional troubling news: Energy consumption is expected to increase by 20% over the next 15 years, and its cost and availability will have a substantial impimpact on their economic health and future.

ARTICLE SUMMARY

Challenge: Rising energy costs and tightening environmental regulations are pushing U.S. manufacturers and industrial wastewater processing plants to discover energy savings.

Solution: Research indicates that up to 7% of global electricity demand could be saved by optimizing motor-driven equipment in industrial processes.

Conclusion: Implementing smart aeration and mixing technologies in existing wastewater lagoons can improve efficiency for cost and energy savings.

Check your wastewater lagoon for potential energy and maintenance cost reductions

Tightening environmental regulations are also squeezing this group. Recent legislation has expanded the commitment of the Energy Policy Act of 2005 (EPAct), calling for a 25% reduction in energy use by 2017. Also, in 2007, President Bush signed the Energy Independence and Security Act, which mandates motor efficiencies beyond the minimums of the 1992 Energy Policy Act. This bill goes into full effect in December 2010.

As a result, manufacturers and processors have enormous motivation to decrease their energy usage and achieve measurable savings that can be returned to their bottom lines. In the industrial sector, however, the proportion of investments in energy efficiency (25%) is lower than the proportion of energy use (34%). Even when underachieving, industrial manufacturers saved $5.6 billion by improving energy efficiency. That means that there is still a long way for industrial operations to go—but good reason for going there. The questions are: Where can cost and energy savings be found, and how can they be realized?

Wastewater Lagoons: A Source of Savings

As it turns out, manufacturers can uncover submerged savings from their large wastewater lagoons—specifically, from their aeration systems.

The use of aeration technology to accelerate biological nutrient removal within wastewater lagoon environments is well known. In spite of this, wastewater lagoons, and particularly aerators and other mixing equipment, are among the most overlooked areas for savings in a manufacturing facility or wastewater treatment facility. The definition of acceptable function may vary from plant to plant, but the reigning theory is, "If it's still running, it's doing its job."

This is a costly misconception. Though mixers and impellers may not be the most expensive element of a capital project, they are mission-critical to the proper function of an aeration system and by extension, the entire facility. Most vested parties seem to want to "leave room for error," which can yield a plant with equipment that exceeds needs by 25% or more before it is even commissioned. Conversely, budget constraints can cause specifiers to choose underpowered mixers, so the equipment is working at more than 100% of spec from the onset.

The economic impact of poor mixer and impeller specification on wastewater lagoons includes unnecessarily high energy costs; increased downtime, both planned and unplanned, due to equipment malfunction; and shorter retention time due to increased solids deposits at the bottom.

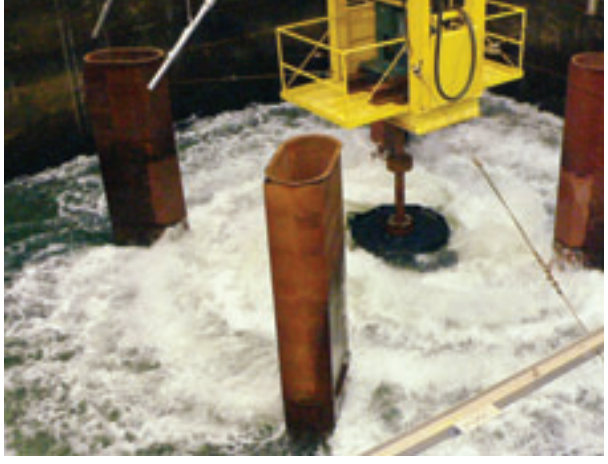
Combined, these elements form a perfect storm that drains manufacturing plants of both energy and revenue. For example, a typical paper mill lagoon may need 2,500 kW of aerators for waste treatment. By improving the efficiency of oxygen transfer by just 10% to $0.12/kW, manufacturers will see annual savings of $250,000 per lagoon. Multiply this by several lagoons and add the savings delivered by less downtime and longer equipment and lagoon life, and the savings are substantial.

A Call for New Treatment Approaches

Current aeration technology for large wastewater lagoons delivers oxygen through the use of floating vertical aspirators/aerators. Studies have conclusively shown that this aerator design is ineffective in keeping solids from settling. However, due to the challenges associated with retrofitting and purchasing new capital equipment, many manufacturers are reluctant to make necessary changes. Increasing efficiency for substantial, measurable results requires proper motivation and an engineer's insight into the root causes of inefficiencies, which most commonly reside within the plant's mixers and other capital equipment.

A directional aerator, on the other hand, combines conventional aspirator technology with blower-assisted aeration. This technique utilizes a spinning impeller that produces fine bubbles that not only keep solids from settling in large areas, but also provide a far-reaching flow of oxygen-saturated fluid that significantly improves overall oxygen transfer. Horizontal aerators also offer compact size, easy placement at any location in a lagoon, a low-pressure drop for oxygen delivery, an efficient gas-dispersing head and high horizontal flow. Because they can be used to reclaim a lagoon by removing solids deposits from the bottom, they also extend the life of a company's existing lagoon investments, preventing unnecessary capital goods expenditures.

A key challenge in lagoon aeration is determining optimum placement for the aerators. A typical lagoon employs between 10 and 100 floating aerators. The distribution of flow is critical for keeping solids in suspension. The calculation of oxygen transfer requirements is straightforward, but proper placement requires an in-depth understanding of the individual tanks in question, and the aerator is best determined by computational fluid dynamics (CFD).



Horizontal aerators induce large circular flow within lagoons, preventing solids deposition, and can also be used in the reclamation of a lagoon by removing solids from the bottom.

The Physics of Savings

Research by the Industrial Electric Motor Systems Efficiency Workshop for the G8 Plan of Action indicates that up to 7% of global electricity demand could be saved by optimizing motor-driven equipment in industrial processes. Energy consumption accounts for approximately 97% of the cost for motor-driven equipment over its lifetime.

Wastewater handlers employ multiple mixers and aerators in their processes, and thus have several opportunities to increase their throughput while improving energy efficiency. They can do so by following the guidelines discussed in this article and consulting with a mixing expert for specific action items.

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By implementing affordable new technology in their existing lagoon systems, water and wastewater processing plants can reduce energy costs, decrease downtime and increase lagoon life by reducing and reclaiming solids deposits at the bottom, all while increasing productivity for the potential of millions of dollars in bottom-line savings. WWD

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