Magnetrol®

Energy Management Takes Some Heat

Energy efficiency is more crucial to the water industry than ever before. With ever-increasing costs and regulatory pressure, plant operators are constantly looking for ways to strategically manage energy use. With solid backing from the concept that knowledge is power, Magnetrol International has introduced its Thermatel product line to help treatment plants understand their energy use by gauging heat transfer.

Tom Kemme, the global product manager at Magnetrol, took the time to walk Water Online through the critical areas of energy use at a treatment plant, the advantages of measuring heat transfer over pressure drop, and how proper management can impact a plant's bottom line.

Image credit: "Washington WWTP Aeration Basin," Steve © 2007, used under an Attribution 2.0 Generic license: https://creativecommons.org/licenses/by/2.0/

Why is accurately measuring aeration flow critical for water and wastewater treatment?

The water industry is one of the most technologically advanced industries that we work in and thermal mass flow meters are widely accepted in it. Instrumentation plays a pivotal role in cost savings as well as meeting potential regulations set forth by the U.S. EPA, Department of Ecology, or the Department of Health.

Thermal mass meters are nearly always used on gases, the most common being air in wastewater plants, but they are also heavily used for measuring biogas from anaerobic digesters as well as chlorine gas. In the case of aeration basins, measurement is important because there needs to be enough air for the microorganisms to successfully consume the waste, but not too much air where energy is wasted in excessively running blowers. The meters may also serve to ensure that air flow is balanced to various sections of the basin, and that there is sufficient air flow to prevent diffusers from getting plugged.

Why do you think customers are eager for energy management solutions at this time?

I think that the biggest reason for energy management projects is the ROI [return on investment]. We discussed the efficiencies that can be gained for aeration monitoring, but many wastewater facilities now are not just burning off methane from anaerobic digesters — known as flaring — but renewing it.

They may use the methane as fuel for a boiler that is providing hot water or steam to the plant, or even as a fuel in an energy generation project to produce electricity. With their own on-site electricity generation, it may save the plant hundreds of thousands of dollars per year. Sometimes these "green" initiatives have a negative connotation, but they can really make a business case depending on the amount of biogas being generated. Thermal mass has no moving parts and can measure flow at very low pressures, increasing the

replacement rate of older flow technologies such as positive displacement type meters.

How has Magnetrol's Thermatel line grown out of the company's expertise in the industrial space?

Thermatel is the Magnetrol product line that focuses on flow. Known for liquid level measurement for over 80 years, stemming back to boiler control in power plants, we have shown through our heavy industrial past that we are a reliable partner for level and flow measurement devices that translate into lasting performance in the world of water and wastewater.

How do Thermatel products help a plant manage energy?

Aeration basin processes are the most energy-intensive at the plant. The energy costs associated with aeration are over 50 percent of the total energy costs. Having dissolved oxygen (DO) measurement is critical, but the air flow measurement is another important piece to ensure maximum efficiency, save unnecessary downtime, and reduce expenses.

Monitoring individual blower performance can help evaluate which blower is outputting most efficiently and provide early warning of potential problems that may require maintenance and troubleshooting. There will be a sweet spot for air flow to have the most efficient DO without excess energy consumption. Thermal mass is a very repeatable technology to make this measurement, but it is also important to have a fast response time. Not all thermal mass meters operate with the same principle, so it's critical to ensure the meter measures heat transfer using a constant temperature (CT) methodology as opposed to constant power (CP), as CT provides a faster response to changes in flow conditions.

Another energy-intensive process that can account for over 10 percent of plant energy costs is running pumps. Similar to thermal mass flow meters, there are thermal switches available for on/off type applications for both liquids and gases. A thermal switch could be used to verify that the pump seals do not run dry, or that liquid is flowing through the body. A thermal switch can detect not just a dry condition but a low flow condition. A 50-hp pump motor can cost from $5,000 to $10,000 as compared to a thermal switch that is less than $1,000.

What is "thermal mass" technology and how does it differ from what's traditional?

Historically, the most popular flow technologies utilize differential pressure (DP) for the measurement. These include orifice plates and pitot tubes, particularly pitot tubes for aeration lines. Thermal mass does not rely on pressure drop to provide a measurement, but rather heat transfer. Because of this, thermal is not subjected to the limitations of DP.

Thermal mass is adept at measuring low flows at low pressures, while maintaining a very high rangeability or turndown ratio. This turndown for a flow meter is the range that it is accurate within. DP commonly has a 10:1 turndown or less, while thermal mass has a 100:1 turndown as a standard. This means that you can measure a wide range of low and high flows accurately. Thermal mass is also naturally a "mass" flow device, meaning the measurement is independent of operating temperature and pressure. With DP, the meter may come with multivariable transmitters to account for pressure and temperature variation. This adds to the cost of the flow meter, along with the added space of impulse lines. If there is any particulate in the flow stream, a pitot tube has very small ports and is more prone to plugging than the opening on a thermal probe.

As an international company, have you found the American market to be as concerned with energy management as others around the world?

Yes, I believe the U.S. is definitely at the leading edge. But that isn't to say that other markets and governments are not striving to take advantage of renewable energy, in the form of biogas in particular. For instance, in India the pollution department requires major treatment plants to record how much biogas is being generated and these renewable projects are supported from their municipal corporation. Certain states in Brazil are also participating in projects to measure how much biogas is being produced to begin the process of heat and power generation rather than only flaring off the usable methane. Measuring how much biogas is being generated is key to sizing the project.

How much can a plant save on its bottom line with proper flow measurement energy management?

Monitoring cost savings from aeration projects seems to be more common than energy management projects involving full utilization of biogas produced from anaerobic digestion, but this number is also growing. For example, one of the smaller plants that we worked with has an average capacity of around 10 MGD and was saving an estimated $100,000 per year by using its biogas to generate electricity. It also provides security from interruptions in natural gas and electricity grids.

When choosing a flow technology, thermal mass is a successful mixture of performance and economics. This is especially true if you look at the life of the flow meter with maintenance costs associated with it. Many manufacturers now have calibration verification procedures that can be run at the plant to prevent unnecessary downtime and recalibration costs. Make sure the meter has a calibration verification option and calculate the costs of performing the procedure along with the initial purchase price. Recalibration costs can easily reach $1,000 each and take multiple weeks for turnaround. ■