Using Automation to Green Your Water Treatment Program

Experts from Chem-Aqua explain how ‘Greening’ your facility’s water treatment program can reduce utility bills, improve energy and water efficiency, and protect the environment.

As nearly every facility manager and chief building engineer knows by now, sustainable buildings with high efficiency systems can produce huge savings in both time and money — not to mention protecting the environment for their family and community. But while the focus of those savings has been on reducing energy costs, the return on investment for implementing Green building practices is also closely tied to water savings and ultimately to water treatment.

The bottom line: in a typical commercial building, the HVAC system accounts for over 60 percent of utility costs and is by far the biggest consumer of energy and water. The water treatment program is a critical part of the preventative maintenance for the HVAC system and is integral for the operation of energy, water and resource efficient facilities. In many cases, the water treatment program can be engineered to improve energy and water efficiency, reduce chemical use and optimize results. An effective way to help make a water treatment program greener is to automate tower bleed, chemical feed and control, and other treatment processes.

Importance of Bleed Control

Evaporative cooling is used in most commercial buildings because it is much more energy efficient than air cooled systems. In terms of raw efficiency, it takes 50 percent more electricity to operate an air cooled chiller than it does a water cooled chiller. However, effective water treatment is required to manage water usage and keep heat transfer surfaces clean so this efficiency can be obtained.

Although evaporative cooling is very efficient, cooling towers require an astonishing amount of fresh water to operate. About 0.1 percent of the water circulating over a cooling tower is lost to evaporation for each degree the water is cooled. This may not sound like a lot of water until you consider that a 500-ton cooling tower/chiller operating at full load evaporates almost eight million gallons over the course of a year.

As the cooling water evaporates, dissolved solids are left behind and concentrate in the cooling tower water. Conductivity of water is a direct function of the total dissolved solids (TDS) level in the water and is easily measured with a conductivity meter. As the evaporation occurs in the cooling tower, the conductivity of the cooling tower water rises. By measuring the conductivity of the makeup water and the conductivity of the cooling tower water, you can determine how much the dissolved impurities are concentrated in the tower water relative to the level in the makeup water.

For example, if the tower water has a conductivity of 1,000 uS and the makeup water has a conductivity of 200 uS, then the cooling tower is five times more concentrated that the makeup water and is said to be operating at five cycles of concentration (1,000/200) because the total dissolved solids concentration of the tower water is five times that of the makeup water.

To prevent the dissolved solids in the water from concentrating to the point where energy robbing deposits and other problems occur, a portion of the tower water must be discharged from the system by a function called bleed. A key water treatment objective is to maintain the minimum bleed rate consistent with good
deposit control. This is accomplished by adding chemicals to increase the solubility of scale-forming impurities and controlling the bleed rate so the target cycles of concentration level is maintained in the tower water.

The Green benefits associated with maximizing the tower cycles are significant. Too much bleed wastes water and increases chemical use. Table One shows that maintaining five cycles versus three cycles reduces water consumption by almost 17 percent and inhibitor requirements by 50 percent. However, insufficient bleed can result in waterside deposits that reduce efficiency and increase energy costs. Because the bleed rate required to maintain the target cycles varies as the tower evaporation rate varies throughout the day and from season to season, an automatic system is necessary for good bleed control.

Importance of Chemical Feed and Control

The addition of chemical inhibitors and biocides allows high cycles to be maintained without efficiency losses and other problems. However, even the best water treatment chemicals will not provide good protection if they are not applied properly or in the wrong amount. Overfeeding water treatment chemicals is wasteful while underfeed can result in corrosion, deposits and microbiological growth problems. Effective microbiological control is an especially important part of the water treatment program for a cooling tower. It has been reported that over 90 percent of failures in cooling water systems occur due to microbiologically influenced corrosion.

Poor microbiological control also contributes to unsafe operating conditions by allowing the Legionella bacteria, the cause of Legionnaires’ disease, to proliferate. Effective microbiological control requires the automatic, controlled addition of EPA registered biocides as part of the overall water management program.

Facilities serious about greening their operations closely monitor energy and water usage. Often, metrics such as the energy/water use per ft² of building space or refrigeration ton are used to track progress. Advanced data logging water treatment controllers are now available that automatically monitor and log key treatment parameters including water use. These controllers can interface with the building automation system and the Internet to enable high-performance water treatment programs. They can warn personnel when upset conditions occur, so minor concerns don't turn into major waterside problems. They allow remote access to controller history and settings. Data management and analysis can also be used to help optimize results and reduce costs.

Automation Supports LEED® 2009 for Existing Buildings: Operations & Maintenance

The U.S. Green Building Council* (USG-BC) LEED 2009 Rating System™ is widely used to certify Green buildings. The Rating System contains several elements that are impacted by water treatment automation including:

- Water Efficiency (WE) Credit 1, "Water Performance Measurement, Submetering," awards a point for metering replacement water use of all cooling towers serving the facility
- WE Credit 4, "Cooling Tower Water Management," awards a point for developing and implementing a comprehensive water management program for the cooling tower including automatic: Bleed control; Chemical feed control, and Biological control.

Along with the WE Credit area, there is also Energy and Atmosphere (EA) Credit 1, “Optimize Energy Efficiency Performance,” which awards up to 18 points for achieving an increased level of energy efficiency relative to typical buildings of a similar type, based on the EPA’s ENERGY STAR® Portfolio Manager tool.

A high-performance, automated water treatment program that maximizes energy efficiency by keeping HVAC system waterside surfaces clean helps increase a facility’s energy efficiency and improve its ENERGY STAR rating, which in turn will result in earning additional points for EA Credit 1.

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<th>Cycles</th>
<th>Bleed (GPD)</th>
<th>Makeup (GPD)</th>
<th>Annual Water Cost</th>
<th>% Reduction Water Cost</th>
<th>Inhibitor (lb/day)</th>
<th>Annual Inhibitor Cost</th>
<th>% Reduction Inhibitor Cost</th>
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*Based on 500-Ton Cooling Tower/Chiller Load Operating 24 Hours/Day, 365 Days/Year. 21,600 GPD Tower Evaporation, Water Cost = $5.00/1,000 Gallons. Inhibitor Dosage = 120 ppm. Inhibitor Cost = $4.00/lb.

Automation and Green Building

An automatic water treatment control system supports several key Green building objectives by providing:

- Good control of cycles of concentration
- Precision in applying the correct amount of chemicals
- Minimum operator contact with chemicals
- The ability to log key metrics
- Optimum program results

The water treatment program for a building’s HVAC system is integral to the operation of energy, water and resource efficient facilities. Obtaining optimal results from the water treatment program has huge economic pay-offs and helps meet Green building and safety objectives on many levels.

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