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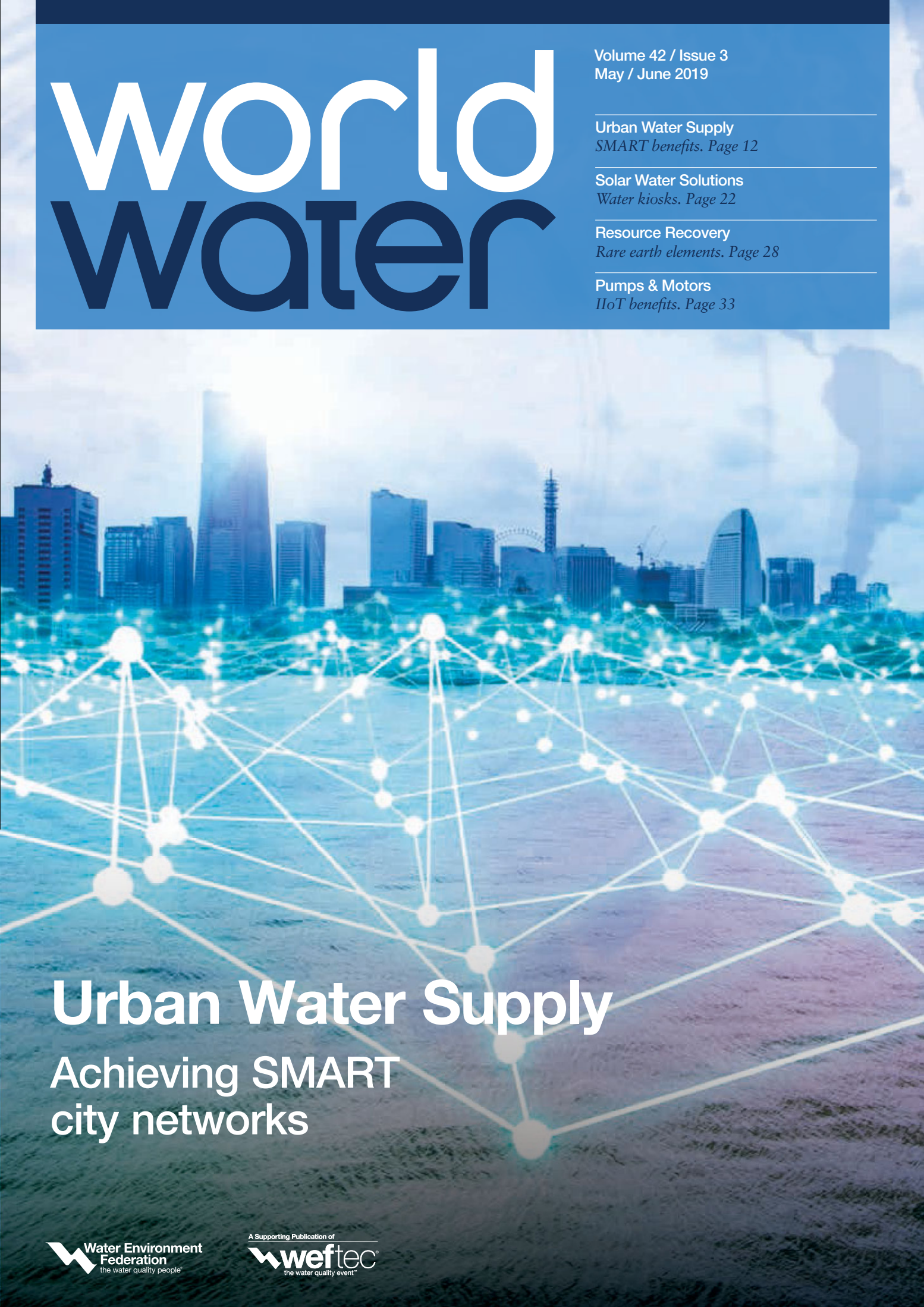

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Cover image: Modern city skyline and mesh network concept. ***Credit:*** metamorworks, iStock

Cooling water treatment pushes water reuse higher

An alternative water treatment technology for cooling towers is reaping impressive results for a commercial cooling water system. CEO Mike Boyko of Dynamic Water Technologies reports how its electrochemical treatment is achieving 34-percent reduction in water consumption for the project in Mesa, Arizona, United States – while plans are underway to expand the application this year.

Dynamic Water Technologies' (DWT) electrochemical water treatment system is saving over 30 percent in water use in the heating, ventilation, and air conditioning (HVAC) water processing system at the Banner Health Corporate Center located in Mesa, Arizona, United States. The Banner Healthcare facilities' management team adopted the company's Universal Environmental Technology (UET) reactor in order to further their sustainability goals by conserving water and eliminating the use of chemicals.

Most water treatment uses traditional chemical dosing, but the UET uses an electrochemical process, which does not need to house and dose hazardous chemicals onsite. The UET reactor allows water to cycle at much higher concentrations than what is typically achievable using chemical treatment – up to target blowdown conductivity of 6,500 microsiemens (µS) or more, in most cases.

Water consumption in cooling tower applications accounts for one of the largest potable water uses in buildings. Domestic water use pales in comparison to water use in HVAC systems. For example, a busy household of five could use up to 1,893 cubic meters (m^3) of water annually, while a commercial high-rise building or mall can consume anywhere from 19,000 to 38,000 m^3 of water for a single cooling tower. For individual households, turning off the faucet during tooth brushing, or carefully metering lawn watering may save hundreds of cubic meters of water a year, but a broken valve or poorly run cooling tower could waste tens of thousands of cubic meters of water over the course of a week.

On April 13, 2018, Banner installed a UET pilot system in their corporate data-center building to test DWT's projection that it could save more than 15,000 m^3 of the water in their HVAC process, which equated to more than 30 percent in water savings in one year. The main building is cooled by using three Marley cooling towers each rated at 800 tons, feeding three chiller systems that provide air conditioning for the facility.

DWT's performance was measured in terms of bio-contamination levels, water savings, and cooling equipment efficiency. With an estimated water usage of 44,000 m^3 a year, DWT hoped to reduce that volume to less than 29,000 m^3. Within one year of operation, Dynamic Water exceeded all goals in its initial proposal. Upon installation, the conductivity setpoint was raised to 6,500 uS/cm, increasing cycles of concentration (CoC) from the previous operation of 2.2 CoC, to more than 6 CoC. This resulted in more than 35-percent water savings – which was higher than the original proposal target.

Depending on the client and application, an optimized HVAC water processing system paired with electrochemical water treatment can achieve water savings ranging from 20 to over 50 percent.

Figure 1. Water savings at Banner Health Corporate Center.

Water Metric	Prior to DWT	With Dynamic Water	Savings
Cycles of Concentration	2.2	6.1	
Makeup Water Usage	11,619,000	7,577,141	35%
Blowdown Usage	5,281,000	1,239,516	77%

In terms of biocontamination, scale control, and corrosion control, DWT achieved all proposed metrics as well. For this facility, all recorded dip slide (a measure of biologics in a system) results are 10 to 100 times better than industry standards. The maximum acceptable level of biologics is 10,000 colony-forming units per milliliter (CFU/mL), according to the Cooling Tower Institute (CTI). Site personnel recorded approach temperatures,

Figure 2. Biocontamination levels tested at Banner Health Corporate Center. Acceptable standards require <10,000 CFU/mL

Date	Reading (CFU/mL)
5/22/18	100 - 1,000
6/13/18	10 - 100
7/24/18	10 - 100
8/20/18	0 - 10
10/29/18	0 - 10
11/6/18	10 - 100
11/28/18	0 - 10
12/20/18	10 - 100

Right: The DWT Universal Environmental Technology (UET) reactor allows water to cycle at much higher concentrations.
Photo by DWT

GSA report recommends UET for government-wide adoption

Impressive results from a 2017 UET performance study conducted by the United States General Services Administration (GSA) are attracting much interest from business and government clients concerned with finding alternative, cost-effective opportunities to reduce water use.

The GSA brought in the National Renewable Energy Laboratory (NREL) to study the science and efficacy of the UET system from July to October 2017. DWT donated a reactor system to a GSA-run office building in Savannah, Georgia, and installed another reactor system on the City Hall East Building in Los Angeles. NREL baselined the facilities and compared DWT's performance to a performance target detailed in the initial proposal.

In both cases, DWT exceeded the initial water savings targets with 32-percent water savings in Savannah and 20-percent water savings in Los Angeles. In addition to water savings, the reports show bonus incentives including ease of maintenance, reduction in hazardous chemicals, increase in the useful life of equipment, and improved safety against chemical spills and bio-contamination outbreaks. After completing both studies, the GSA recommended the government-wide adoption of DWT's electrochemical process to conserve energy and water.

The full report can be accessed online at www.dynamicwater.com.

which showed no loss in chiller efficiency, and corrater corrosion results gave better than acceptable CTI corrosion rates.

Additional system benefits with expansion plans underway

The UET technology also strips process equipment of scale fouling, which reduces system efficiency by using more energy needlessly during heat exchange. The system reduces further corrosion, increasing effective equipment life. The reactor system generates continuous halogenation, which prevents biocontamination by providing a constant biocide without the need to feed a chemical biocide on a schedule. The result is more effectively run process equipment, unhindered by scale, corrosion, or biocontamination.

With the process equipment at peak performance, DWT uses real-time monitoring to ensure treatment remains within the specified range, so that the process equipment continues to run at peak operation. For example, if a valve becomes stuck or a leak springs, real-time monitoring alerts DWT personnel and client facilities with an alarm. This allows for quick resolutions without extended periods of time where cooling towers could be blowing down needlessly or overflowing – a common occurrence that happens in HVAC water processing.

Depending on the client and application, an optimized HVAC water processing system paired with electrochemical water treatment can achieve water savings ranging from 20 to over 50 percent. Pleased with these results, Banner has decided to install UET systems in their entire portfolio this year.

Water is a finite resource that can easily be depleted by populations that consume more water than the amount recycled back into natural sources. In arid states often prone to drought, DWT's UET system provides a new way to conserve water that could help sustain future generations in water-scarce communities.

Left: Dynamic Water Technologies CEO Mike Boyko. Photo by DWT

Water consumption in cooling tower applications accounts for one of the largest potable water uses in buildings.

Author's Note

Mike Boyko is the chief executive officer and principal at Dynamic Water Technologies, LLC, headquartered in Scottsdale, Arizona, US.

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