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# Water Online

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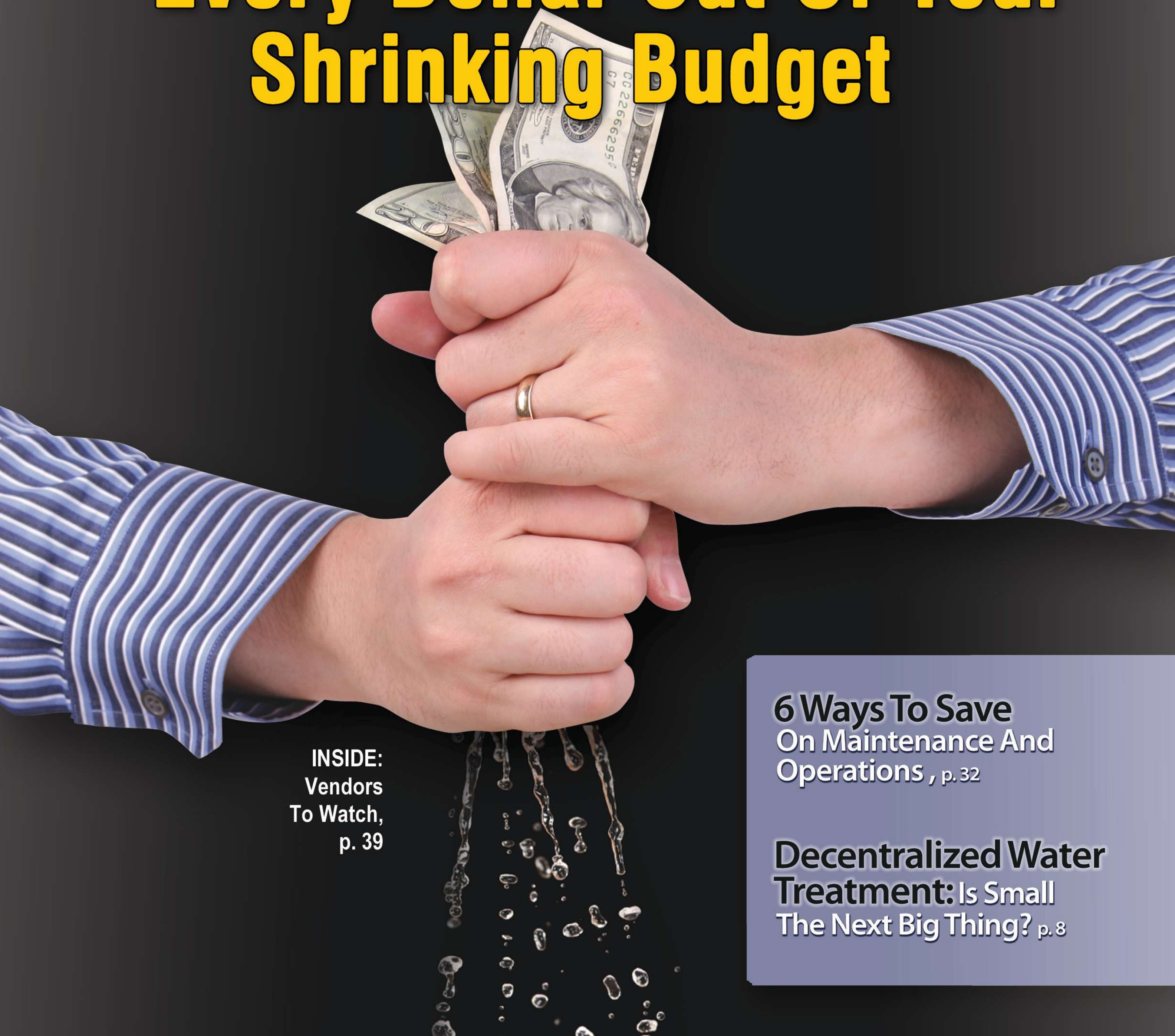
Clean Water Edition

# A Guide To Squeezing Every Dollar Out Of Your Shrinking Budget



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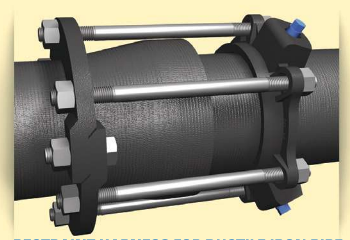

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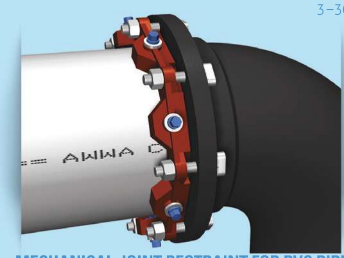


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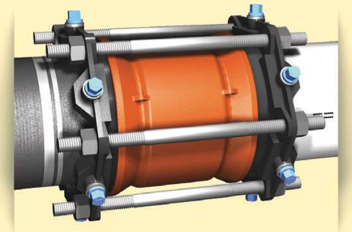

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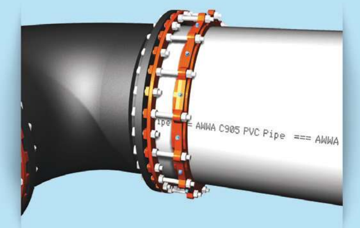


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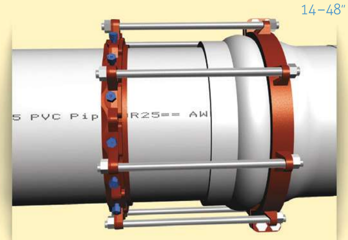

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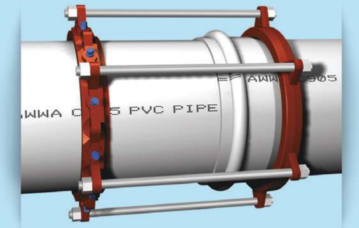


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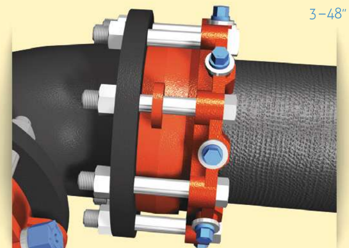

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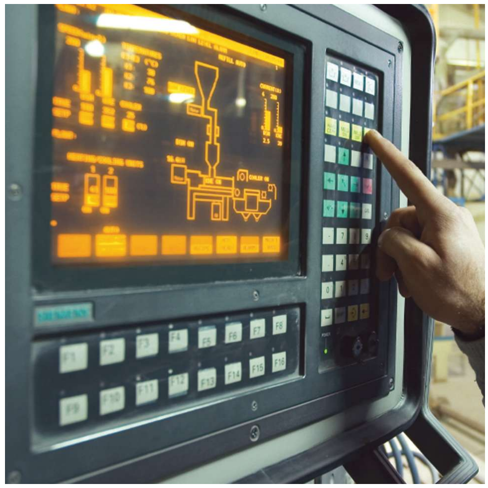



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# Overcoming Municipal Sticker Shock

The municipal water industry has been painfully aware for years that America's water infrastructure is ailing and that funding needed to restore and expand it is scarce, to say the least. But, even the jaded had to shudder at the proposed price tag: a not-so-cool $1 trillion(!) over the next 25 years.

The staggering trillion-dollar estimate was submitted by the American Water Works Association (AWWA) in its February report *Buried No Longer: Confronting America's Infrastructure Challenge*. The AWWA analysis trumps the U.S. EPA's latest *Drinking Water Infrastructure Needs Survey and Assessment*, published in 2009, which pegged the cost at "only" $334.8 billion over 20 years. It seems the EPA was low-balling us.

On the financing front, the water community has rallied this year in support of legislation that would help ease the cost burden for local governments and, in turn, utility customers. The Water Infrastructure Finance and Innovation Authority (WIFIA) initiative, which seeks to leverage available federal dollars through low-interest loans, is exactly the sort of shot in the arm the industry needs in these trying economic times.

However, even with innovative financing efforts such as WIFIA, the funding gap remains significant. In order to bridge that gap, the water community must learn to do more with less — to be more efficient, more responsible, and flat-out smarter.

This issue of *Water Online The Magazine* addresses these concerns with articles devoted to improving your operations and your bottom line. For example, *Dollars And Sense: The Financial Case For Automation*, starting on page 16, explains how unified plant controls and remote SCADA systems can help municipalities overcome today's financial, environmental, and efficiency challenges. Meanwhile, on page 12, *Real-Time Monitoring Offers Savings Across The Spectrum* details the cost-saving advantages of spectral analysis.

**The need for foresight and investment was a hard lesson learned, and one that now needs to be heeded.**

While saving money in the present is important, we must also understand that our predicament — strapped with underfunded, failing infrastructure — did not happen overnight. The need for foresight and investment was a hard lesson learned, and one that now needs to be heeded. As population and water consumption rates increase, and federal regulations get ever-tighter, the pressure on municipalities will only increase as well. To help plan for the future, learn about *Maximizing Your ROI On Test Equipment* on page 28, then turn to page 20 for *Spend Now To Save Later: Evaluating Water Treatment Systems Over The Long-Term.*

Speaking of the future, decentralized water treatment is a growing trend poised to have significant impact on municipalities, industry, and communities at large. Turn to page 8 to see what's driving this movement (hint: it may have something to do with the economy).

If money makes the world go 'round, then lack of money (or misuse, waste, etc.) can grind things to a halt. Therefore, it is incumbent upon municipalities to stretch their dollars further than ever, and to "find" money in the course of their operations. Tips to do so can be found in the article *Do You Think You're Out Of Money? Think Again*, starting on page 34.

Since this ever-present funding issue is so impossible to ignore, we chose — for this edition — articles that address this reality and provide solutions — because while money isn't readily available, technology and innovation are abundant. Relying on these tools, municipalities can generate revenue to help finance the necessary repair and expansion of our distressed water infrastructure system.

With a $1 trillion sticker price, we better get moving.

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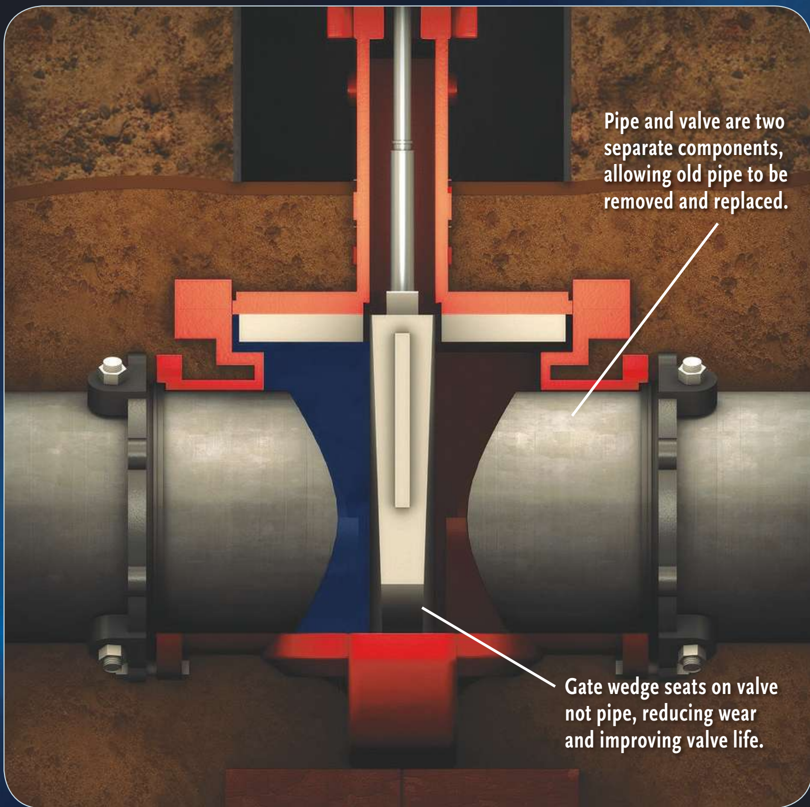


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# Economy, Efficiency Drive Trend Toward Decentralized Water Treatment

New Direction Creates Oppportunity For Water Treatment Companies, Shift Economic Burden Away From Municipalities

by Jim Lauria

The next big thing may be smaller than ever. As urban areas continue to grow, many will outreach and outpace the capacity of their centralized municipal water treatment and wastewater treatment facilities, and, thus stretching the limits of cities' crumbling infrastructure. Decentralized water treatment is on the horizon, and companies across the industry can help make it feasible.

Nearly 80% of Americans live in urban areas, according to the 2000 U.S. Census, and those cities are likely to keep growing — and not just in population. Los Angeles is a great example; the region's population grew 45% between 1975 and 1990 and tripled in area. Sprawled over five counties and nearly 90 municipalities, the greater Los Angeles area is now home to more than 17.6 million people.

Similar spread is evident across the United States, and even more pronounced in global mega-cities like Hong Kong-Shenhzen-Guangzhou, with 120 million people, or Nagoya-Osaka-Kyoto-Kobe, the sprawling home of 60 million residents.

That's a lot of sinks, swimming pools, and toilets — as well as factories, refineries, office buildings, and corporate parks.

In the United States municipal water utilities do a valiant job of maintaining one of the world's best and most reliable water supplies and wastewater treatment systems. However, they are faced with constant budget constraints, ongoing pressure to limit taxes, and tightening regulations on both drinking water and treated wastewater. Future municipal facilities will need to be highly effective and compact. Many cities will also likely push off water treatment responsibilities — at least on the pre-treatment level — on the developers who are creating the growth.

That creates tremendous opportunities for water technology companies. Integrated water treatment systems that take a multi-barrier approach to deliver high-quality water or efficient wastewater treatment can offer top-quality performance to high-rises, hospitals, corporate parks and subdivisions. Smart technology — from better sensors to remote monitoring and chemical management — will open the door for water treatment specialists to service the growing decentralized market. And, an army of private water treatment technicians and engineers, working on the model perfected in the industrial sector for boilers and cooling towers, will be needed to service and maintain future stand-alone treatment systems.

**Decentralized water treatment is on the horizon, and companies across the industry can help make it feasible.**

### Money, Health, And Regulation:

The big drivers will be economics, health, and regulation.

As it stands, many cities can't afford to keep up with demands for water treatment, and federal help is endangered. According to the U.S. Environmental Protection Agency's *Drinking Water Infrastructure Needs Survey and Assessment*, 53,000 community water systems and 21,400 not-for-profit systems will need to invest as much as $335 billion by 2027. There's no word on from where that money is going to come.

Meanwhile, cities continue growing. That means more demand. It also yields untold acres of new pavement, contributing to floods of stormwater into municipal systems that frequently cause combined sewage overflows in many cities. Stormwater is the major contributor to non-point source water contamination in the United States and a huge burden on municipal systems and neighboring waterways. Removing suspended solids (TSS) and dissolved solids (TDS) — as well as oil and often nutrients — will be increasingly vital, using systems ranging from swales and retention ponds to compact treatment systems.

Some cities require developers to identify the source of water for the residents, office occupants, or industries slated to occupy their projects. Many include systems development charges in their development fee structures, collecting money to offset the increases in

**Technologies that deliver high efficiency with a small footprint will lead the charge to decentralization.**

municipal services the new projects will demand.

Increasingly, we will see cities require developers to supply their own potable water, treat stormwater leaving their property (look to Washington State for examples of this), and, likely, also require some developments to pre-treat wastewater before delivering it to municipal sewers. Expect to see limits — or higher fees — imposed on biological or chemical oxygen demand (BOD and COD) or volume by municipal wastewater utilities.

An example of this pre-treatment already exists in California and Oregon, where many wineries must dramatically reduce BOD and neutralize pH in their wastewater before releasing it to sewers or the environment. In California's premium wine capital of Napa, municipal wastewater capacity was overwhelmed by wineries, forcing many to manage their wastewater themselves. That's a peek into the future for many industries in many cities.

### TMDLs Set Values

One of the driving forces in many cities for decentralized water treatment will be total maximum daily loads (TMDLs). TMDLs are required for streams, rivers, and lakes that are considered "impaired" by state and federal environmental agencies due to an excess of

**The demographic trends are clear; the regulations are pointing the way, and the technology is available.**

specific water quality parameters. Those parameters can range from phosphorus to coliform bacteria to temperature — anything that can prevent a body of water from being drinkable, swimmable, or fishable.

In the TMDL process, stakeholders and regulators study the water body to determine the source of the particular contaminants. Then, they apportion the reduction among all the contributors. Farmers may have to adopt certain management practices and plant vegetative buffer strips outside of town, while the local wastewater treatment plant may need to add a processing step, area factories must treat their cooling water before discharge, and a corporate park on the edge of the city has to treat all the runoff from its roofs and parking lots. It's politically fraught and far-reaching, and can push wastewater treatment to the level of a single facility or subdivision.

Plan to see TMDLs increase demand for rainwater harvesting systems (better to treat and use the water than pay to treat and just discharge it), stormwater treatment technology, and facility-scale wastewater treatment.

### Protecting Private Health

Municipal water treatment systems in the United States have set a global standard for protecting the public health through effective disinfection. But, as private water treatment systems — for housing subdivisions, vast corporate parks, and mega-buildings — come into prominence to pick up where municipal systems can't keep up, non-municipal water treatment plants will have to live up to the same high expectations. There is no room or tolerance in society for outbreaks of waterborne pathogens such as *Legionella* or *Cryptosporidium*.

Even where municipal drinking water is available, point-of-entry and point-of-use filtration systems are likely to become more popular. Hospitals and elderly care facilities are on high alert against waterborne disease, as are a growing number of hotels and high-rises. Ironically, the number of faucets behind which water can stagnate, and anti-scalding codes or guidelines that maintain water at temperatures below the *Legionella*-killing temperatures of 135 degrees F, can dramatically increase the likelihood of a buildup of deadly bacteria. Crumbling delivery systems only contribute to the problem.

On-site disinfection will be critical in those situations. Even in non-potable water systems, anti-bacterial programs are vital — remember that the first documented outbreak of Legionnaire's disease, and many that followed, were spread by cooling water, not drinking water.

### Technology Creates Opportunities

Technologies that deliver high efficiency with a small footprint will lead the charge to decentralization. Membrane systems will play a leading role in both clean water and wastewater applications, and integrated membrane/pre-filtration systems will be at the center of it all. Managing BOD and COD will gain ground. Non-chemical and on-site disinfection systems, such as UV and mixed oxidant generation technologies, will grow as planners seek ways to treat water in small, local facilities without the cost and risks of stashing chemicals all over the cities. Pre-treatment systems will make polishing steps more efficient.

Energy efficiency will prove to be a key benefit to smaller decentralized water treatment systems. Those projects can be tailored to treat water based on influent quality and the intended use of the water. This resource-efficient approach is difficult at best to manage on a city-wide basis, but can easily be tailored to an individual site or subdivision.

In all, the big opportunities in the water treatment business may turn out to come in small packages. The water industry is poised to help growing cities serve their expanding populations and aid industry in meeting stricter rules and expectations for water and wastewater use while residents of high-rises and housing subdivisions maintain their access to safe, available water supplies. The demographic trends are clear, the regulations are pointing the way, and the technology is available. It's time to think big by thinking small. ■

*Jim Lauria is a water technology executive with a bachelor of chemical engineering degree from Manhattan College. He has more than 20 years of global experience as a senior executive in the water treatment industry. Lauria is a marketing executive, engineer, writer, blogger, and water evangelist. He is a frequent speaker at water industry conferences and has published more than 50 technical articles in water trade publications. He can be contacted at (805) 410-2674 or jimlauria@teamchem.com.*

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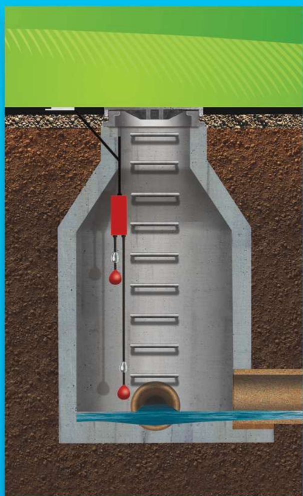

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# Real-Time Monitoring Offers Savings Across The Spectrum

The Expanding Role Of Spectrophotometric Analysis Yields Water Quality And Cost-Saving Benefits

by Jodi Glover

With increasingly tight budgets, it's becoming more important to look for new ways in which we can reduce costs and improve efficiencies. A good place to start is by assessing what water quality monitoring solutions we are using, or could be using, to help us take control of our treatment processes.


Water quality monitoring has seen an incredible amount of change and improvement over the years with the advancement of new technologies being applied to this area. A prime example of this is with real-time spectrophotometric analysis.

Spectral analysis has now been effectively moved from the lab to the plant environment and even to the municipal distribution system, without the high costs and maintenance requirements and with more reliability and usability. This new generation of spectrophotometric instrumentation is opening up many new opportunities for monitoring in applications for which real-time monitoring has not previously been feasible, offering many cost-saving advantages.

There are several specific water and wastewater applications for spectrophotometric instrumentation that can allow companies and municipalities to significantly reduce their costs while meeting their water quality goals.

### Coagulation Optimization

Many plants utilizing coagulation treatment processes are affected by organics in the water. Although much attention is often given to different treatment technologies, many plants still do not monitor their organics levels in real time, even though real-time organics monitoring can significantly reduce costs associated with coagulation and without significant capital investment. The return on investment (ROI) that these plants receive from this purchase can often be seen within a few short months through reduction of their spending on coagulation chemicals and sludge removal.

### UV Disinfection Optimization

Some applications may not require analysis of the full spectrum as is the case with the UV disinfection application which requires monitoring just the 254-nm wavelength, often referred to as UV254 analysis. With the increasing adoption of UV disinfection systems, monitoring the UV transmittance (UVT) of the water at the 254-nm wavelength is vital for ensuring performance. Utilizing UV254 at the design stage can also provide cost reduction by ensuring the UV system is appropriately sized for the water quality range requirements of that particular site.

Once installed, by understanding the UV254 of the water it allows operators better efficiency with regards to servicing of the UV system, saving operator time. As well, in larger UV systems monitoring UV254 can offer significant energy savings by automatically adjusting the UV lamp intensity or turning off banks of lamps, greatly reducing operating costs.

### Meeting Regulations, Avoiding Fines

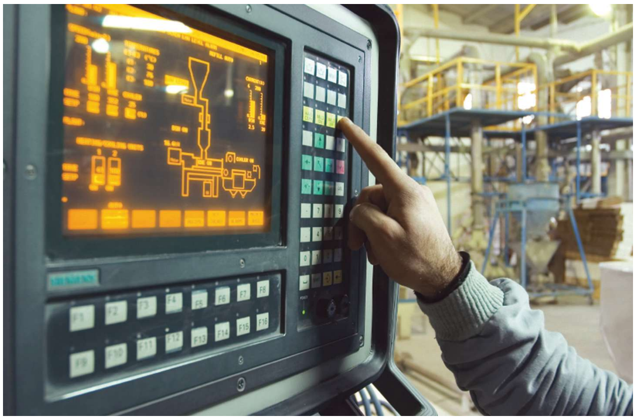
Water quality is complicated and always changing, and the task of meeting many regulations can be challenging. Real-time spectrophotometric instrumentation can allow plants to effectively measure organic compounds in the plant effluent, providing valuable information to enable plant operators to properly understand fluctuations and spikes in organic contamination. Better control of organic loading in plant effluent can allow the plant to reduce the potential for contamination events and help reduce the potential of being fined.

### Process Control For Activated Carbon Performance

Activated carbon technologies are increasingly being utilized within plants to aid in removing organic contamination. However, better efficiency can be obtained with this treatment method through low-cost online monitoring which can in real-time rapidly identify a breakthrough in carbon, and potentially allow for reduced backwashing and less frequent carbon regeneration, resulting in significant cost savings.

### Distribution System Monitoring

There is no question that an accidental or intentional contamination event within a distribution system would be devastating, and yet most utilities do not have adequate monitoring within the distribution system, primarily because of the cost versus benefit associated with this application. However, with the advent of lower-cost spectrum analyzers that balance



A new generation of monitoring equipment offers greater control of plant processes.

can now be achieved. Installation of these new monitoring devices at key locations within the distribution system can allow utilities to spend more wisely and gain the real-time ability to immediately detect a contamination event, warding off extremely expensive and harmful consequences.

Some of the latest real-time analyzers are significantly more sensitive than the lab spectrophotometers due to technological advances, including the ability to use very long pathlengths. This allows some real-time spectrophotometric analyzers to be much better suited to an application that requires high sensitivity to contaminants such as the requirements for distribution system monitoring. This strengthens the value for utilities to be able to move forward with security monitoring applications.

## TOC Alternative For Organic Analysis

Spectrophotometric analysis and especially UV254 analysis offers a far lower cost alternative to traditional TOC monitoring not only in the upfront capital investment, but also due to the very low maintenance requirements of spectrophotometric instrumentation, saving users money and time.

Many plants understand the benefit of organic analysis since organics in water have many negative consequences. Typical negative effects of organics in municipal applications include causing taste and odor, providing food for bacteria, consuming coagulant chemicals and combining with disinfectants such as chlorine and chloramine to create toxic disinfection by-products (DBP's). Increasing regulations are coming into place to include more regular monitoring and control of organics.

The traditional method for testing organics is total organic carbon (TOC). However, TOC testing is extremely expensive, complicated and time consuming, and for many applications is not the best organic test. Unlike TOC testing, the use of spectrophotometric organic testing allows more specific information about the reactive portion of the organic material in the water to be determined. This makes spectrophotometric analysis a more valuable indicator of the organics that are going to be problematic.

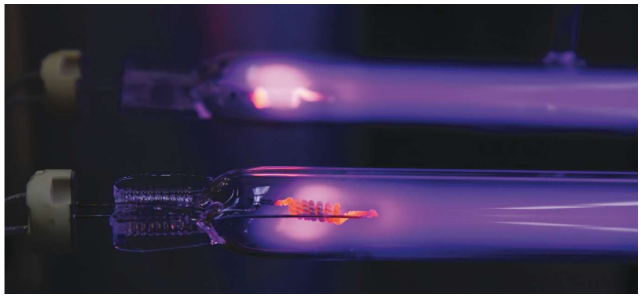
In many cases, this type of application only requires UV254 analysis. UV254 organic analyzers are a fraction of the cost of TOC analyzers, do not require any consumables, and have very low maintenance. The cost savings and overall benefits that a plant can see from comparing the purchase of a TOC analyzer to a UV254 analyzer are clear and represent a great example for how plants can spend more wisely in today's more budget conscious environment without sacrificing their ability to ensure water quality.

### Real-Time Analysis Of Multiple Compounds With A Single Instrument

By analyzing multiple wavelengths or perhaps the full spectral absorbance of the water, a single spectrophotometric instrument can provide detection of multiple chemical compounds in the water, thereby reducing upfront costs and long-term maintenance requirements, and reagents are often not required. Often for less than the cost of a lab spectrophotometer, a real-time spectrophotometric instrument can provide immediate detection in real-time of multiple contaminants. For example, until relatively recently, a plant that needed to measure both nitrates and organics at one location in real time has had to purchase a nitrate monitor and an organic monitor, whereas it is now becoming commonplace to purchase a real-time spectrum analyzer for less cost than just the nitrate analyzer alone.

### The Right Spectrophotometric Instrument For The Application

Once it has been determined that real-time spectrophotometric analysis can improve the efficiency of a given process, the right instrument must be chosen for that application. The latest generation of real-time spectrum analyzers now comes in several varieties. The price point for a spectrum analyzer can vary widely, primarily due to the technology, light source, path length, options and features desired, and the water quality range of testing required.



The light source and wavelength range of spectrum analyzers is an important consideration.

### Importance Of The Technology Inside

Spectrophotometric instrumentation measures light within the UV and/or visible light range. To be able to do this in real time on a continuous basis, these analyzers must provide some accommodations or compensation mechanism for dealing with the drift and fluctuations of the system's light source and sensor. There are several technologies being implemented in spectrophotometric analyzers and all have varying degrees of effectiveness. The success of the technology utilized in the analyzer will greatly impact the accuracy, reliability, maintenance, and cost of the system.

Most analyzers on the market today have chosen the traditional dual beam principal for compensation, which requires additional optics increasing expense while often adding even more potential for inaccuracy.

New technologies are now on the market that provide compensation for the inherent challenges associated with spectrophotometric instrumentation in a more simple and effective manner. These new technologies are creating solutions at price points unmatched by other analyzers while improving performance.

### Light Source Customization

The light source and wavelength range of spectrum analyzers are another important consideration. Deuterium light sources, which are the kind most commonly found in lab spectrophotometers, can allow the best accuracy and sensitivity. Xenon light sources have longer lifetimes reducing maintenance requirements, but they do not have the performance of the deuterium light sources. For applications that only require the 254-nm wavelength such as UV disinfection applications or for monitoring of various organic compounds, a mercury lamp can be used reducing the cost of the analyzer while providing ample performance for the application.

Choosing the right spectrophotometric analyzer with the right light source and wavelength range for the particular application is important to making an informed decision to ensure best performance at the lowest price point.

## Water Quality Range And Importance Of Path Length

Different applications for spectrum analyzers can have very different levels of water quality. Therefore, it is important to select a spectrum analyzer that is designed for the correct water quality range. In spectrum analysis the range is primarily determined by the path length of the analyzer. Many analyzers simply are not capable of offering various path lengths to ensure optimal performance across various water quality ranges. Choosing an analyzer with the right path length for the application at hand can ensure the best performance and value.

## Bypass Or Probe For Municipal Water

Making the right choice between a submersible probe-style spectrum analyzer and a bypass spectrum analyzer makes a big difference to both performance and cost. Probe-style instruments are best suited to wastewater applications with higher levels of suspended solids, whereas bypass-style instruments are better suited to drinking water and wastewater effluent.

Even so, probe-style instruments are often installed in drinking water applications resulting in increased capital costs and unnecessary maintenance headaches. Bypass systems allow significant cost savings for drinking water especially for the applications that require multiple sample points to be monitored. A single bypass analyzer can be used to monitor multiple sample streams, whereas a probe-style instrument can only sample the water in which it is immersed. Additionally, bypass systems offer the ease of maintenance associated with cabinet analyzers reducing recurring costs.

Some probe style analyzers do provide optional bypass conversion kits that clamp a housing around the sensor portion of the probe. Tubing is then run to and from the housing attachment in an attempt to turn the probe-style instrument into a bypass-style instrument and leads to added expense. For drinking water applications, the bypass spectrum analyzer is the clear choice.

## Summary

In summary, the latest generation of spectrophotometric instrumentation, including UV254 analyzers, can be used to provide affordable and reliable alternatives to other more traditional and costly instrumentation, optimize our treatment processes to reduce chemical costs and provide energy savings, and minimize fines for non-compliance with regulations. By evaluating these new monitoring solutions on the market, water and wastewater treatment plants can greatly improve the control of their plants. ■

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# Dollars And Sense: The Financial Case For Automation

Advanced Automation Systems Allow Municipalities To Do Much More With Less

by Doug Johnson

Whether it is dining out less often or putting off that new car purchase just a bit longer, it seems that doing more with less is something many of us have become accustomed to over the last few years. Consumers are not the only ones feeling the pinch. Corporate America has hunkered down, something that has been well chronicled in the news. But there are other organizations struggling to make ends meet: the municipalities and regional authorities responsible for keeping our water and wastewater infrastructure operating smoothly.

Population growth, increasingly complex regulations, aging infrastructure, and cyber-security threats are all straining the ability of organizations to serve their communities. These challenges, complicated by tax base losses driven by the economic downturn and the retirement of experienced industry managers, engineers, and operators, are moving those in the industry to seek out creative solutions in their mission to maintain essential services.

Extreme couponing is not an option. Automation is. Automation can have a profound impact — helping an organization meet today's competing operational, environmental, and financial objectives.

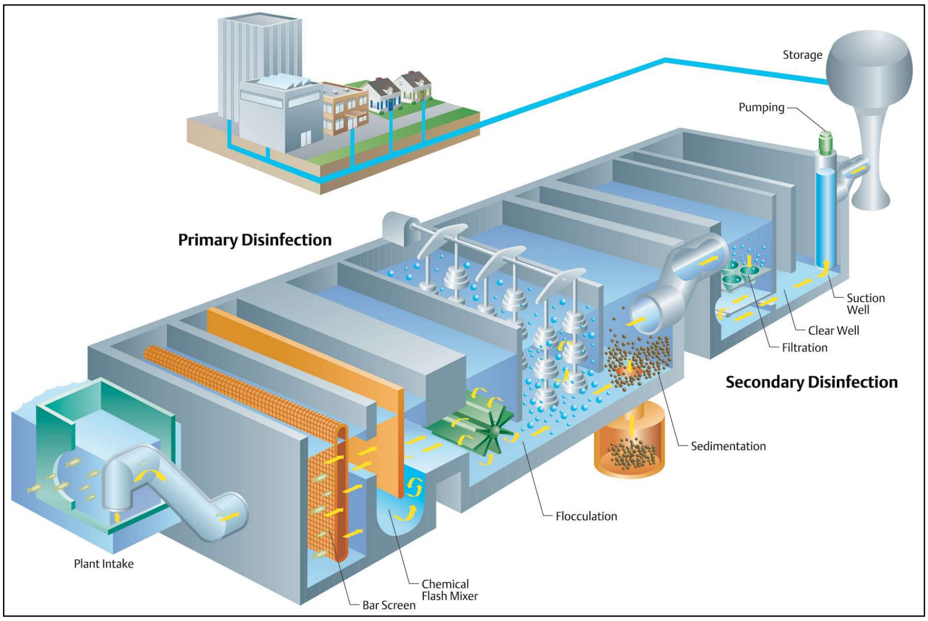
Moving beyond the walls of a single facility, an integrated approach to automation allows for wide-area monitoring and control of district-wide assets from a single, centralized location. *(image courtesy of Emerson)*

The majority of municipalities and regional authorities utilize automation to some degree. In some cases, control replacement is done to meet immediate needs — without a clear overall automation goal in mind. Consequently, over time these organizations may find themselves saddled with a patchwork of PLCs and/or outdated proprietary controls that don't easily "speak" to each other (if at all), are expensive to maintain due to the scarcity of spare parts, and do not lend themselves to system expansion to meet the needs of a growing population or the implementation of new treatment processes and technologies. These disparate islands of automation are part of the problem, not the solution.

Conversely, unified plant controls and remote SCADA systems, integrated on a district-wide basis, go far beyond the basic definition of process control. At the plant level, tighter overall control and process visibility made possible by an integrated control architecture can translate into improved management of treatment processes. The control system can constantly adjust chemical deployment based on flows, levels and other critical process measurements, resulting in better control over the amounts of chemicals used in a treatment process, as well as potential cost savings.

Moving beyond the walls of a single facility, an integrated approach to automation allows for wide-area monitoring and control of all assets — including remote pumping stations, treatment plants, wastewater collection systems, water distribution systems, storm water retention reservoirs, weather monitoring systems, etc. — from a single, centralized location. Such district-wide visibility enables operators to more quickly detect and isolate system leaks as well as better react to rapidly changing conditions such as storm water inflow. Adjusting operating parameters according to changing situations, advanced control technology helps prevent the overflow of untreated sewage into waterways during wet weather events thereby eliminating the subsequent health, environmental, and regulatory consequences. And by providing continuous, up-to-date information from remote facilities, it is possible to detect equipment failures early, helping to eliminate potential environmental problems while also improving process reliability and reducing operations and maintenance costs.

Even greater efficiencies and potential cost and time savings can be achieved by integrating process automation and plant management systems with other information systems. These include maintenance management, laboratory




Unified plant controls and remote SCADA systems go far beyond the basic definition of process control. At the plant level, tighter overall control and process visibility made possible by an integrated control architecture can translate into improved management of treatment processes. *(image courtesy of Emerson)*

information, plant design, and/or financial information systems.

For organizations struggling with how to do more with less, these examples illustrate a few of the ways in which automation solutions can deliver significant operational savings while also helping to ensure cleaner, safer water supplies and reduce environmental hazards. And because the technology is scalable, these benefits can be achieved by organizations large or small.

A small borough in Pennsylvania is indicative of how even small municipalities can benefit from replacing separate, older controls with a unified automation platform. Ridgway installed a new control system that monitors and controls its water treatment and five-bay filtration processes. The borough's search for a new control system included some strict requirements:

- State-of-the-art technology that unifies the plant processes into a single system with a high degree of reliability;
- Ability to expand and move with the borough into the future;
- Ability to work within budget constraints.

Replacing several outdated, non-supported systems with one unified platform significantly reduced plant costs by decreasing spare parts expenditures and time spent pursuing multiple vendors for support. New reliable components reduced plant downtime, which had been frequently required in order to replace parts with the old systems.

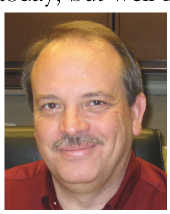
The control SCADA server, located in the plant's office and laboratory, maintains constant communication with the telemetry unit located at its Laurel Mill Reservoir. Important information from the SCADA remote terminal units is readily available to the control system and desktops of Ridgway supervisors and managers, enabling faster and more effective decision making. Operators who used to spend a total of two hours per day manually checking reservoir water levels can now dedicate those hours focusing on improving plant processes and water quality.

The new controls have greatly increased the efficiency of many Ridgway operations. One example is improvements to the extremely sensitive and complex backwashing system, a cyclic process in which filters are periodically washed out to remove sediment. With the new control platform, Ridgway now utilizes only 15,000 gallons of water, versus approximately 20,000 gallons needed previously, translating into a 25% reduction in water and chemical usage during each backwash process.

Before, important plant data was collected and compiled manually from each separate control system. Now the control system provides approximately 90% of the information required to complete EPA reports.

Today's advanced automation technologies can help tackle tough financial, environmental, and efficiency challenges. To fully reap the benefits of automation, all options should be carefully evaluated. This is best accomplished through master automation planning that is based on a strategic vision for the organization's long-term needs and an understanding of how automation technology can address these needs today and well into the future. Increasingly, forward-thinking municipalities are developing an integrated automation master plan that lays the foundation for strategically unifying operations throughout the entire service area in a phased approach, over time — 5, 10, or even 15 years. This enables organizations to expand and take advantage of new technologies as circumstances dictate.

The tide of this current economic climate is beginning to turn, and operational, regulatory, environmental, and economic issues facing the water and wastewater industry are continuing to evolve. Amidst this shifting landscape, one thing remains unchanged: the need for municipalities and regional authorities to do more with less. Deploying advanced automation solutions can help organizations effectively address these challenges, enabling them to be good stewards of the public assets entrusted to them not only today, but well into the future. ■



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# Spend Now To Save Later: Evaluating Water Treatment Systems Over The Long-Term

Analyzing The Costs Of A New Water Treatment Installation

by Bruce Scholten

Stricter government regulations combined with shrinking operating budgets means that many municipalities are struggling to install or upgrade water and wastewater systems. But even with limited funds, water treatment is a smart long-term investment, and one that can yield economic benefits quickly.

In order to make an accurate cost evaluation — and the best water treatment system choice — municipalities should consider installation costs and long-term lifecycle costs, including operating labor, media and chemical usage, and waste handling.

## The Challenge: Pure Water For A Thirsty California Valley

In 2007, a desert community's water district in southern California faced a growing water crisis. Serving approximately 30,000 people, this water district had a single supply source, a local groundwater aquifer. In recent years, their water demand had increased, exceeding the natural recharge to the groundwater basin. As a result, the valley was experiencing chronic downward trending of usable water.

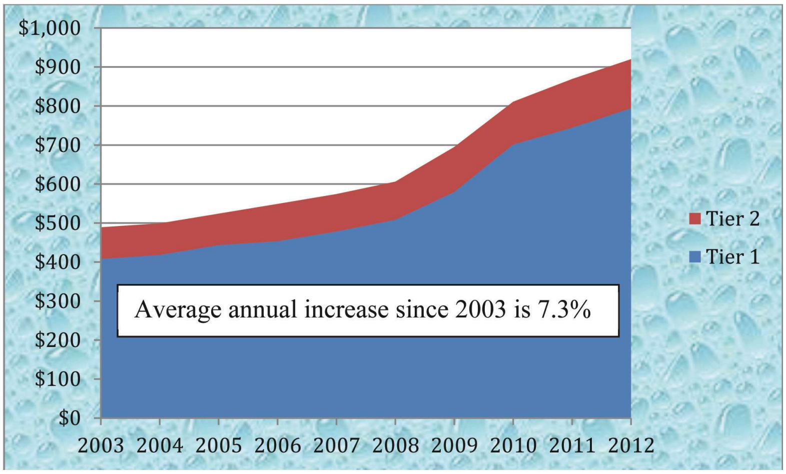
The water district began researching options that would ensure its ability to meet present and future water needs for the over 12,000 valley homes and businesses. Purchasing water from the metropolitan water district (MWD) would be costly in this water-constrained high-desert environment, and was incompatible with its mandate of delivering the highest quality water at the best possible price to the local community while ensuring self-sustaining water resources.

According to the American Water Works Association, the average United States domestic indoor per capita water use is approximately 70 gallons/day (drinktap.org). This means the 30,000 people in the Valley consume approximately 2.1 million gallons of water every day simply for indoor domestic use (not including outdoor domestic, agricultural, or industrial water, all of which could be significant). At an average California wholesale cost of $794/(acre foot)(Tier1) according to MWD, the cost to purchase enough water to satisfy just its current water needs would be approximately $8,700/day, or $3.2 million the first year.

Furthermore, over the past decade, MWD has averaged a 7.3% price increase per year. Projecting a similar price increase for the next 20 years and calculating the net present value (NPV) of those costs results in a projection of $68 million just to meet this community's current demand for water.

With this benchmark in hand, the

MWD Full Service Treated Volumetric Cost ($/acre foot)




Tier 1 Supply Rate: recovers the cost of maintaining a reliable amount of supply.
Tier 2 Supply Rate: set at MWD's cost of developing additional supply to encourage efficient use of local resources.

## A comprehensive pilot test is critical for determining the most effective and cost-efficient treatment solution for a particular location.

community's water district chose to explore ways of optimizing its use of existing groundwater supplies by pilot testing three water treatment technologies: coagulation/filtration, adsorptive filtration, and reverse osmosis (RO). While adding to the initial cost of installing a water treatment system, a comprehensive pilot test is critical for determining the most effective and cost-efficient treatment solution for a particular location.

At the conclusion of its 2007 pilot study, the water district chose to implement a pressure media filtration system to reduce the amount of arsenic in its raw water to below the maximum contaminant level (MCL) of 10 ppb in accordance with California Department of Public Health standards. A pressure media filtration system would achieve the goal of blending filtered and other source water to achieve total arsenic levels below the MCL, while realizing lower installation, operations, and maintenance (O&M) costs than the other two pilot-tested technologies.

A high-level analysis of costs associated with the new water treatment installation proves instructive.

### The Solution: Two Automatic Filter Stations

In 2010, the water district installed a new water filtration system at two separate treatment facilities. Designed for combined flow of 2,500 gallons/minute, the two fully automated stations have six filter vessels (three each per site); two reaction vessels (one each per site); and standby capacity with automatic backwash and backwash recovery.

At the time of installation, one complete load of application-specific permanent media was furnished for the system. An additional 5% of media was also provided for the first required media refresh in approximately five years, which will be necessary to replace media lost in backwashing. In addition to not requiring complete change-out, another key advantage of the new filtration system's media is that it is custom-designed for this water district's unique water treatment needs.

The price for their new pressure media filtration system was close to $14.5 million, a significant investment for the small municipality. However, this figure does not tell the whole story; a closer look at some key costs — including the lifecycle costs associated with operating the system — is critical.

### A Closer Look At Key Cost Drivers: Installation Versus Lifecycle Costs – Tanks And Waste Handling

After considering all available options, the district chose a water filtration system with a highly efficient four-minute backwash cycle and a one-minute rinse, much shorter than many others in the market, which can run from 15 to 20 minutes with a 15-minute rinse. With an overall efficiency of 98.9%, its new 2,500 gallons/minute system produces approximately 1.3 billion gallons of water/year, and generates approximately 600 gallons of waste/year when reclaim solids are removed. The backwash volume from the system is 22,500 gallons per flush, versus 150,000 gallons from a system with a longer backwash cycle. A treatment system with a long backwash cycle will produce up to three million gallons more waste water per year than a comparable system with a short backwash cycle.

Because their backwash volume is comparatively small, it can be stored in small reclaim tanks — unlike systems with longer backwash cycles and huge backwash volumes, which must discharge to a pond. The district's backwash water does not become surface water; rather, it is reintroduced into the system for further processing, and solids in the reclaim tank are settled and removed every six months. Waste disposal is limited to 600 gallons/year of nonhazardous materials, and there is no affiliated cost for drying beds.

As result of this high system efficiency, the backwash and reclaim tanks are approximately 75% smaller than the competing systems' tanks, resulting in upfront capital costs savings for the water district and its community of at least $275,000.

An additional benefit of these significantly smaller tanks is that they require a smaller installation footprint, which also can result in meaningful land

and infrastructure cost savings, as well as reduced installation costs. The district's two water treatment facilities are half the size of a comparable filtration plant that utilizes a longer backwash cycle. And configuring the original system to utilize efficiently, its modest footprint allows for possible future expansion if necessary, which also can result in significant long-term savings. The smaller tanks also will require less electricity and smaller pumps to operate. Finally, a highly efficient backwash cycle conserves water, which is particularly important in water-constrained environments common in the southwestern United States. As much as 99.9% of the backwash water can be reclaimed and put back into the system (a good backwash-to-filtration ratio should be 0.2% or less).

### Automation
### $348,000 (2.2% of total system cost)

A high degree of automation ensuring full, unattended operation is a key benefit of the district's filtration system. It reduces operator time, providing smooth, consistent management as well as system alarms and advanced status reporting. While it will have higher upfront costs at installation, automation will significantly reduce on-going labor costs over the 20-year lifecycle of the system. For example, a fully automated system typically requires approximately 50 man-hours/year for O&M, versus a less automated system, which may require as many as 700 man-hours/year to operate. Using the Bureau of Labor Statistics' national average rate of $25/hour for water treatment

| Factors\Option | Purchase Water | Reverse Osmosis | Greensand Filtration | Designer Media |
|---|---|---|---|---|
| Cost of building out treatment plant | N/A | $5,100,000 | $12,700,000 | $12,400,000 |
| NPV of O&M or Purchasing Water | $67,995,400 | $20,803,117 | $2,629,705 | $489,045 |
| Equipment Initial Investment | N/A | $1,700,000 | $1,000,000 | $1,600,000 |
| **Present Value** | $67,995,399 | $27,603,117 | $16,329,705 | $14,489,045 |

system operators (BLS.com), a lower level of system automation could add over $320,000 to the water district's operating costs over 20 years.

### Media
### $270,000 (1.7% of total system cost)

While the district's initial media costs were higher at installation, the customized media in its new filtration system never needs to be replaced because of its application-specific nature and the efficiency of the system's short backwash cycle. Instead, every five years this permanent media is replenished; that is, approximately 10% more media is added to the system to replace media that may have washed out. For the district's system, total media replenishment costs are approximately $27,000 every five years, or $54,000 over its 20-year system lifecycle, with the first replenishment load cost included in the installation price. On average, approximately 20% of total media in the district's system will be replenished over 20 years.

In comparison, non-customized media in systems with longer backwash cycles require total replacement every three to five years when it becomes expended and allows containment breakthrough. This results in ongoing media costs of approximately $190,000 per exchange, not including the cost of removal and disposal of the spent media. Over a 20-year lifecycle, this amounts to $570,000 in media replacement costs, or $516,000 more than the water district's projected media costs.

### Chemicals

Chemical costs are often a significant percentage of operating cost. The chemicals used in the filtration systems at the water district are ferric chloride, sodium hydroxide, sulfuric acid, and sodium hypochlorite, and actual costs are approximately $500/week, or $26,000/year. The district's treatment system does not require as much pH adjustment because its customized media is effective at oxidizing contaminants over a wider range of pH. This results in significant savings of the chemicals required by undifferentiated media types to bring feed water into a suitable range for effective oxidation.

## The Outcome: Net Present Value Calculation

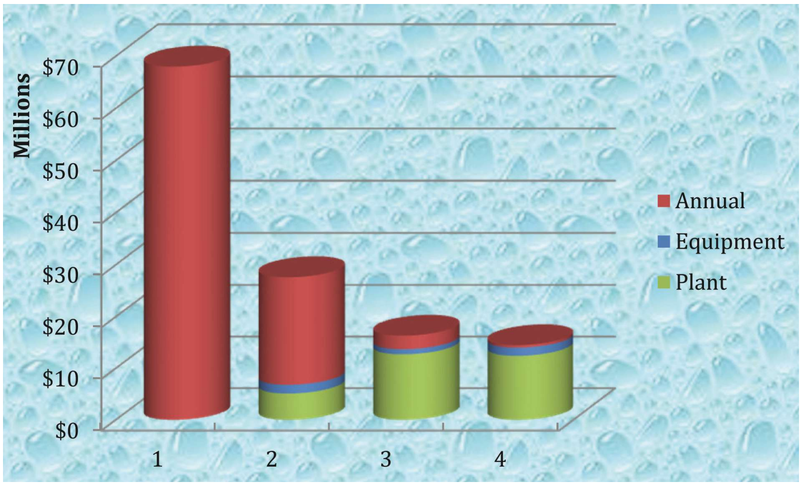
The new filtration system's lifecycle savings will continue through 2030 (20 years from installation) and will increase after the initial investment payback period. A net present value (NPV) calculation provides a way to evaluate these savings. In an NPV calculation, each cash outflow is discounted back to the present value (PV), and then summed (wikipedia.org). *(See prior page for illustration of calculations).*

The NPV calculation reveals that the district will pay approximately $14.5 million in present day dollars for installation, including the 20-year O&M costs for its new pressure media water filtration treatment system. This compares favorably to $16.3 million if they had purchased a treatment system with a long backwash cycle that used undifferentiated media, $27.6 million for a reverse osmosis treatment system, or the $68 million it would have cost to purchase the same amount of water from the MWD for 20 years.

## Conclusion

The present value cost of this desert community's water treatment system is less than $.55 per 1,000 gallons for the next 20 years, and its water is now clean and safe. Before filtration, the raw water's arsenic influent contamination level was 19 ug/l; after treatment, it is non-detectable at or below 4 ug/l. The water district's experience has demonstrated that lower initial filter costs often do not represent best long-term value because lifecycle operating savings can outweigh initial capital cost savings when compared in today's dollars. The district's new

**Net Present Value Of Purchasing Water Vs. RO Vs. Coagulation/Filtration**




Option 1: Purchase Water from MWD
Option 2: Reverse Osmosis System
Option 3: Greensand Filtration Plant
Option 4: Customized Media Filtration Plant

customized media pressure filtration system costs 60% more than a greensand system to install; however, the smaller tankage, smaller footprint, and far lower operating costs will save almost $2 million over the 20 year period versus the lowest price competitor — a 12.5% savings on the district's $14.5 million investment. ■


### Citations

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Historical Inflation Data – Source: Historical Inflation (Inflationdata.com, Jan 2012)


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# Maximizing Your ROI On Test Equipment

How Choosing The Right Instrument Affects Performance And Your Bottom Line

by Heather Reskalske

In today's economic climate, it's tempting to want to buy the cheapest test equipment you can now. But, how can you tell what the true cost of test equipment is? You have to consider how widely your water and chemical consumption will vary as the readings on your instrumentation does. And, if you're using that instrumentation as part of your system maintenance or equipment calibration, inaccurate readings can crescendo into system failures over time.

Even given the same specifications, not all instruments are equal. How can you tell which instrument to choose? Even when you choose the best instrument for your application, how can you get accurate repeatable readings? This article addresses design and use issues that affect the accuracy of one of the most significant process control parameters: dissolved solids, as measured by conductivity, resistivity, and TDS measurements. The goal is to help you choose the right instrument for your application, use it correctly, and get an immediate payoff for your investment in quality.

## Dissolved Solids Instrumentation Design

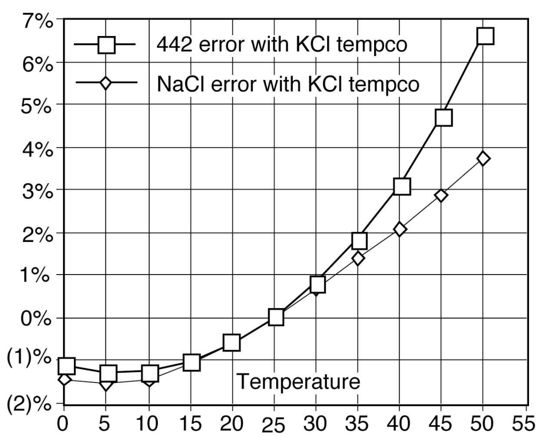
Several design features affect the accuracy and repeatability of a dissolved solids instrument: the conductivity cell and circuit design and the algorithms used for temperature compensation and TDS conversion. So, it's important to know about your instrument's cell construction and how the temperature compensation and TDS conversion are made. You also need to be aware of the range of characteristics and concentrations of the solution the instrument will be testing.

## Conductivity

A conductivity measurement can give you a good indication of the concentration of dissolved solids in solution because any chemical constituent that carries a charge, or ion, can conduct an electric current, and how well or poorly it conducts electricity is a property specific to that constituent. (Pure water is a very poor conductor of electricity.) So the current measured is a representation of the types and concentrations of ionized particles in solution. In water quality applications, conductivity is reported in units of micro/millisiemens (μ/mS). Choose an instrument that holds its accuracy in the conductivity range of the solution you plan to test, considering daily and seasonal fluctuations.

The accuracy of a conductivity instrument is heavily dependent on the way it measures this current. The accuracy of this conductivity reading, in turn, affects the accuracy of other measurements derived from it, such as resistivity and TDS. Choose an instrument manufactured with high quality materials designed to withstand the conditions to which it will be subjected.

**Figure 1: Example error from wrong solution selection**




The graph illustrates the error that would result from selecting KCl for a solution that should be compensated as NaCl or as 442 in the range of 1000 $\mu$S.

Most instruments measure conductivity by applying a potential across two electrodes and measuring the current. The cell must be designed to minimize such factors as polarization caused by the accumulation of ions near the electrodes. Some instruments attempt to resolve polarization issues by coating electrodes with platinum black to increase surface area, thereby increasing current density. But, platinum black can be scratched. Don't use a platinized cell if you will be testing viscous samples and suspensions that can remove the coating. Also, the cell constant drifts faster, requiring frequent calibration.

A high quality, lower-maintenance option for reducing the influence of polarization resistance is a 4-wire cell. The 4-wire cell measures the current where it is very small — as it passes between the inner two electrodes, which are close together. Less accurate instruments use a 2-wire cell that measures resistivity by passing an electric current through a solution then determining the difference in voltage between the two electrodes. A less accurate reading is made because the resistivity of the solution AND the resistivity of the electrode are measured due to polarization of the electrodes and the field effect.

The stability of the circuitry is an important factor in extreme accuracy. A feedback mechanism that compensates for any nonlinear correlation between the current applied and the conductance of the sample will offset polarization effects and electrode fouling.

Most conductivity instruments include a temperature compensation feature to account for the profound effects of temperature on the activity of ions. Compensation is made to some standard, generally 25ºC, to create a basis for comparison when solution temperature fluctuates. Temperature affects the conductivity of particular chemical constituents in solution in a nonlinear fashion. This is compounded by the fact that each chemical constituent responds to temperature changes in varying degrees, affecting the total conductivity of the solution disproportionately.

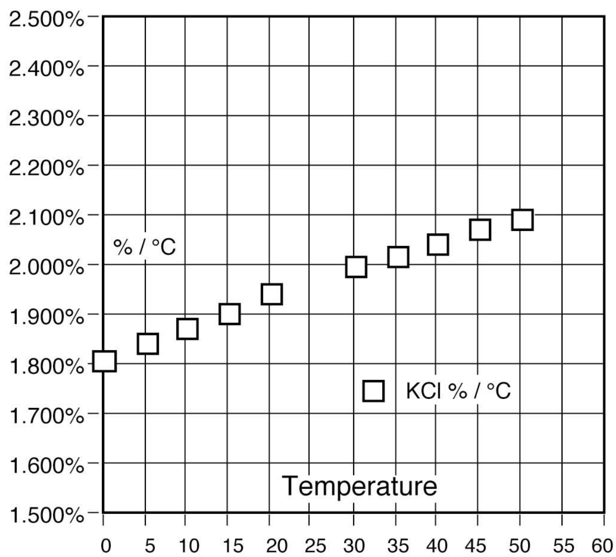
To account for solution type characteristics, choose an instrument standardized to a solution type that closely matches the solution you are trying to measure. If measurements of the solution have historically been made using another standard, KCl, for example, choose an instrument calibrated to that standard to determine relative changes in concentration. Users dealing with seawater, however, achieve the best results using NaCl. Users dealing with freshwater should consider choosing 442™. (*442 is a proprietary formula originally developed by the Myron L Company to model fresh water. It contains the three predominant components of natural water: sulfates, carbonates and chlorides. 442 is formulated with these anions in naturally occurring proportions.*) If you are going to use the same instrument in diverse applications, choose one that gives you the flexibility to choose from multiple solution types. Using an instrument standardized to the wrong solution type results in increased error or reduced accuracy because the incorrect temperature compensation algorithm is applied (*see Figure 1 on the prior page*).

The accuracy of temperature-compensated readings is also dependent on how well the instrument's temperature conversion algorithms model the behavior of the solution at varying temperatures. Lower quality instruments use a generic temperature compensation slope, for example 2%/ºC for naturally occurring water, that assumes changes in conductivity are directly proportional to changes in temperature. This is actually true only for a very narrow range of temperatures. Choose an instrument that uses corrections that change with concentration and temperature instead of single average values (*see Figure 2 on the next page*).

Choose an instrument that allows you to enter a user-defined temperature compensation based on actual testing if you are working with a known solution. This requires knowing the precise proportioning of chemical constituents in solution and bench testing for variations with temperature. Though this may be the most accurate method if you have a unique solution type, it is not always the most practical.

For calibration, choose a solution standard that matches the instrument's selected standard and has a concentration that falls somewhere in the upper two-thirds of the test solution range.

**Figure 2: Example temperature compensation**




The KCl values used for temperature compensation for this instrument vary correctly with temperature, in a nonlinear fashion.

### Resistivity

If the water has a very low current, it also has a high resistance. In this case, choose an instrument that measures resistivity to get the best resolution and meaningful data. You can determine the resistivity yourself by taking the inverse of the conductivity, but many instruments that measure conductivity will convert that reading to resistivity for you. In this case, the accuracy of the resistivity measurement is dependent on the accuracy of the conductivity measurement and the temperature compensation. Choose an instrument standardized to a solution that most closely matches your application and calibrate to a standard in the upper 2/3 of the range in which measurements will be taken.

### Total Dissolved Solids

Conductivity instruments cannot measure particles dissolved in solution that do not conduct electricity. Conductivity is not a good way to determine the concentration of dissolved organic compounds, for example. But in most cases, where there is high inorganic salt concentration, conductivity can be used to determine dissolved solids with a high level of accuracy.

A TDS instrument uses compensated conductivity measurements, taking into account solution type to determine the actual amount of dissolved solids in solution or Total Dissolved Solids (TDS). The measurement is reported as parts per million or parts per thousand, generally. Proper solution modeling is critical to accurate TDS readings, as well as the accuracy of the original conductivity reading. Again, this is because each kind of chemical constituent conducts electricity to varying degrees and will affect the total conductivity disproportionately with variations in temperature. Select and calibrate a TDS meter by the solution standard that most closely matches the application in which the TDS measurement will be made. A meter that has a conductivity-to-TDS conversion algorithm that accounts for critical points in changes of the behavior of the solution based on actual testing is more accurate. Ask the manufacturer about the conversion algorithms if you are unsure. A TDS meter that allows you to specify a custom solution TDS conversion based on your own testing will yield the greatest accuracy in situations where the characteristics of the sample are known. Some manufacturers will make calibration solutions to order. Calibrate with a solution in the upper two-thirds of the range of concentrations that will be measured.

### Routine Calibration And Maintenance

Choose an instrument that can stand up to the conditions to which it will be subjected. Familiarize yourself with the operation and maintenance of your instrument. Clean your conductivity cell and calibrate conductivity, resistivity, and TDS parameters to the proper standard solutions per your operation manual. Inspect the instrument for wear and tear and store it properly to prevent unnecessary damage.

Finally, an instrument is only as good as its user. The dissolved solids meter is designed to tell you how much of a known substance is in the water, not what is in the water. A dissolved solids meter will not identify specific ions, only the concentration of ions, generally. You must know what chemical constituents exist in what concentrations in the solution to be tested and choose an instrument standardized to that solution type with accuracy specs that match the range of possible measurements. This means that, ultimately, the accuracy of the instrument depends on you.

### Saving Time And Money

The more accurate your process control measurements are, the fewer chemicals and solutions you'll have to use generally. And, using fewer chemicals means reduced costs in chemical removal. When optimizing cycles of concentration, accurate monitoring could mean increasing the number of cycles until the solution has to be dumped, drastically reducing water consumption. Imprecisely calibrating and spot checking/monitoring with cheap instrumentation is going to cost you in increased chemicals, cycles, and downtime or even eventual equipment failure. So, purchasing a quality instrument up front will pay for itself almost immediately, whereas getting that cheap low quality one may cost you for a long time. ■

*Heather Rekalske is a technical writer for the Myron L Company, a provider of a broad spectrum of water quality instrumentation, including monitor/controllers as well as precision digital and analog handheld meters.*

# Do You Think You're Out Of Money? Think Again

Six Steps To Reducing Your Maintenance And Operations Budget

by Grant Van Hemert

Let's look back to the "good old days" when the ARRA pumped four years' worth of funding into a single calendar year. Some municipalities got long sought after projects funded, but the good times have ended, and many municipalities have a list of projects with no means to fund them. To make matters tougher, reduced tax revenues are forcing some municipalities to cut back on operations expenses.

The good news is that many municipalities have the funds, but don't realize it. Many times, these funds exist in the maintenance and operating budgets. It just takes a little creative thinking to utilize the money. Here are six suggestions for how utilities can achieve their goals by managing their maintenance and operations budget.

**Many options exist to improve facilities without relying on the traditional method of creating a project and securing a loan.**

## ENERGY PROCUREMENT

In the cyber world, social networking is all the rage. Many websites such as MySpace, Facebook, and LinkedIn are vehicles that enable this type of networking. Companies pay attention to the power of these social networks and adapt accordingly. So we must ask: can networking save money on a municipality's energy bill? In a nutshell, this is how energy procurement works.

By itself, a municipality may not have the tools, expertise, or usage clout to negotiate for a better rate from the power utilities, this is especially true of small utilities, however a municipality can hire an energy procurement company (EPC). An EPC, will combine your energy usage into a network with other users. This large network of users can then be used to negotiate lower rates for everyone.

For instance, a municipality alone may represent a 1,000 kWh of business to a power utility, however if the municipality uses an EPC, then the EPC may represent 350,000 kWh of business. If you were the power utility, who would you listen to for rate negotiating?

EPCs can do more than just negotiate rates, they also look at the terms of the energy contracts, market dynamics, and contract terms. Furthermore, quality EPCs will look at errors in your bills, demand response, and other opportunities to identify wasted energy, and or wasted billing.

So how does an EPC work? Simple, the EPC reviews your past energy invoices to identify current energy purchasing options and issues a request for proposal (RFP) to the municipality to purchase energy.

After the municipality indicates a willingness to participate in an RFP, the EPC sends the energy load to the supplier community. Once the responses are obtained from all sources of energy, an EPC energy consulting expert review all responses and recommend the best option for your company based on key factors such as pricing, contract terms, product structures, and credit conditions. Finally, once a municipality selects a source of energy, a high-quality EPC will handle the transactional process and complete all relevant legal documentation — achieving savings with little involvement from the municipality.

## PERFORMANCE CONTRACTING

Performance contracting is an alternate method of financing projects, using anticipated savings to finance a project. Here is how it works.

An energy services company (ESCO) does an analysis to identify and quantify potential savings. The savings can come from energy, chemical, or

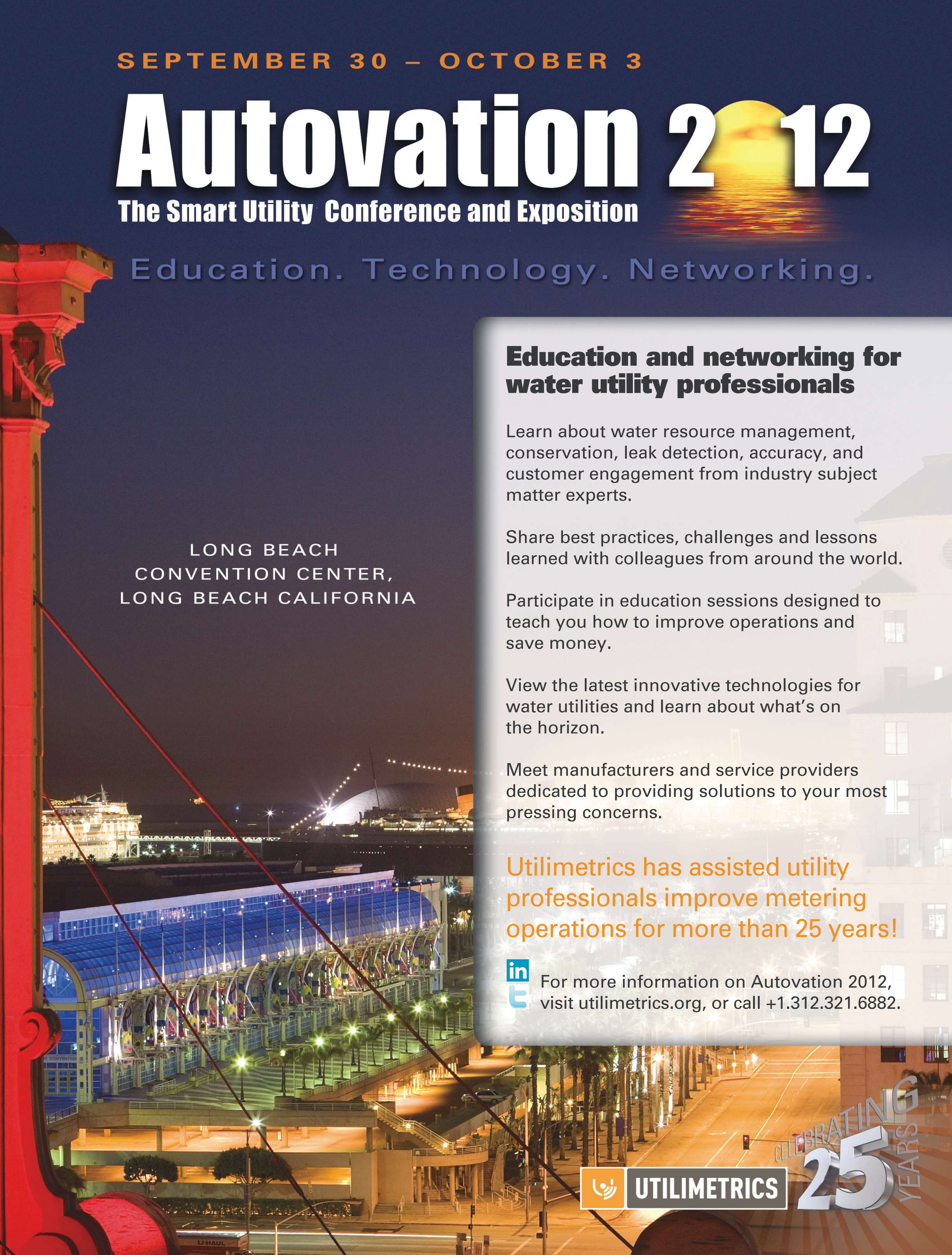

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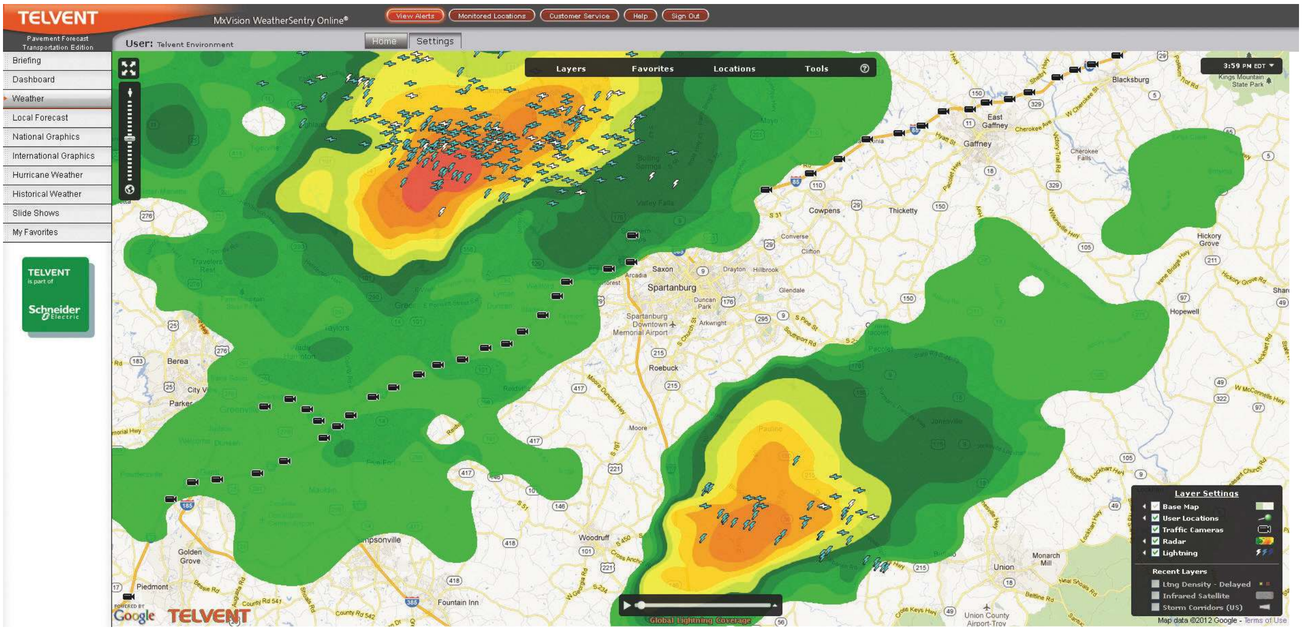
Figure 1



Real-time Televent weather service map of Spartenburg, SC, on April 5, 2012.

other means. Once this savings is determined, costs of retrofit are calculated. Once the retrofit costs are calculated, then this is compared to a portion of the anticipated savings. If the comparison is within the proper range, then the ESCO will secure a loan for the project and proceed with construction. Once the new system is in place, and savings are being realized, then the municipality pays the ESCO a portion of the savings until the loan is satisfied. Since the payment is realized from saving, the municipality's total budget is the same as before the project.

The question arises as to what happens if the expected savings are not realized. In this situation, a quality ESCO will pay the municipality the difference between the real and anticipated energy savings. Thus for a municipality, this is a no-cost solution with a guaranteed pay check if the savings do not materialize.

## WEATHER FORECASTING

In an article focused on reexamining how money is spent in a municipality, it might seem strange to mention weather forecasting; however, this is not your average weather forecasting. It is very specific up-to-the-minute oriented forecasting. Let's look at some examples.

Some combined sewer overflow (CSO) applications have a solids removal mechanism, such as a sand filter or plate settler. These systems may use power and or chemicals; therefore, there is a cost associated with running the system. Let's say the system takes about ten minutes to start running. With a general weather forecast you may be told that a storm is coming in the afternoon, so you may start the system at noon, but with a detailed forecast, you can monitor the storm as it comes in. For instance, the tool may show the storms arrival around 4:12 p.m., prompting you start the system at 4:00 p.m. If you start at 4:00 p.m. instead of noon, then you have just saved four hours of operating costs.

In another example, advanced weather can save money through lightning mapping. If a facility is damaged by lightning, an insurance company may want proof that lightning was the cause. If you have this service, you will see when, where, and how strong the lightning strike was. This event can then be matched with SCADA alarms showing loss of communication and/or power that occurred about the same time. Without this service, positive proof may not be possible, and the claim may be denied. If this occurs, then the municipality must pay for the repairs out of its budget.

A final example references a real-time picture of Spartenburg, South Carolina (*see Figure 1 above*). For illustration sake, let's say the water department is working to locate a leak near the airport. This map shows that the worst weather, and all the associated lighting, is going both north and south of the work crew. Furthermore, traffic cameras along I-85 can be consulted to provide a visual view of the weather to the west. Based on this information, the city might decide to keep its crew deployed even though the crew may be able to hear thunder. By keeping the crew deployed, the city eliminates the cost of redeployment, and minimizes the losses from the leak since it can be located and fixed faster.

> **Devices put in when the facility was new may not be providing the proper [power factor] correction, and a municipality may be overpaying for its energy and not be aware of it.**

### PUMPING APPLICATIONS

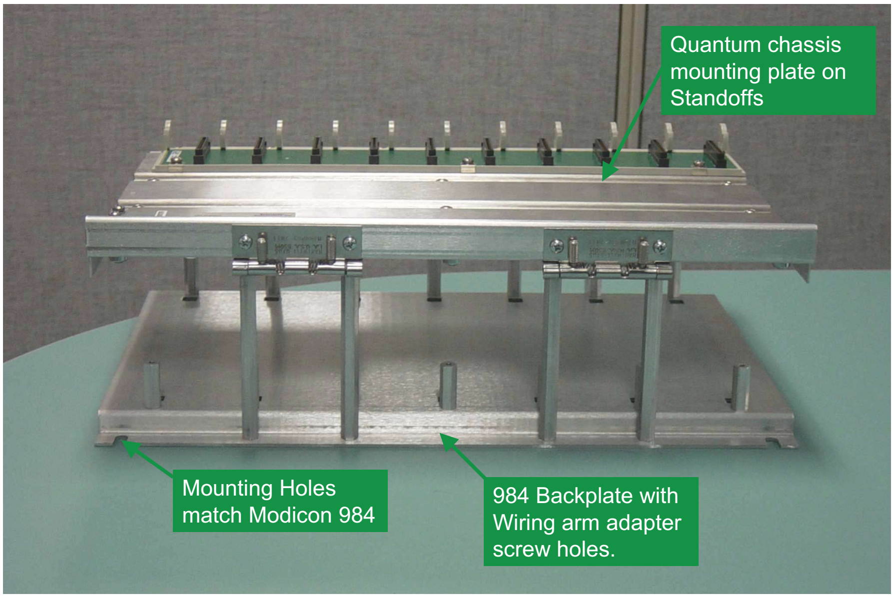
Many articles have been written about saving energy in pumping applications by using a variable frequency drive (VFD) on variable flow applications. These articles quote the affinity laws and talk about how pressure drops by the cube for any change in flow.

But most applications are constant speed. In these applications, pumps are staged on to provide step changes in flow. What can be done to reduce energy in these applications?

Believe it or not, the VFD can be used here. Most VFD's can be programmed to go to a set speed when a start command is received allowing you to have the drive go to a fixed reduced speed and save energy.

How does this work? As previously mentioned, the

Figure 2




affinity laws will change the power by the cube for a given change in speed; however, the pressure changes by the square, and the flow changes proportionally. If we want to save 10% of energy in a constant speed pump, we need to figure out what speed will be needed, and how that affects our pressure and flow. It turns out that an approximate 10% reduction is obtained when a 60-hertz motor is reduced to 58-hertz. This results in about a 6.5% drop in pressure and a 3.3% drop in flow. When we consider that most pumps are oversized, this minor reduction in speed and pressure can be accommodated by many systems.

Are there other benefits to using a VFD in a constant speed system? Yes, these include reduced mechanical stress, and thus less maintenance. This reduction also helps to relieve pressure on the maintenance budget.

## POWER AND AUTOMATION EQUIPMENT LIFE EXTENSION

A good bit of capital is tied up in the power and automation equipment within a municipality. Over time, this equipment will need to be replaced; however, buying new can cost a substantial amount of money, and even more must be spent on labor to remove the existing equipment and installing the new systems. This does not include any additional resources that may be required for temporary systems during removal and installation of this equipment.

A better way exists. For automation systems, you can look at systems that fit into existing panels. Sometimes, the replacement system has adapters that can fit into the bolt holes of the existing hardware, and adapters that will allow the existing wiring arms to be attached to the new input/output (I/O) cards. An example of this is the Schneider Electric 984 to Quantum™ conversion kit shown in *Figure 2*. This method keeps the existing panel wiring intact and prevents errors from rewiring existing panels. It also removes the need to do complete panel replacements.

Sometimes the migration can be staged. For instance, the processor can be changed to a newer model, and then the I/O cards changed later, allowing municipalities to extend the migration overtime and accomplish it within the limits of the maintenance budget.

Replacement of existing switchgear and motor control centers can be expensive, and the hidden challenge of moving or rewiring field wiring and relocating conduit stubs is often overlooked. Sometimes this can mean removal of concrete. Replacement of power equipment takes a long time, and in a water and wastewater facility, some means must be found to keep the systems up and running while the replacement occurs. Obviously, it would be beneficial to be able to upgrade these older systems to newer systems without having to remove and replace old equipment. Fortunately this can be done. Service teams can upgrade their own systems, and those systems manufactured by other companies. This can be done on current and discontinued systems. Conversion can occur slowly, and in stages; therefore, if a pump is off line for maintenance, it might be the perfect opportunity to replace the MCC bucket with a newer model. Like its automation counterparts, this migration method oftentimes can be accomplished slowly and

**Figure 3**

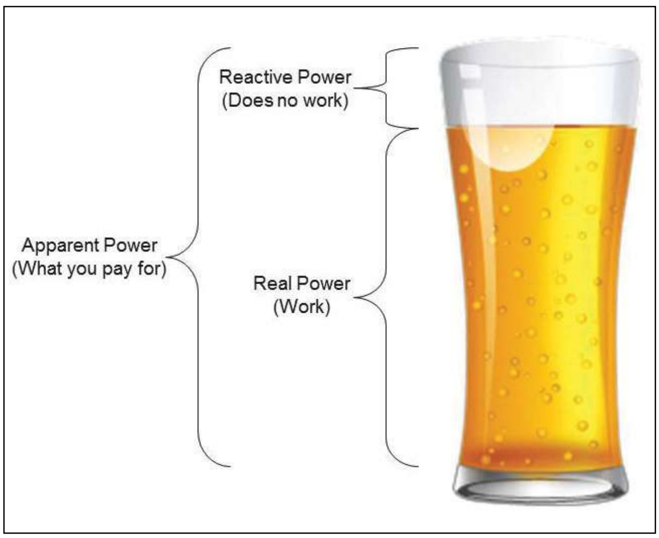



Illustration of how power is used and paid for.

**Many municipalities have the funds, but don't realize it. These funds exist in the maintenance and operating budgets. It just takes a little creative thinking to utilize the money.**

within the confines of the maintenance budget.

### POWER FACTOR CORRECTION

Hopefully you are aware that AC power comes in three varieties. But if not, let's review this without getting too technical in regard to terms. To help explain this, let's compare these three types of power to a full beer glass. In this analogy the power company is the beer vendor. Let's assume the beer vendor charges based on the volume of the glass, but the glass is filled with foam and actual beer (*see Figure 3 on the prior page*).

In our analogy, the consumer wants the most beer with very little foam. In power, the beer is a type of power that is used by lights, pumps, etc. The foam is a type of power that cannot be used by the devices in a facility. Unfortunately, pumps and motors tend to create a lot of "foam". So, how can we minimize the "foam" load?

This is where power factor correction comes in. Equipment placed at the front of the facility can convert this "foam" into good quality "beer". With the foam minimized, the total volume of the glass is reduced, and the power company believes less power has been consumed, and therefore the bill drops.

Power factor is often looked at when a facility is constructed; however, as the load changes over the years, this may be overlooked. Devices put in when the facility was new, may be not providing the proper correction, and a municipality may be overpaying for its energy and not be aware of it.

We have seen that many options exist to improve facilities without relying on the traditional method of creating a project and securing a loan. There are many other examples out there — all it takes is creative thinking and a bit of exploration to find the best options for your municipality. Many utilities are not as restricted as they may think, which is good news in today's environment of limited funds and unpredictable energy costs. ■

*Grant Van Hemert P.E. analyzes trends, and existing technology, to find solutions and educate the marketplace via articles, case studies, presentations, and professional committee leadership. Since 2005, Van Hemert has been providing this expertise to Schneider Electric's Water and Wastewater Competency Center. Mr. Van Hemert's experience in water and wastewater dates to 1995.*

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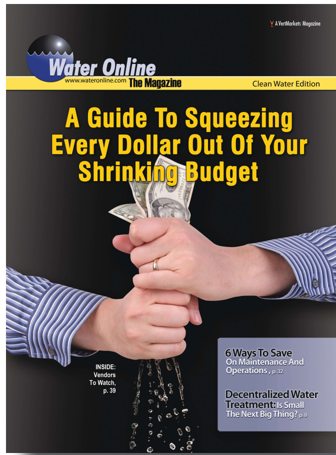


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While saving money in the present is important, we must also understand that the current predicament — utilities strapped with underfunded, failing infrastructure — did not happen overnight. The need for foresight and investment was a hard lesson learned, and one that now needs to be heeded. As population and water consumption rates increase, and federal regulations get ever-tighter, the pressure on municipalities will only increase as well. It is our hope that through the shared experiences and solutions in this year's clean water edition of *Water Online The Magazine*, you can better prepare to navigate the rocky terrain of the modern water landscape ...

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