Water Management

A New Opportunity for Energy Managers

John J. McGowan, CEM
Vice President of Marketing
Hydroscope-USA

Managers in the energy business have demonstrated amazing versatility over the last two plus decades. As the immediate impact of the energy crisis waned, new ways were found to justify energy management efforts through financial analysis. Sound reasoning was also developed by creative energy managers to present the far-reaching benefits to an organization's mission from energy management. The field, already demanding tremendous breadth of skill with multiple disciplines of engineering, finance and creative implementations such as performance contracting, continued to respond to challenges.

Energy managers have often been those creative and capable individuals in any organizations that took on new challenges, such as ensuring compliance with environmental regulations. The complexities associated with deregulation have further expanded the energy manager's role to also include procurement initially for gas and now for electricity.

With all the changes and complexities that energy managers have addressed in the past, a question for speculation is what crisis will challenge these professionals in the next millennium? The author believes that the greatest challenge of the next millennium will be *water.*

Is there a scarcity or crisis regarding this simple resource? In fact a major crisis does exist with regard to water. There is a critical and growing need to save water, as we have seen throughout the United States and the world. Only 3% of the Earth's water is fresh and it is essential for human life. The importance of the issue may be seen in the fact that the Federal Energy Management Program, and the President's Executive Order on reducing consumption, now include mandates for water savings.

Another important trend is the significant activity underway in the utility industry, where consolidation of electricity, natural gas and water services is common. Stories in the business press are also pointing to consolidations in Europe that include combination of utilities by companies that are offering complete facilities services for a fee, including water. Bear in mind that chauffage, the offering that spawned performance contracting, was born in Europe as a way for owners to purchase a complete package of services including comfort and access to electricity and water.

The term "WESCO" (Water and Energy Service Company) is likely to become common worldwide over the next decade. A December story in the *Wall Street Journal* reported that Enron Corporation has launched a Water Services Business, and drafted a manager from the Energy Services business to run it. All these factors show that energy managers can use the same requisite skills to address water issues, but what are the issues?

The need to preserve water as a resource is certainly important and, as with any resource that is metered and purchased, there are opportunities to reduce consumption and save money. In fact with water service reductions there are accompanying sewer charge savings as well. These savings can be significant, a recent university performance contract the author worked on generated $1.5 million in water savings alone over the 10 year term.

Of special interest with water, as with electricity, is that the resource can be viewed from both the supply side and demand side. Demand side measures that offer savings are quickly being adopted by energy managers, because they are very similar to energy measures. Consider the similarity in these measures: replace a 100 watt incandescent lamp with an 18 watt compact fluorescent or replace a 3.5 gallon per flush toilet with a 1.5 gallon per flush toilet. These measures are so easily understood that this article will not dwell on them, but rather take a look at the supply side of a water system and the challenges that are faced there. These challenges face water system managers whether they work for a university, municipality or industrial complex.

WATER SYSTEM OPERATIONS AND CHALLENGES

Acquiring and distributing water to system users involves ever increasing cost, and presents significant challenges in making operating

and capital budgets meet current needs. At issue is the difficulty associated with managing a business that sells a scarce resource, but is severely limited in its ability to raise prices to cover overhead, grow the business and deal with the condition of existing facilities.

Water System Managers face a daunting challenge making operating and capital budgets meet current needs without implementing regular rate increases. Ratepayers do not want increases, and taxpayers are becoming more reluctant to pass bond issues, which adds to fiscal concerns. Another concern, along with diminishing budgets, is that studies published in recent years address the condition and age of water, building and highway infrastructure.

This article focuses on what is perhaps the most critical topic facing the United States, as well as the world today: *aging water infrastructures*. What makes water distribution even more challenging, in this climate of fiscal austerity, is that it will require $138 billion in funding to address city infrastructure needs over the next 20 years (4). This figure is daunting, but it will only deal with the challenges we know about today! This figure dwarfs many of the estimates for deferred maintenance in buildings and clearly indicates the need for energy manager talent.

The negative impact of aged infrastructure, among other critical issues, is what the American Water Works Association term's non-visible leaks (1). These are not simple drips however; the U.S. Department of Energy estimates that losses from leaks and breaks range between 15 and 25 % of system use (2). The American Water Works Association published an estimate of water line leaks in the State of California of 250,000 acre feet (325,000 gallons per acre foot) of water. At $150 per acre-foot, the very low value of water in California's Central Valley, this much water would be valued at $37,500,000 (3) per year, though many would consider it a priceless resource to waste (3).

When you talk to system owners today they seem faced with a tremendous question: how to do more with less and still offer the services that customers expect and want? Even more challenging is how to keep track of escalating costs in the operating budget and not eliminate services. The next major challenge is how to address capital needs, and that is where the water infrastructure issue must be solved. The water infrastructure issue complicates this problem, because the need for funding is immediate. This isn't a brick and mortar project that can be put off until next year; it is a water main providing one of the most essential

facility services, and it can fail at a moment's notice.

In fact it isn't a "moment's notice." The problem has been gradually worsening since 1950 or so, but since it was underground, out of sign and out of mind, the "moment" passed without notice. This entire discussion assumes there is a simple solution—more money!

Again, experience gained by energy managers is essential. Justifying projects based upon cost reductions will be an essential tool for water managers in the future. Equally important will be the availability of creative financing approaches and performance contracting.

ALTERNATIVES AND SOLUTIONS

Implementing guaranteed savings contracts for water system supply-side projects, is not without challenges. Some traditional savings methodologies are difficult to apply on the water supply side, which comprises all the equipment required to acquire and distribute water. Acquisition is from fresh water sources like rivers, but many systems also drill wells and pump water from the ground. Pumping is predominantly done with electric motors, and one medium size western city where the author has worked has an annual electric bill for motors of $7 million.

As with the facilities that energy managers are familiar, systems control is necessary and in this case done by "System Control and Data Acquisition" (SCADA) equipment. SCADAs are able to start and stop all pumping equipment and can be programmed to take advantage of electric rates for on and off peak. The water is typically pumped to purification facilities and storage reservoirs or tanks; it is then available to meet demand. Based upon the amount of storage available, on-peak pumping may be required.

The opportunities for plant efficiency programs will already be evident to any energy manage. The motor opportunity has spurred DOE's Motor Challenge to co-sponsor an Energy Efficiency Forum with *WaterWorld Magazine* (the water industry EUN) which was held in August in San Diego.

The water system challenges discussed thus far are "plant" oriented, and can be addressed easily by efficiency programs thus saving water, energy and money. The real challenge comes in addressing the

water distribution system.

Water distribution systems, whether in a city or on a university campus, share a common problem: they can not be observed, audited or measured. These systems are made up of water lines that are predominantly cast iron, ductile iron, steel, PVC or concrete. There are 970,000 miles of these lines in North America, and the largest percentage and greatest problems are with cast iron and ductile iron lines.

The major portion of the $138 billion addressed above, $77 billion, is needed to deal with water lines that are at or beyond their useful life. The expected useful life of these types of line is around 40 years, and given the age of lines all over the country there is a major deferred maintenance problem.

Conventional wisdom, in the water industry, is to address this issue by replacing lines as needed. Typically elaborate mathematical models are developed that identify where water line breaks have occurred. These models are used to track proximity and frequency of water line breaks, and the associated street cave-ins, etc. Based upon that data water lines are scheduled for replacement. Each year miles of water lines are dug up and replaced at significant cost, only to find out that a majority of the lines replaced would have been fully serviceable for decades to come.

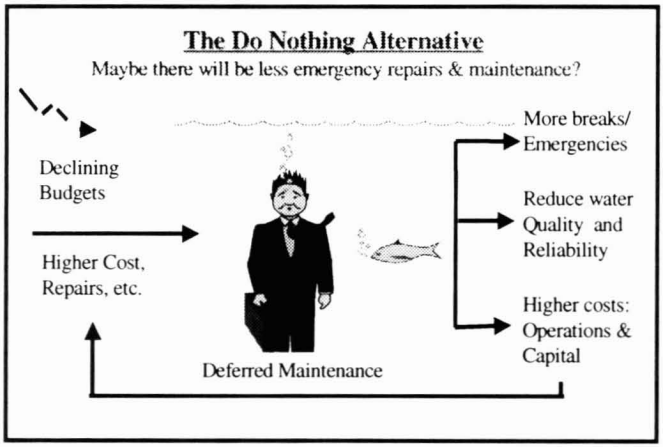
Perhaps the most exciting new technology in the industry today came with the development of a remote field eddy current (RFEC) based hardware for use in water lines. Many in the HVAC industry are familiar with the use of eddy current to determine the integrity of boiler and chiller tubes. A recent technological breakthrough allows use of an RFEC hardware and software product combination. This technology, called Hydroscope© can provide a real viable solution for water distribution, *...and it can be guaranteed.*

Hydroscope® offers an opportunity to conserve water and reduce costs in the distribution system, and is unique in the industry because it is a technology company. Unlike WESCO's, the company does not complete either engineering design or retrofit. Instead the company teams with engineering consultants and traditional ESCOs, or allows the customer to put these portions of the project out to bid. Equally critical is that managing water line assets, and preserving line integrity through *"intelligent restoration,"* ensures access to safe water. The Safe Drinking Water Act mandates water quality standards, yet these are nearly impos-

sible to meet with aged distribution infrastructures that leak, and introduces contaminants, through the same through holes.

In spite of these issues, water system managers can succeed in increasing services by proactively addressing system infrastructure. With new technology cities can address water, energy, operations and capital costs, and get some unexpected benefits.

WHERE ARE YOU NOW?



This chart shows the situation that most cities find themselves in with a "deferred maintenance"— or "do-nothing" alternative. With declining budgets, maintenance is deferred and the result is more emergency repairs, declining water quality and reliability and high cost. These issues are critical for the system, but also can have dramatic impacts on the community. Reliable water supply, for example, is essential for the local economy, but the larger concern is that without it there is not adequate fire suppression.

As with energy management, it is often hard for cities to assess their current situation and define system opportunities. Assessment takes three steps:

1. Conduct a water audit and rethink operating expenses,
2. rethink capital improvement planning (CIP) for water, and
3. complete a technology based condition assessment.

Conduct a Water Audit; Rethink Operating Expenses

Water managers need to measure *"water intensity"* and *"energy intensity"* of systems. It is critical to identify and measure cost components such as emergency line break repairs, water treatment, water asset value, energy for pumping, the impact of point breaks on road repair, and potential fines for non-compliance with federal regulations. Evaluating costs like these, and how they vary from one section of your system to another, is the first step to continuously improving the cost of service, and ultimately customer service.

Rethink Capital Improvement Planning (CIP) for Water

Measuring intensity information will make it possible to evaluate which portions of the system hold the greatest potential for cost reductions. It is also possible to rank the best investments to make within the system, and to effectively plan capital projects rather than guess in the dark. Results can be dramatic considering that water costs make up 10% or more of the total operating costs in a city.

Technology-based Condition Assessment

Developing meaningful benchmarks and using them in planning is a valuable process. This step demands evaluation of every type of technology that can improve system efficiency. Meaningful benchmarks must be developed to measure the most cost effective alternatives, and then determine priority based upon how well each alternative supports the mission of the organization. New technologies such as Hydroscope® must be evaluated and should be implemented via guaranteed savings programs.

FINANCING

The final question is always, how do we pay for it? Opportunities that have been identified for both plant and distribution components of the system, may be funded in many ways. The best return on investment always comes when managers can pay for projects now from existing budgets, because it eliminates a cost of money. However, no one has $77 billion available to pay for water line needs.

Energy managers are familiar with various types of leases and loans. They also know that for technologies that can be guaranteed or when funding is scarce, performance contracting offers a desirable alternative.

SUMMARY

Clearly, the issues discussed point to significant potential for an impending water crisis. This crisis will be impacted by both water scarcity, which is more critical in some states than others, and an aged infrastructure that suffers from long-term deferred maintenance. Armed with this information, water and energy managers may be positioned to deal with a new frontier, water and energy services. New technologies, along with the combined talents of both industries, will make it possible to proactively address water system needs through guaranteed savings.

ABOUT THE AUTHOR

John J. "Jack" McGowan, CEM, CLEP, CDSM, is an author and vice president of marketing with Hydroscope Inc., USA. He has worked in every capacity, from analysis through financing and implementation of wide ranging energy and water projects, as a manufacturer, end user and turnkey contractor. He was named 1997 "International Energy Professional of the Year" by the Association of Energy Engineers. He has published five books, and has taught seminars in the U.S. and Southeast Asia. McGowan served on the *Energy User News* Technical Advisory Board in 1992.

References

[1]American Water Works Association Manual 36, Water Audits and Leak Detection, American Water Works Association, Denver, Co. 1990, P. 34

[2]Proceedings of Water Resource Management Conference, U.S. Department of Energy, Federal Energy Management Program, Denver, Colorado August, 20 -21, 1996, P. 51

[3]American Water Works Association Manual 36, Water Audits and Leak Detection, American Water Works Association, Denver, Co. 1990, P. 34,—Water Value, Water Efficiency, The Water Program, Rocky Mountain Institute, Snowmass, CO. 1994

Hydroscope-USA, 1776 Montano Road NW, Albuquerque NM 87107-9874; 800-993-9629, fax 505-345-1896; johnjmcg@Hydroscope-USA.com