



Kingsport estimated that it was losing more than 1.2 million gal of water per year due to leaks and breaks.

DROP-BY-DROP water loss prevention

By Craig Hannah

*T*oday's economic demands are challenging all organizations to find ways to reduce operational expenditures. Many utilities are diligently seeking ways to conserve water and energy. Finding and repairing leaks and breaks in a water distribution system is a proven method to save both water and energy while reducing operational costs (e.g., the cost of chemicals used in the water treatment process). Smart water management can make the most of a valuable natural resource on each step of its journey—from the source, to the end-users and then back to the environment—while saving energy along the way.

Kingsport, Tenn., adopts comprehensive water loss optimization program

ARTICLE SUMMARY

Challenge: Leaks and breaks were causing the city of Kingsport, Tenn., to lose more than 1.2 million gal of water annually, wasting tax dollars and energy.

Solution: The city partnered with an energy services company, conducted a water audit and implemented leak detection and AMR solutions.

Conclusion: To date, Kingsport has prevented the loss of more than 600 gal per minute of water, plus energy and chemical savings totaling more than \$130,000. Significant additional benefits are guaranteed over the 17-year performance contract.

Located in the heart of northeast Tennessee's Tri-City region, the city of Kingsport has positioned itself on the cutting edge of energy-efficient initiatives as the state's first municipality to implement water infrastructure improvements using a performance contract.

In the spring of 2008, Kingsport partnered with energy services company Johnson Controls to implement systemwide improvements to its water utility. Among other things, this comprehensive water loss optimization program included both a mobile automated meter reading (AMR) system and an automated leak detection system that are helping the city contain costs while improving customer service.

At the time the contract was signed, the city estimated that it was losing more than 1.2 million gal of water per year due to leaks and breaks. This water loss was wasting taxpayer dollars and energy through the treatment and pumping processes. The city realized that it needed targeted solutions to reduce these losses. Johnson Controls began developing solutions by conducting an American Water Works Assn. (AWWA) water audit to benchmark the performance of the city's utility.

Water loss is classified in two ways: real losses and apparent losses. A real loss occurs whenever water physically escapes from the distribution system and never reaches the end-user. An apparent loss is caused by inaccurate accounting for water use; in this case, water reaches the end-user but the utility cannot properly account for it. Some of the most common causes for apparent losses include inaccurate water meters, improperly sized or typed water meters, errors in the billing system and inaccurate billing due to human error.

Leak Detection Prioritizes Repairs

The city worked with Johnson Controls to diminish its real water losses by implementing an automated leak detection system. Whenever there is a leak in a pressurized water line, some of the energy from the water is transformed into audible noise and some is transformed into a mechanical vibration that radiates through the pipe. Leak sensors, which are permanently mounted on the service line upstream of the water meter setter, record these vibration frequencies each night between 12:30 a.m. and 4:30 a.m., when water usage and ambient noise levels are



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at a minimum and system pressure is at a maximum.

The vibration frequency histories are stored within the leak sensor and then transmitted via radio frequency to a mobile collector. The city then uploads this data to a secured, customized website to be analyzed by leak detection specialists. Once the analysis is complete, the results are posted to a Web page that displays a map of the city, the status of each sensor and a prioritized list of probable leak sites. A red balloon on the map designates a probable leak site, a yellow balloon represents a possible leak and a green balloon indicates that no leak is present. The prioritized list can be exported as a spreadsheet so that work orders can be cut.

Leak repair crews are then dispatched to each probable leak site, where a correlator will be used

to locate the source of a leak to within about a 3-ft radius. The city confirms the results of the correlation by using a ground microphone.

Since Kingsport installed the new leak detection system, 55 line leaks and breaks have been identified, enabling repairs that now prevent the loss of more than 618 gal of water per minute. The annual water, energy and chemical savings to date exceed \$132,900.

AMR Eliminates Error

To minimize apparent losses, Johnson Controls replaced the city's inaccurate water meters with new meters that are connected to a mobile AMR system. Company engineers verified that the correct type of meter was installed at each service. The mobile AMR system virtually eliminates human error by allowing

city workers to read the water meters remotely from their vehicles. This helps to increase accuracy, improve efficiency and enhance overall customer service.

As part of the project, Johnson Controls provides a Business Review Services program to review the billing system data on a quarterly basis. The company also provides a dedicated performance assurance engineer to analyze data and identify accounts that appear to have abnormalities. This service helps the city keep its water utility in peak condition.

Savings Through Performance Contracting

Innovative financing options enabled the city to update its aging water system infrastructure in a self-funding, budget-neutral manner. The water loss management solutions are funded entirely by operational savings. Performance contracting allows the city to significantly improve infrastructure without dipping into reserve funds, raising taxes and fees or issuing revenue bonds. Over the course of the 17-year performance contract, the AMR and leak detection systems are expected to generate more than \$15 million in guaranteed benefits.

Kingsport is a model for other municipalities looking to reduce costs through water conservation. Drop by drop, water loss prevention can help cities realize tremendous savings and improved efficiency, especially as public budgets are stretched. It is an investment that will allow the city to reap long-term benefits for many years. Thanks to pioneering leadership in innovation, Kingsport is paving the way for municipalities across the U.S. to implement similar water solutions, while ensuring a more sustainable future through sound stewardship of its water resources. **WWD**

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