

# Metering and More

By Randy Shoemaker

## HOW LEESBURG, VA, SLASHED WATER LOSSES

I had to smile when I saw the EPA officially call “installation of water meters” a water efficiency measure recently. It was in a memo that clarified what the EPA considered green projects worthy of funding through the stimulus bill that passed in February.

At the Town of Leesburg Department of Utilities, we learned first-hand that modern versions of automatic meter reading (AMR) lead to greater efficiency and conservation. The lesson was clear to us in 2004, when our newly installed wireless, fixed-network metering system helped us cut our unaccounted-for water—the difference between water treated and water billed—from approximately 15% to 7%.

Fixed-network metering was part of a larger, multi-dimensional campaign that helped Leesburg reduce unaccounted-for water from a high of 23% to 3%. It was a smart conservation move that made the utility more accountable to our citizens, our customers, and our town leaders.

### Growth Brings Progress

In 2002, when the town decided to look at upgrading its metering system to the most advanced technology available, Leesburg’s 10,000 meters were being read, using a touch-read AMR system. This had proven to utility managers that metering automation was a reliable way to capture accurate and consistent readings. It eliminates human errors made when meter readers key numbers into handheld computers, and it reduced the estimated bills that occurred when readers couldn’t access meters in hard-to-reach locations, or when harsh weather made manual meter reading a challenge. Problems like those had previously led to increased customer dissatisfaction and compromised billing issues.

Still, it was time to look at upgrades. For years, Leesburg has experienced rapid growth. The town is located in Loudoun County,

VA, about 35 miles west of Washington, D.C., and in close proximity to Dulles International Airport. In 2004, Loudoun County was recognized by the US Census Bureau as the fastest-growing county with a population of greater than 100,000 in the nation. During the years of 2000 to 2005, we experienced an unprecedented 10%—per year increase in our water and sewer connections, which outpaced the prior decade, where our utility service nearly doubled in size.

One positive aspect of the tremendous growth was that we were able to accumulate a very large capital reserve from what we refer to as “availability fees,” and these funded many capital projects in the new millennium. Availability fees are charged to developers for purchase of capacity within our water and sewer systems, and they are based on a one-time charge of approximately \$10,000 for water and sewer availability for each single-family residence that connects to our utility. Furthermore, it has long been our utility’s policy to maintain our system with the best, most up-to-date, and proven technology we can find.

An example of this foresight includes the distinction of being the first municipal water and sewer utility in the Commonwealth of Virginia to have approved and constructed a dryer/pelletizer system to transform potentially dangerous wastewater sludge into a product that could be marketed and distributed without fear of creating an environmental health concern.

All photos: Actara Technologies of ESCO

# *Fixed-network metering was part of a larger, multidimensional campaign that helped Leesburg reduce unaccounted water from 23% to 3%.*

Our product, marketed as Tuscarora Landscaper's Choice, is given to customers at no charge, used on city parks and open spaces, as well as sold to farmers, golf courses or others who want to amend their soil. The program helps our utility protect the Potomac River and Chesapeake Bay by reducing the amount of nutrients that runs into these watersheds.

The Town of Leesburg also holds the distinction of being the first municipal wastewater facility in the Commonwealth to utilize ultraviolet disinfection for wastewater effluent.

In addition, we currently have both our water and wastewater infrastructure monitored by a Supervisory Control and Data Acquisition (SCADA) system. It provides online data acquisition and gives us the ability for supervisory control over remote equipment, such as water-booster stations and isolation controls on storage tanks.

In Leesburg, we have been fortunate. Through the growth of our system, we have had the resources to afford new technology, such as the SCADA system, pellitizer, disinfection alternatives, and wireless fixed-network AMR. We also have benefited from an elected governing body that recognizes the long-term benefit value of a technically adequate utility.

Along with our utility's preference for up-to-date technology, we serve a customer base that expects us to remain up-to-date. Loudoun County is a high-tech area with one of the highest median family incomes in the nation. Corporations with major facilities here include such noted leaders as AOL, Orbital Scientific, SAIC, Oracle, and Northrop Grumman. The customers who work at these companies are technologically adept and tend to be knowledgeable about the latest in automation and electronics.

So, in 2002, the town assigned a committee to study and evaluate various AMR systems for upgrade of our metering system from touch-read to a drive-by reading system. As the study progressed, the committee became knowledgeable on a diverse range of metering technologies, including the latest and most advanced technology available—wireless fixed-network AMR.

At the completion of their study, the committee determined that the STAR Network system—now an Aclara brand, but then from Hexagram Inc.—was the ultimate choice, as it exceeded the town's selection criteria and long-term objectives. A proposal was then accepted from VSI Group, operating as a prime contractor. VSI also was contractually partnered with Badger Meter Company on the project.



Data collectors for the STAR Network system are located on light poles and building roofs.

The STAR Network system was the newest AMR technology available at the time. Once we had an opportunity to study the system and learned the basics, we felt it would be a good fit for our tech-savvy citizens and our utility philosophy. We were, once again, one of the first municipal water companies in the Commonwealth to adopt this technology.

## **Sharpening Our Pencils**

As I mentioned earlier, the metering system was an integral part of a larger campaign to reduce water losses. Before starting the new-meter deployment, we addressed unaccounted-for water with a number of programs aimed at pinpointing how much water loss came from real estate development.

First, we implemented a fire hydrant metering program, whereby all contractors, including site developers, were required to rent hydrant meters from us and report readings quarterly for billing purposes. Prior to initiation of this program, contractors were allowed to use water on construction sites from the fire hydrants for free. Not only were we losing revenue, we had no way of knowing the amount of water used. Metering this consumption closed one of the major gaps in our unaccounted-for water. Of course, metering also makes water users more conservative when they're paying for the resource.

In conjunction with the hydrant metering program, we began requiring our field inspection staff to calculate and submit written reports on the amount of water used in flushing and filling new water lines.

We also, during this period, instituted a leak detection program on our major water lines. We contracted with an engineering firm to test portions of our water system at night, using acoustic equipment to monitor the lines and listen for changes in the sound frequency, which signifies a possible leak in the pipe.

These three initiatives—the hydrant-metering program, the new service-line site inspections, and the systemwide leak detection—were responsible for reducing our unaccounted-for water from more

than 23% to 12% between 1997 and 1999. Although we had reduced our unaccounted-for water by nearly 50%, we still felt the remaining 12% was excessive, even though a lot of jurisdictions operate with a greater loss factor.

That's the primary reason we began looking at our water meters. We suspected we were losing revenue due to metering inaccuracies, because many were more than 20 years old and thought to be under-registering either due to misapplication or malfunction. Several multi-family units were being served by turbine meters that were much larger than needed. Consequently, we decided to include meter change-out in our contract and to utilize the best meter-reading technology available.

### How Fixed-Network Metering Helps

The STAR Network AMR system from Aclara that we selected utilizes a meter-transmission unit (MTU) that sends a radio signal to a data-collection unit (DCU) twice per day, or as programmed, with up to 12 readings per hour. We elected to place the DCUs on top of public buildings, where possible, and we were able to provide coverage of the entire town with 14 devices. The MTUs are mounted in meter pits along with our meters.

To extend battery life, the transmissions are programmed to come back to the utility head-end system only twice a day, but they carry readings that can show us consumption every hour. The accuracy depends on the meter multiplier that, for a five-eighths-inch meter, is typically 10, or read to the nearest 10 gallons.

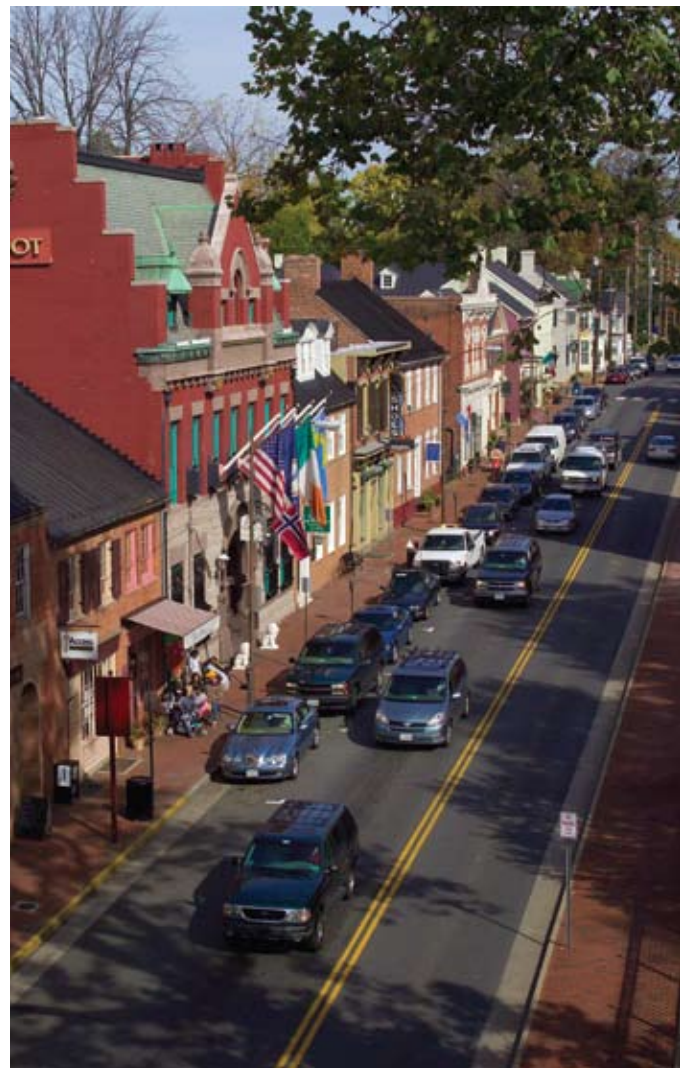
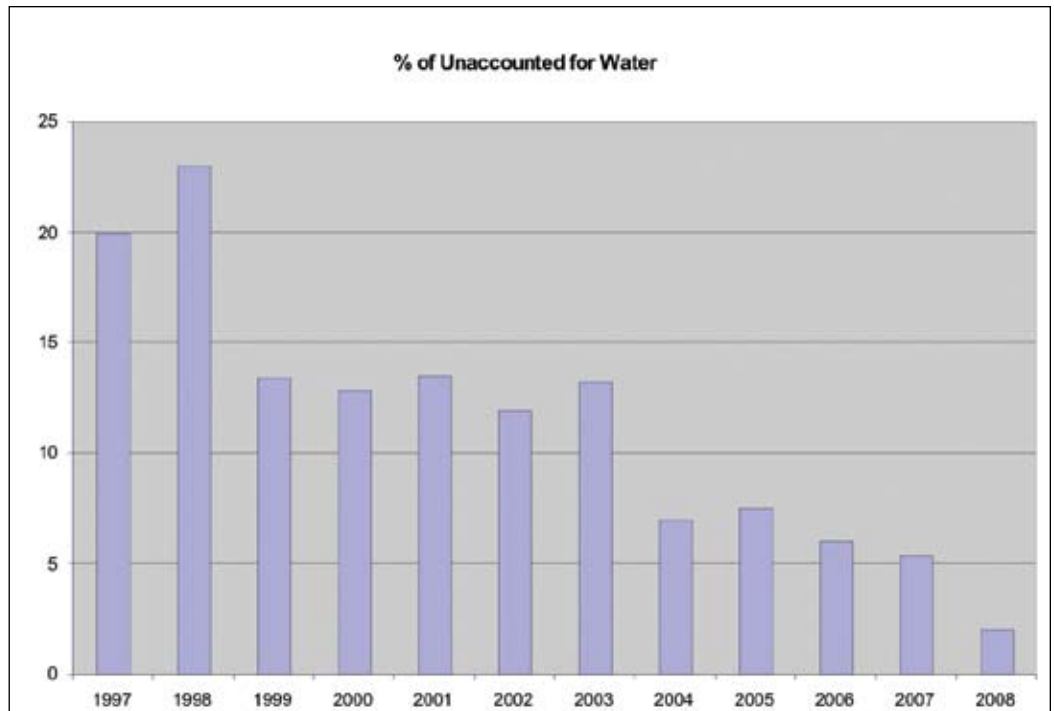
While installing MTUs at each customer's premises, we also upgraded the water meters for a very minimal additional cost. By doing so, we saw an immediate increase in revenue, indicating that we had been correct regarding the under-registration on the old meters. This enabled us to accelerate our cost recovery period.

Unaccounted-for water has continued to drop steadily since 2004, the year we installed the new meters and STAR Network system. The hourly data we are capable of retrieving from our Aclara system aids us in proactively notifying customers when there may be a leak on their side of the meter.

This is because the system generates a number of management reports, some of which alert us to readings that are abnormally high or low. Generally, there are so many high/low reports generated, we are unable to investigate each one. We also know we'll get a low-consumption alert if the resident is out of town or the property is vacant for resale or rental. However, the high-consumption alerts usually indicate a leak or excessive lawn watering, which is distinguishable by the use pattern that shows up with hourly readings.

When we receive a high-consumption notice, we will watch it for a few days. If it doesn't go away, we then examine the consumption record for that endpoint. The data can tell us what kind of leak probably exists.

For instance, if there is a service-line leak between the meter and the house, the pattern will indicate a continuous leak. With time, that



Leesburg has experienced an unprecedented increase in new water and sewer connections.

# *If you can cut your water loss to less than 5%, why aren't you doing it?*

leak will increase in volume, as the hole in the pipe grows larger. We usually can identify this happening.

Another identifiable leak we see quite often is an intermittent increase in usage, such as a continuous consumption pattern that totals more than 200 gallons per hour, with usage then returning to normal. That quite often reflects a commode leak. The flapper valve in the tank may hang open and allow the commode to run for several hours at 3 to 4 gallons per minute before someone flushes it again. This situation has occurred numerous times with houses on the real estate market, and it has resulted in quarterly water and sewer bills in the thousands of dollars with no one living in the house. Try explaining this to a realtor.

Irrigation systems that are served from the house plumbing are set up with a timer and electrically operated valve, so when there is a break in the irrigation line, we'll see high consumption for a specific period of time.

From just a brief analysis of the consumption numbers, we usually can identify patterns that indicate to us the type of leakage problem we can expect to encounter before a service technician ever responds to the complaint. Now, as a routine practice, we send letters to our customers informing them of a potential problem prior to receiving their quarterly water and sewer bill. We also have door-hangers with leak-notification messages that we can distribute. Customers really appreciate this proactive approach, since it usually saves them money over discovering their problem sometime later through a high bill.

## **Consumption Data for All**

In the future, we hope to provide our customers with online Web access to the same consumption data we utilize. We currently are working with our AMR system vendor on a software package that will make this possible. We think this may raise the conservation value of our metering system even higher.

Several studies have shown how electricity consumers react when they're given near real-time feedback on their electricity use. In one, customers at Hydro One, an electricity supplier in Ontario, Canada, cut their energy use by an average of 6% during a two-year study. Many of the 400 program participants chose to have the display mounted by the front door to remind family members to shut off lights and TVs before leaving the house.

Or, look at the experience of Salt River Project (SRP), a water and electricity utility in Phoenix, AZ. There, more than 50,000 customers have signed up for M-Power, the company's pre-paid electricity program, which provides program participants with an in-home display that shows people how much energy they're using.

According to SRP's Web site, customers can look at the display screen and see how their costs change when they turn out a light or adjust the thermostat. That kind of insight has helped M-Power customers reduce their consumption by an average of 12.8% compared to



The collectors use solar panels to keep the batteries that operate the units charged.

energy use of customers in similar households.

People like having that kind of control over their consumption. The utility's Web site says, "Eighty-four percent of M-Power customers report being very satisfied with the program, and more than 90% believe they use energy more wisely as a result of being on the program."

It makes sense that having similar access to water consumption information will help customers conserve water resources and save themselves some money. At our utility, we saw how price-responsive consumers are when we raised our rates in 2006. By 2008, our billed-water and demand were down by 100 million gallons (7%) compared to 2006 numbers, and this decrease occurred despite the fact that our system grew by approximately 5% during that period.

Having access to online consumption data will allow our customers to avoid what is referred to by some as a "high-use surcharge," but it is actually a rate surcharge to encourage conservation. We bill our sewerage services throughout the year based on consumption from a customer's winter-quarter meter reading, and we use that same amount of consumption as the base from which we measure high water use. If water use exceeds the winter quarter consumption by 35%, we add a 36% surcharge to the water rate for that quarter. Some bills top \$1,000 or more. Those customers could benefit from technology that helps them track usage and avoid the costly surcharge.

And, online data could assist customers in finding their own system leaks. As mentioned earlier, our utility monitors suspected leaks

for a few days before we take action to alert the customer. But, if there is a break in the irrigation system, the customer can lose a large quantity of water very quickly.

Plus, customers will see the same data our customer service personnel see. Already, access to this consumption information has helped representatives answer questions, resolve high-bill complaints and shorten their call-handling times.

### Quick ROI

With all the benefits of fixed-network AMR systems, I think many would be surprised by their affordability.

In Leesburg, we currently bill for 1.5 billion gallons of water per year at an average rate of \$3.21 per thousand gallons. If just 10% of the reduction in unaccounted-for water we've seen since installing AMR could be attributed to the fixed-base metering, the system would have delivered some \$500,000 per year in revenue saved. Since the system cost the town roughly \$2.2 million, it has already paid for itself. In fact, it paid for itself in less than five years from the savings of unaccounted-for water alone.

What's more, the utility's customer base has grown by 50% since adding AMR, but labor costs associated with meter reading have gone down, not up. When we started the metering project, we had two technicians working full time to cover all our meter-reading needs on a quarterly billing schedule. We still have those two technicians, although their jobs have changed. Meanwhile, we haven't had to add any labor to keep up with the community's growth.

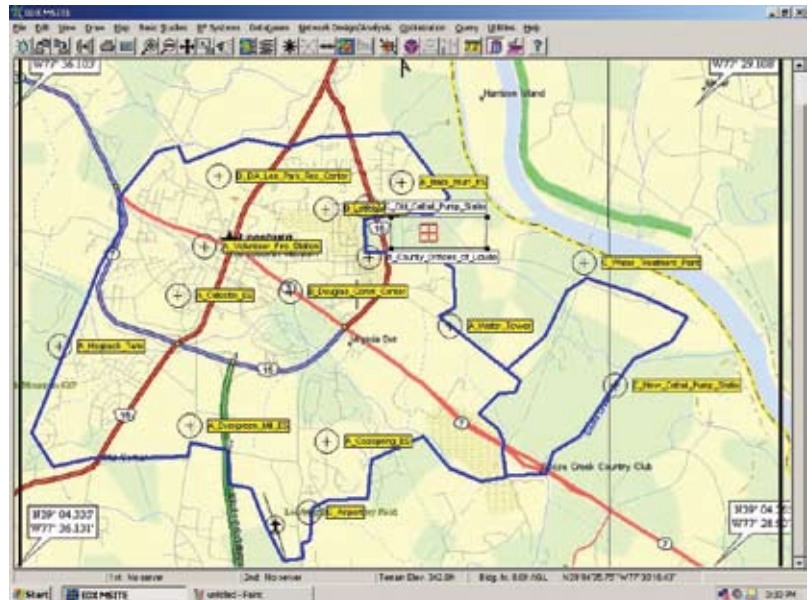
Finally, conservation is just good business. Water resources are finite. In many jurisdictions, they're limited or downright scarce. Meanwhile, the cost of water and wastewater treatment isn't getting any cheaper.

Not long ago, someone asked me what advice I'd offer to other utilities thinking about fixed-network AMR systems. I could only answer the question with another question: What are you waiting for? The technology is there and proven to be reliable.

Unaccounted-for water equals water treatment costs you paid for but didn't recover. It's equal to revenue lost, and any utility could benefit financially by reducing it.

If you can cut your water loss to less than 5%, why aren't you doing it? Even for a utility like Leesburg's, a system currently without any water shortages, drought or constraints, fixed-base AMR has been easily justifiable. So, I'll say it again: What are you waiting for? The time to do fixed-base AMR is now. **we**

*Randy Shoemaker is Utilities Director for Leesburg, VA.*



Data collectors placed throughout the town of Leesburg are positioned to collect meter readings redundantly, helping to ensure that no meter ever goes unread.



Unaccounted for water versus ERC



The STAR Network meter transmitters installed inside meter pits are hermetically sealed, protecting internal components and batteries against damage from the elements.



“We need to spend less time  
*collecting* meter reads and more time  
*understanding* our water system.”

## Aclara simplifies.

Quit knocking on doors. Proven fixed-network AMI solutions from Aclara automatically collect meter readings and provide the information you need to perform leak detection, conserve resources, reduce theft, and improve customer service and billing. When you need to *understand* your water system, Aclara simplifies.

**Capturing data. Liberating knowledge.™**

Find out more at [Aclara.com/simplifies](http://Aclara.com/simplifies)  
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