Measuring the Value
of Water

The college town of Ann Arbor, Mich., home to the University of Michigan and well known for Wolverine football, is also home to a state-of-the-art water system that offers its 114,000 residents cost-of-service rates that are supported by automated meter reading (AMR). Ann Arbor's holistic approach considers how water, storm water and wastewater operations interact to affect the functioning of the system as a whole. This basic approach has resulted in leading-edge improvements that have benefited customers.

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AMR supports cost-of-service rates in Ann Arbor, Mich.

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Ann Arbor looks at all options for serving its residents through robust citizen engagement efforts and has been successful in finding creative solutions to problems. For example, when storm water was flooding the city's sanitary collection system and aging wastewater treatment plant during big storms, the city began a project to disconnect footing drains that were emptying into the sanitary sewer to solve the problem, rather than expand wastewater treatment and collection facilities at great expense to and with significant environmental impact on the community. Community support was critical to this solution, which was largely accomplished by doing work in residents' homes.

Ann Arbor has taken the same creative approach to solving problems related to water supply. Ann Arbor is a rarity in Michigan—a city with no easy access to the Great Lakes. Limited river water capacity means the city relies on remote well fields for additional water because its local groundwater resources are not plentiful or well protected. These issues made the potential for managing demand on the system and living within existing capacity the most prudent approaches to water supply problems. In addition, if new investments had to be made to meet maximum-day demands, those costs should be assigned to the appropriate users. The city uses both cost-of-service programs and AMR to supports its efforts in this arena.

Cost-of-Service Options

In Ann Arbor, cost-of-service programs were undertaken to assure equity in assignment of costs for current as well as any future expansion of facilities. The Ann Arbor Council further directed, as a matter of policy, that the rates should promote conservation. In the late 1990s, it was clear that Ann Arbor's water system was reaching a critical decision point. The system was operating close to 80% capacity at peak loads—a point that would trigger systems planning and potential significant immediate investment in new infrastructure to increase capacity. The city had to find ways to encourage changes in peak use patterns, assign costs to customers fairly and roll out investments in water infrastructure to residents in an equitable way.

The city has tackled the problem through cost-of-service rate structures for both residential and commercial customers. Cost of service is a method of developing rates that considers customer use characteristics and the various investments in the system that support those characteristics. Ultimately, Ann Arbor's cost-of-service rate structures allow it to distribute the costs of developing and maintaining the water system more fairly.
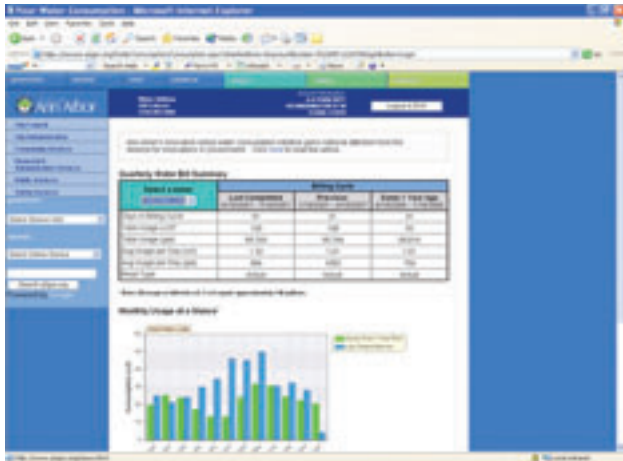
In Ann Arbor, residential customers are charged on an inclining rate structure. To develop the tiers that comprise the structure, the utility took quarterly
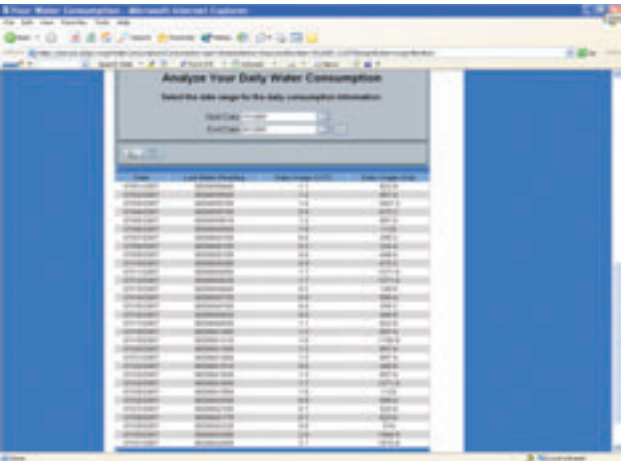
Consumers have the option of viewing daily water reads to determine any fluctuations in day-to-day use.
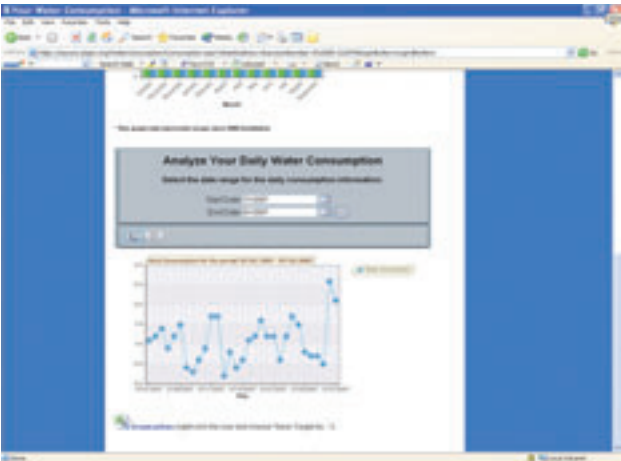
Ann Arbor customers have the option of graphing water use for a specified period of time, making it easier to see consumption patterns. They can also download use data in a spreadsheet.

Water customers can compare their usage over various time periods.

bills, plotted them on a bell-shaped curve, ran the numbers through a unit-cost recovery calculation and came up with four rates for charging water costs. Customers pay the lowest rate to use of one to seven units of water, and rates progressively increase in each block as more water is used. The highest rate per unit is paid once a customer uses 45 units of water or more.

Commercial customers also pay based on a cost-of-service rate structure. However, this structure works a bit differently than the residential one. Because there are fewer of them, the city is able to analyze the water use characteristics of each individual commercial customer and assign a rate class based on historic water use. Once assigned a rate class, a commercial customer pays the same rate for all water units used for a year.

A key component of the calculations used to determine commercial rate-class assignations is a peaking factor, or the ratio of peak to average water use. Peaking factor makes it possible to assign rates that take into account the costs of providing the infrastructure necessary to support peak usage. This means the customer that uses water consistently over time will pay less for each individual water unit used than the customer that uses a lot of water for a few events and little water over the rest of the year. For example, the University of Michigan football stadium uses millions of gallons of water during the course of nine single-day events a year. The stadium peaking factor is higher than that of most other facilities, such as campus dormitories, that account for more consistent water use.

The city utilizes a six-year financial plan for each of its water utilities in order to evaluate changes in capital investment, operating expenses and use projections to plan for changing revenue requirements. This approach has allowed Ann Arbor to propose rate adjustments that are distributed in a level way across several years, thus avoiding rate shock and allowing for development of fund balances to pay for needed improvements.

Recently, the city used $28 million of the sewer fund balance to pay for part of a $42-million plant project (the rest of the cost was covered by bonds). This type of project would be extremely hard to fund without the preplanning inherent in Ann Arbor's approach.

How AMR Fits In

Although Ann Arbor rolled out its AMR system after implementing the initial cost-of-service programs, the technology has served to support and enhance the programs. Ann Arbor began deploying the STAR Network system from Aclara in 2004, about a year after it first implemented its residential cost-of service program. The STAR Network system automatically reads most water meters on a twice-daily basis, though some are read more frequently, sending the readings directly to the utility via a series of data collectors located throughout the service area. Previously, Ann Arbor took water meter readings quarterly.

The city uses the regular water meter readings provided by AMR to help people understand how they are using water, as they are using it. Previously, customers would get a bill at the end of a quarter but have no idea what their usage pattern was. Therefore, even though they would be charged based on usage, there was little customers could do to modify their usage patterns, and thus billed amount, during a billing cycle.

Today, Ann Arbor uses its AMR data to provide customers with real-time consumption readings online. Customers can log on to the city's website at any time, see their usage and gauge how much their bills will be at the end of the current cycle if

their usage patterns remain the same. This type of feedback can help customers make decisions about how they want to use water. It can also help them understand the effect that specific types of usage, such as lawn irrigation, have on a bill.
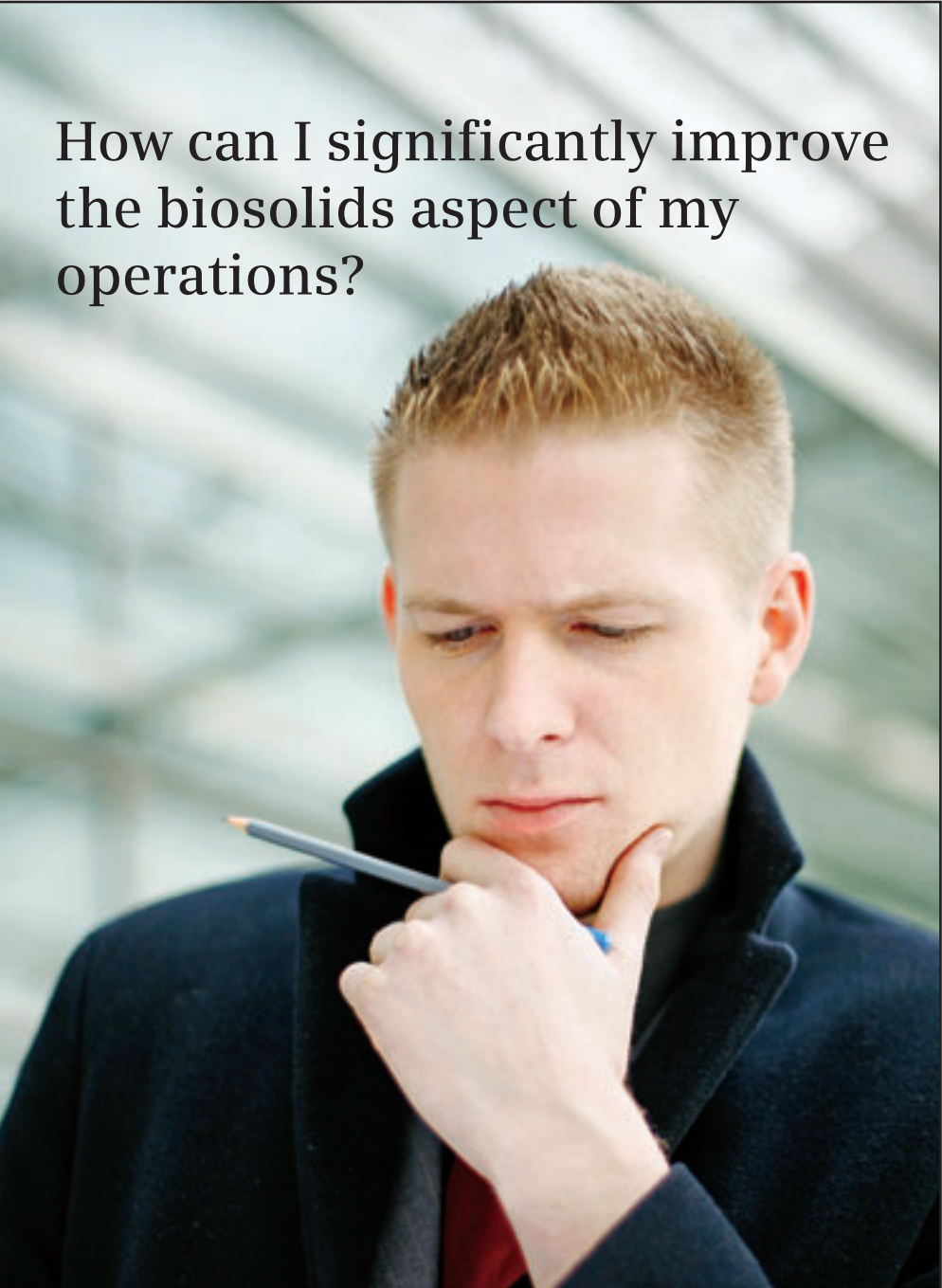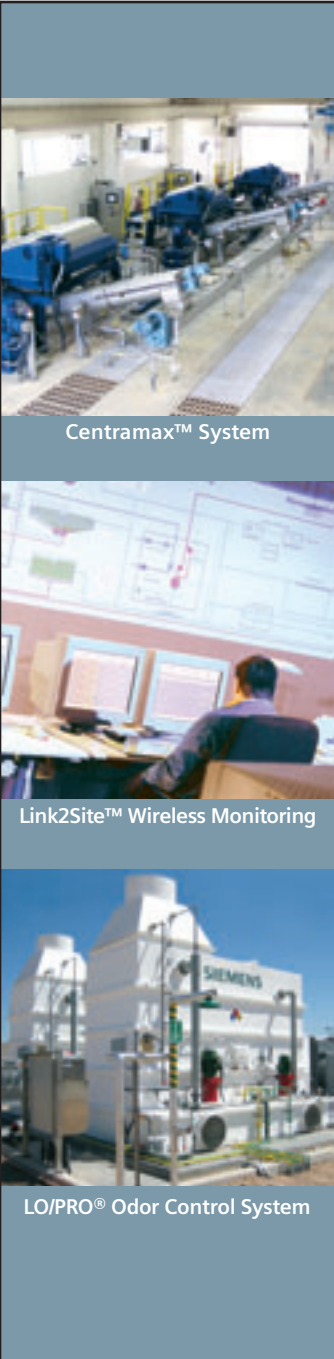
The city hopes to eventually do predictive analysis based on usage patterns that will allow it to better optimize its water system. This type of analysis requires a large amount of data collected over a number of years. So far, Ann Arbor has seen some change in water usage patterns based on feedback to customers, but the city does not have enough information to know whether these patterns will hold during the worst conditions, for instance drought.

AMR data may also help Ann Arbor refine its residential cost-of-service rates. Today, rates are based on a distribution of all residential billing data across a bell curve. This approach does not take into account the peaking factor for individual accounts. In the future, with improvements in ability to mine the AMR data, the city may be able to utilize the peak usage of individual residential customers in the same way that peak factor is used to determine rates of commercial customers. This approach might lower rates for residential customers who use larger amounts of water over time but whose peaking factors are low (i.e., large families). Conversely, it might raise rates for the gardener who irrigates profusely during a few weeks in the summer.

Its holistic approach to water utility requirements has allowed Ann Arbor to anticipate infrastructure needs as well as maximize the benefits of AMR for its citizens. Through cost-of-service programs and creative use of technology, the city will continue to refine how it distributes costs to customers based on peak usage and see the benefits as customers respond to the value and cost of water.

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