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Ingenuity for life

Advanced flowmeters save millions in maintenance costs and non-revenue water losses

At one of the largest municipal water treatment departments in the United States, 1400 employees work hard to keep clean water flowing through the taps of households and businesses over a 2795 km² (1079 mi²) service area in the Midwest. That includes a major city and 127 suburban communities. Wastewater service covers an area almost as large: 2450 km² (946 mi²), including the city and 76 neighboring communities.

The department's system draws fresh water from a large lake to the north and a river to the south. Its network consists of 5533 km (3438 mi) of transmission and distribution mains within the city, plus 647 km (402 mi) of transmission mains to its remaining service areas. Its five water treatment plants deliver an average of 4.5 billion L (1.2 billion gal) of clean drinking water each day. Its sewage capacity is 3.03 billion L (800 million gal) a day.

Like other municipal water and sewer departments across the country, this department must deal with an aging infrastructure that shows itself in expensive and disruptive broken water mains and undetected leaks that can cost tens of millions a year in lost revenue. Some of the city's water mains are more than 100 years old.

Major upgrades underway

The department can only recover the cost for providing water and sewer service to its retail and wholesale customers. By law, it can't make a profit – but employees are still concerned about cost, efficiency and productivity, just like any profit-making business.

In fact, given the department's annual operating budget of more than $360 million and its mission of providing fresh drinking water and wastewater treatment for nearly four million citizens, its business is both big and, more importantly, vital to the health and well-being of its customers.

Flow measurement that knows no bounds

Case at a glance

Customer: Municipal water treatment department

Challenge: Lack of precision and modularity in hundreds of legacy manual and Venturi flowmeters hindered efforts to reduce non-revenue water losses.

Solution: Phase in Siemens SITRANS F M MAG 5100 W AC-powered magnetic flowmeters for wholesale customers and SITRANS F M MAG 8000 battery-powered magnetic flowmeters for industries, schools, hospitals and other institutions.

Results: Reduced annual maintenance costs by $265,000, while forecasting an ultimate savings of up to $3 million in yearly non-revenue water losses.

SITRANS F M MAG 6000 transmitter remotely connected to the 66-inch SITRANS F M MAG 5100 W flow meter sensor.

In 2014, the department began a $1.1 billion, five-year Capital Improvement Program to replace its legacy infrastructure and upgrade its treatment facilities, using the latest technology wherever possible to improve efficiency and safety.

Major projects included replacement of aging water mains; rehabilitation and upgrades to water and wastewater treatment plants, pumping stations and reservoirs; rehabilitation or replacement of sewer lines and outfalls; and construction of combined sewer overflow control facilities to ensure that sewer systems effectively handle storm water flows and protect the environment.

Challenge

Metering precision was of particular concern, as the department works on fixed-rate contracts with wholesale customers. The contracts are based on the department's best forecasts of customer water usage – so if metering is precise, then their per-unit water costs increase.

One problem they experienced with their old mechanical and Venturi-based flowmeters was lack of precision, especially at low flow rates like what occurs at nights and on weekends when water use falls off. This leads to a much bigger challenge called non-revenue water recovery, something all water departments face. In this case, non-revenue water recovery was estimated to be as much as 25 percent of the department's water flow, which they wanted to reduce to 15 percent. While water leaks and theft contributed significantly to this problem, so did legacy flowmeters that could be more precise. The department's retail side had installed newer meters in 2008, but the wholesale side had meters that were much, much older.

Solution

Unfortunately, the department's flowmeter replacement strategy wasn't straightforward. When they called their current supplier of nearly 70 meters within their system (one of Siemens' biggest competitors), they were shocked to find that their meters had been moved into an end-of-life stage with imminent termination of service, support and parts – and no upgrade path.

In a real sense, the department's supplier had boxed them in: they faced a rip-and-replace situation even if they sought an alternative supplier. But they were determined to never again subject their operations to such vulnerability.

After evaluating the next-generation magnetic flowmeters of several leading suppliers, they chose to work with Siemens and its local instrumentation distributor, an environmental municipal water and wastewater treatment specialist. Why? In addition to the capabilities, breadth and flexible modularity of the Siemens SITRANS F M line of magnetic flowmeters, they found both Siemens and the distributor to be extremely knowledgeable and responsive.

Their chosen solutions: SITRANS F M MAG 5100 W AC-powered magnetic flowmeters for wholesale water and sewer customers and SITRANS F M MAG 8000 battery-powered magnetic flowmeters for industries, schools, hospitals and other institutions.

More precision…up to 10 times more in low-flow scenarios

Today, the department is phasing in the SITRANS F M MAG 5100 W magnetic flowmeter sensors at its 290 wholesale metering sites and at many sewage sites as well. This AC-powered model is matched with the SITRANS F M MAG 6000 transmitter, which measures with an accuracy of ±0.2 percent of the flow rate.

The transmitter also comes with a built-in HART communications card to connect the sensors with the department's SCADA system. They appreciate the modular design of the Siemens flowmeter solution. This way, if they need to service a part, they don't have to replace the whole device. They may also consider upgrading their communications to Modbus or Profibus in the future, and in that case they would

only need to swap out the communications card.

The broad SITRANS F M flowmeter portfolio provides the department with the flexibility to choose from a wide range of diameter nominal (DN) sizes, from DN15 (0.5 in) up to DN2000 (78 in). For the revenue meters, their needs range from DN50 (2 in) to DN900 (36 in); for the sewage requirements, they are deploying sizes from DN1200 (48 in) to DN2000.

Easy, automated meter verification

To ensure the flowmeters' accuracy, especially to validate accuracy for wholesale customers, the department uses the SITRANS F M Verificator. It's a portable, briefcase-sized device for easy, fully automated onsite verification without disrupting a flow meter's operation. From signal input to output, the Verificator checks accuracy against the device's defined factory values. It ensures that the flowmeter's insulation is intact and that its magnetic behavior is unchanged.

For metering large commercial customers like industries, schools, hospitals and other institutions, the department is testing and planning to deploy the battery-powered SITRANS F M MAG 8000 water meter, which also provides ±0.2 percent accuracy. Its replaceable battery is designed to provide reliable power for up to 10 years. Their retail side uses ITRON automatic meter reading systems on a fixed wireless network.

Results

The department is confident that their decision to engage Siemens was the right one due to the supplier's responsiveness in service and support: whenever they call Siemens, they are either connected right away or receive a call right back.

They are also starting to see the cost savings, particularly in regards to labor costs – including an estimated $265,000 reduction in annual maintenance expenses while forecasting an ultimate savings of up to $3 million in yearly non-revenue water losses. That's because the SITRANS F M magnetic flowmeters are solid-state with no moving parts, so they require much less service and corrective maintenance.

Time and money savings

What's more, verification of each meter takes much less time. Previously, it would have taken a two-person team up to four hours to service and verify a turbine or Venturi meter, but with the SITRANS F M Verificator it takes just an hour. And if parts need replacing, the modular design of the Siemens magnetic flowmeters allows a defective part to be swapped out easily and quickly.

The department projects that, due to the much greater accuracy of the Siemens magnetic flowmeters, they can save up to two percent of their non-revenue water losses. Although that may not sound like much, consider this: given the size of the system and water volumes, two percent can translate into savings of up to $6 million a year.

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