How to increase your water system’s revenue with water meters

An analysis of the revenue gap and meter technologies that help fill these gaps
Customers in your community are the primary source of revenue for water systems. The revenue from water services goes toward covering operating expenses and preparing for future capital investments. However, there is a wide gap between how much revenue utilities earn versus the amount of funds utilities will need to repair our aging infrastructure. One way water systems can earn more revenue is with rate increases; however, these increases often come with public objection or at the reluctance of elected officials. A fairer and more favorable way to mitigate this funding discrepancy is utilizing water meters that can capture every drop of water distributed to customers.

When a water system’s earnings are rooted in customers paying for every drop of water they use, the water system stands on solid ground to earn enough revenue to support operational costs and future capital needs, while maintaining favorability with the community by limiting rate increases. This paper will address how water meters can increase water systems’ accounts receivable to help overcome the future infrastructure challenges on the horizon.
Understanding the infrastructure challenges and revenue gap

The American Water Works Association Buried No Longer report (AWWA, 2002) indicates that our country will face roughly double the necessary investment costs for water infrastructure replacement, from about $13 billion a year in 2010 to the tune of almost $30 billion annually by the 2040s (a figure that does not take into account inflation). An estimated 29% of investment costs will need to be allocated for water loss control and that the average water loss within a public water system is 16%, of which up to 75% is recoverable (Thorton, Sturm & Kunkle, 2008).

These figures are not news to water professionals; between organizations such as AWWA, EPA, Water Environment Federation and American Society of Civil Engineers, water professionals are constantly reminded of the looming infrastructure crisis. So what can be done to subsidize this inevitable need to invest in our future water infrastructure needs? A solution as simple as replacing your water meters can help.

Ratepayers are the central source of revenue for water systems. Unless billed at a flat rate, ratepayers are typically billed based on their volume of consumption. Consumption is determined by the amount of water registered by the water meter. Therefore, it is key that the water meter capture the same volume of water that is delivered to the customer.

This also includes leaks, such as a leaking faucet or running toilet, in which the customer may not be consuming the water, but the water utility is still incurring the operating costs to distribute this water.
Not all water meters are built to measure lower volumes of water, such as leaks in a customer’s home. The standard start flow rate a water meter must be able to register to meet AWWA standards is .25 gallons per minute (AWWA, 2012). However, the EPA (Fix a Leak Week Fact Sheet, n.d.) reports “the average household’s leaks can account for more than 10,000 gallons of water wasted every year.” In calculating the rate of flow of these household leaks, it equals an average flow rate of .019 GPM (10,000 gallons per year / 365 days per year / 1440 minutes per day).

Water that reaches the end-customer but is not billed for can be costly to a utility, since this is the point where water reaches its highest cost to produce and distribute. And if your water system’s water meters are only meeting the minimum standard of .25 GPM low flow rate, your water system is missing the leaks the EPA reports are assuredly happening.

A water meter that measures at a low start flow rate provides a water system with a method to recoup revenue that is legitimately earned; after all, your water system does deliver the water, and your ability to manage the tightness of water fixtures past the water meter is out of the water system’s jurisdiction. This brings about a challenge for water systems to be able to run a healthy operation if they do not receive equal value for water distributed.

Additionally, if your current water meters are not registering water usage at this low level, it is more difficult to identify the leaks and notify your customers so they can repair the issue. With smart water meters, water systems can set continuous flow thresholds for their water meters. If water runs continuously through the meter for 24 hours at a particular flow rate, an alert inside the meter will indicate a leak on the customer’s side of the meter. Customers also benefit from smart water meters with this proactive approach to identifying and stopping leaks.

Calculation of flow rate for household leaks

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10,000 \text{ Gallons per year} &+ 365 \text{ Days per year} &+ 1440 \text{ Minutes per day} = 0.019 \text{ GPM}
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Converting unmetered water to dollars

Let’s do some additional calculations to demonstrate how your water system can covert unmetered water into dollars. Suppose that for the Town of Springfield, their average water and sewer rate is $10.00 per thousand gallons and they have 5,000 meter connections.

If the average household leaks 10,000 gallons per year, that is $100 per year, which – depending on the low flow measuring capabilities of your water meters – is either captured as revenue or lost and never billed.

With an accurate water meter that can measure the .019 flow rate of leaks, combined with a meter lifecycle of 20 years, the water system can recover $2,000 per meter. Over the course of 20 years, the Town of Springfield will recover $10,000,000 or $500,000 per year.
Why the type of water meter matters

The above-referenced increase in revenue is dependent upon two criteria: the sustained sensitivity and accuracy of the meter and its ability to measure lower start flows. Reducing water loss “caused by meter inaccuracies at low flows can result in substantial increases in revenue for a utility” (Richards, Johnson & Barfuss, 2010, p. 131). Therefore, it is imperative for a water system to select a water meter that utilizes an accurate and stable measuring principle. An examination of the three most common metering technologies can help determine which one provides sustained accuracy and low start flow capabilities: positive displacement (nutation disc), ultrasonic and electromagnetic (meter size 5/8”x 3/4”).

Positive displacement water meters (this paper will only discuss nutating disc, as this is the more accurate of the two kinds of PD meters).

Positive displacement water meters measure volume by the rate at which a rotating disc turns, with each disc rotation correlating to a specific volume of water that passes through the meter. The disc connects to a magnet that moves the consumption figures on a meter’s register (Water Research Foundation, 2011). Unless water quality is low, the nutating disc is an effective measuring technology to measure within the AWWA start flow parameters of .25 GPM. However, in tests results depicted in WRF Accuracy of In-Service Water Meters at Low and High Flow Rates report (2011, p. 73), shows nutating disc water meters on average only measured 30% of 1/32 GPM or a 70% loss (when the meter has 1.5 million gallons of throughput).

This measuring technology does not support the .019 GPM start flow to recoup the revenue from customer water leaks. Additionally, inherent to nutating disc water meters is the risk that wear and tear from the meter will cause the disc to rotate less and therefore measure less water volume.

Comparison of top meter manufacturers’ start flows in gallons per minute (GPM)

All product, company names and brands are property of their respective owners. Use of these names does not imply endorsement.
Why the type of water meter matters

Ultrasonic water meters

(*this paper will only discuss transit time measuring principle, as this is the more accurate of the two kinds of ultrasonic measuring*).

Ultrasonic water meter uses the transit time measuring principle, meaning it measures the velocity of water to calculate the volume. With this technology, flow is measured by the time it takes for an ultrasonic signal to pass from one transmitter to another. It measures upstream and downstream velocity and then compares the difference in time in order to determine the flow.

The ultrasonic measuring principle maintains its accuracy over long periods of time because of two factors: no moving parts and noise rejection attribute. With no moving parts, there is no risk of wear and tear to any portion of the measuring mechanisms. Ultrasonic measuring also has an attribute called noise rejection, in which if one or both of the two sound transmitters produces a sound outside of its programmed 1 MHz frequency, the transmitters automatically reject this measurement. It will only “hear” the frequency it is programmed to hear; therefore, if acoustic noise, such as electrical noise, radio frequency or magnetic interference, is near the water meter, the transmitters are unaffected because it is at a level not “heard" or "understood" by them. Additionally, water quality, such as iron or manganese, also has no effect on the meter’s accuracy because ultrasound waves can still travel through these metals.

Electromagnetic water meters

In an electromagnetic (mag) meter, as water passes through the flow chamber, a magnetic field is applied to the flow. When water passes through the magnetic field, it causes a voltage that is proportional to the flow velocity. When the velocity and flow tube area are known, the volume can be calculated. When a mag meter measures lower flows, it does so on the basis of small levels of voltage; when measuring for small levels of voltage, higher and unwanted voltages can interfere with determining what the true voltage is.

Therefore, in order to obtain accurate low start flows when using this measuring principle, it is imperative to keep items that can cause electrical and magnetic noise from the meter or the meter will calculate the magnetic field created by that item into the voltage calculation, which causes over- or under-registering of water usage.

If iron and manganese are present in the water, resistivity, or the resisting power of a material to the flow of electric current, can occur.

The next step toward bringing your water system closer to this additional revenue is knowing your available options for water meters capable of this return on investment – meaning, the water meter must be capable of measuring at or below the .019 GPM flow rate of leaks. Below is a figure that depicts the leading water meter manufacturers’ published start flow rates.
Conclusion

It is possible for a water system to earn more revenue by ensuring the water meters are sensitive enough to capture even the lowest flows. When your water system’s revenue is rooted in customers paying for every drop of water they use, it makes covering operational costs and future capital needs feasible. In addition, the benefit of limiting rate increases is beneficial to your community. It is true that the average household leaks an average of 10,000 gallons per year. Depending on the water meters your water systems has, you are either capturing the leaks as revenue or never billing for it. However, the metering technology exists today to ensure every drop of water is captured as revenue for your water system and community.

References


Meter manufacturers’ low-flow data obtained from their respective meter data sheets as of March 2017.