JAMES BREHM & ASSOCIATES

The Connected Conversation

Volume 8, Issue 4, Article 3

Smart Water and the New Laws of Hydrodynamics-Finding Better Ways to Manage our Most Precious Resource

Smart Water and the New Laws of Hydrodynamics-Finding Better Ways to Manage our Most Precious Resource

According to The Nature Conservancy, water shortages are expected to rise along with spikes in food demand as a result of migration, urbanization, and climate change. By 2050, it is projected that more than 1 billion urbanites could be living on less than a bathtub full of water per day (approximately 26 gallons). This would be a shocking transition for most of America, as we traditionally use between 42 and 130 gallons of water per day. This does not bode well for us. Societies have relied on water for centuries to build cultures and to create and improve agriculture, but now we are seeing the dramatic effects of drought and poor water management taking hold.

> *"Americans use between 42 and 130 gallons of water a* day"

As we move closer to having truly smart cities, boasting smart meters and more integrated infrastructures, what does this mean for municipalities? Do smart cities save time, energy, and resources? Before that is answered, let's take a step back to the very beginning and understand that as humans we've been manipulating water for thousands of years. First, it was to simply survive; however, over time, we began to irrigate crops, then to grow cities and empires.

Oman, Jordan, and Persia were some of the first to perfect the use of running water within homes and buildings, so much so that we still use the same systems of channeling water today. While the engineering may have changed, aqueducts still provide water to major metropolitan cities throughout the world. New York City, for example, gets roughly 40 percent of its water from the Catskill Aqueduct.

Overcoming Clogs in The System

Building such massive infrastructure and maintaining it is starting to negatively impact the environment, as we are seeing throughout California and the rest of the American Southwest.

Additionally, the increasing demand for fresh water is costing even more money to build out infrastructure or retrofit old systems to meet new needs. These large pieces of infrastructure have a multitude of connected components to manage pressure, usage, and maintenance. The management between the macro (reservoirs) and the micro (individual buildings) are where things get a bit interesting, because this is where the value of smart cities truly lies. It isn't enough just

to have access to information; departments and industries also need to be able to collect, analyze, and share that information to make real change. Over time, city development and infrastructures have slowly matured from basic controls and manual systems to connected systems. Sure, we're not seeing anything advanced in the deployed markets yet, but there are connected IoT controls and reporting systems in place today to manage flow and distribution. As the technologies have advanced and changed, so has the responsibility of the municipalities.

Municipal governments have some of the biggest burdens in water management and related market silos, but city water departments have not been updated as rapidly as other legacy infrastructures, such as telephone and Internet lines. In fact, not much has changed since the Chelsea Waterworks Company in 1723 to the water department of the city of London today. Unfortunately, communications between the water department and others within municipalities hasn't changed much either because water departments have to work with various other departments inside a city to furnish what's necessary. This includes incorporating the needs of a city's parks and other municipal properties, in addition to those that are commercial and residential, requiring water departments to work across their billing and budgetary needs in addition to those of the city. Currently, there are many manual processes in place to manage water usage, as is standard with any sort of government (except Ireland apparently).

Take for example, the human resource hours spent on residential water meters; this is the type of cost a connected city can avoid. Typically, a city deploys a team to check each meter manually and report back the meter reading. This occurs each month to measure the amount of water used and then allows the city to set up billing. The dumb meter that only reads the amount used is not collecting pressure, flow rate, or various other statistics a smart meter would report back in real time. If something needs to be measured in depth, data is collected and processed, then the report goes through several departments. Next, the water department works with the facilities or maintenance department to repair a leak that has taken months to find and report.

Lost Water

But why do water statistics matter, especially those in real time? Most cities that pump water from wells, aquifers, reservoirs, and other water sources, only get roughly 60 to 70 percent of the water to the end user. That means that 30 to 40 percent of that water is lost in the

processes, generally due to leaks or poor pressure. Oftentimes, leaks go undetected for a very long time, or are never found, causing negative impacts on the use of such a finite resource – in addition to costing the municipality money due to loss and repairs.

> *"approximately 30% - 40% of water is lost due to leaks or poor pressure"*

According to the EPA, the average American family uses 300 gallons of water per day, and of that, roughly 70 percent (~210 gallons) of the water is used indoors. Of that 70 percent, nearly 49 percent (~102 gallons) of water lost within the home comes from flushing toilets and running the washing machine. Yet, when drought restrictions are in effect, limitations are placed on outdoor water use, which is only approximately 30 percent of residential water consumption. According to IBM, water demand for manufacturing is going up by 400 percent by 2050.

Having smart water meters in homes can also inform homeowners how much water they use every day or month and can help them alter their water usage habits accordingly. For places like California, this could be a huge step in the right direction – especially since daily water consumption must be cut by 25 to 30 percent; otherwise, the state will run dry in the next five years. One woman found a leak because of a smart meter installed at her house and saved more than 90 percent from a rather large leak (granted, this is an extreme case). Because of California's continued population expansion and agricultural industry (in addition to years of drought), lakes, streams, and aquifers are drying up at a historic rate. Unfortunately, the rest of the U.S. is not immune – at least six other states are running out of water, including Arizona, Kansas, Nevada, New Mexico, Oklahoma, and Texas, according to USA Today.

How Smart Meters Can Save Us

Despite the fact that many states in America, and other nations, are struggling with depleted water sources, all is not lost; there is a connected solution that can solve these problems.

Intelligent metering and real time flow monitoring goes further than the more common simple meter readings of how much water is used each month. Instead, by monitoring flow in real time many of the issues that municipalities and water districts now face can be solved by collecting data related to pressure, time of peak use, preventative maintenance, and leak detection and communicated via SMS alerts. In one case, real time SMS alerts help inform a town's water department to proactively manage the infrastructure with other sensors to determine if there are problems with the water itself. Is the water out of balance with pH or chlorine levels? If so, the system can alert the right municipal staff to correct what could potentially be a problem for all customers from residential, to manufacturing and agricultural.

For instance, intelligent meters can help determine if there are leaks in the system when a pressure delta occurs between two meters. The smart meter can then report this back and start saving the city money, as well as curbing the environmental cost of pumping too much water from such a finite resource.

Improving Billing and Collections

All of this data collected can then be hosted in the cloud and is accessible to multiple departments, saving many hours of paper shuffling and report filing. In addition to the metering and usage issues, cities also face challenges in regard to the billing and collection aspect to monitored

water systems. Many cities are owed large amounts of unpaid bills but have not had the resources necessary to collect or even shut off water to those who have not paid. A connected meter can offer better management for billing and control through automation and visualized data via dashboards.

Detroit and New York are two of the more recent examples of water woes for payment collections. Detroit needs the outstanding bills to pay for much needed upgrades and fixes to the system. Without the easy ability to shut off the water there are still many customers using water and accruing charges without repercussions.

In New York the situation is similar, only the people who are not paying are listed in some of the highest valued property in the city and can easily pay. The shut off would be paid off but an overworked municipal staff can't get around to shutting the water off to collect the overdue bill. However, flow control is much more important; in some cases, the infrastructure may have too much pressure at one end of a block and not enough pressure at another end of a block serviced by one line.

Pressure management is another issue. By controlling the pressure individually between endpoints (residences), all of the residences can be serviced with equal pressure. In some cases, the higher-pressure house may be using more water than it's billed for because some of the older meters cannot sustain that much water going through and a controlled flow meter can now accurately charge for water. On the other hand, the house at the end of the block with lower pressure may not be able to generate as much revenue for the city because of the water consumption being lower than it could be.

Water stagnation issues in the system lead to wasteful discharge in times of need. According to research from the EPA, up to 30,000 gallons per day can be saved with correct smart systems in place. In the Texas heat, pressure will build up in some parts of the system with water vapor and the pressure right now can only be dealt with by releasing water through a fire hydrant. A system using smart controls can be managed through infrastructure, saving time and money by automated flushes that don't need a crew but rather just a computer monitoring the system. Flushing also prevents water quality issues in the system, which in some rural areas can be an issue where water is not used as frequently as other areas.

Final Thoughts

Directing water to the place where it is needed is one of the first things we've done as a civilization (let's not forget the aqueducts of ancient Rome) measuring and conserving our resources came next. It has become abundantly important that smarter cities proactively manage their finite resources - especially resources that will need to stretch further with less.

According to the U.N., if the current abuses of water sources do not change, by 2030, there will be a distinct 40 percent global water deficit. However, there is a way to reverse this. As Michel Jarraud, chair of UN Water and Secretary General Emeritus - World Meteorological Organization stated in a recent UN report: "Measurability, monitoring, and implementation are urgently needed to make water use sustainable."

From the start, water has propelled not only life, but has helped provide the foundation for all we have ever needed to grow as a species. Our job now is to find a way to better manage not only our cities but also ourselves, allowing us to continue to evolve.

Come see us in 2022 at:

AOTMP Engage 2022: April 24-27 in Orlando, Fl
IoT Evolution Expo: June 21-24 in Ft Lauderdale, FL
LoRaWAN ® World Expo: July 6-7, 2022, in Paris France

Contact us at info@jbrehm.com to get time on the schedule.