Introduction

As the water industry evolves, leaders are embracing new technology to improve efficiency and employ predictive maintenance. And in a year like 2020, remote monitoring and digital management efforts have been expedited. In this "Water @ Work" white paper, we'll look at how early adopters are benefitting from emerging technology as well as the impact COVID-19 has had on water management.

- Remote Pressure Monitoring: An Alternative to Telemetry
- Water+Energy: Changing the Status Quo
- Using IIoT for Conservation & Cost Cutting Initiatives
- An Unlikely Source for Monitoring COVID-19

Remote Pressure Monitoring: An Alternative to Telemetry

Overview

Le-ax Water District is a drinking water facility located in southeastern Ohio. This rural water district supplies drinking water:

- 6,800 taps
- 17,000 people
- 500 miles of waterline
- 4 counties

Le-ax contacted Sealevel Systems, Inc. for a pilot project to monitor pressure reducing valve stations. Approximately 20 stations are strategically located throughout the district to prevent damage from high pressure and avoid unnecessary stress to the infrastructure.

They sought a solution to remotely monitor their existing facilities and detect spikes in pressure or water main failures. Technicians were often not alerted of an issue until a homeowner or business called – after the damage had been done.

"If a device could send an alert to our distribution crew that a drop in pressure has occurred, we could react proactively."
Travis A., Le-ax Water District Principal Engineer

Key Application Requirements

- Ability to configure thresholds
- Alerts via email or text
- Communicate via cellular
- Powered by a solar-charged battery

The Solution

A Sealevel SeaConnect 370 monitors analog outputs from two pressure transducers and is configured to alert technicians when thresholds are exceeded. The device relies on solar power with a battery backup. To protect against the elements, the SeaConnect 370 and solar charging controller are installed in a waterproof enclosure. Once the pilot is complete, Le-ax Water District will begin fielding units across their territory.

"Before finding Sealevel, the only way to monitor a PRV was to install a full-blown telemetry system which would require us to provide power at the site. However, the SeaConnect 370C is a perfect, low-cost solution that provides just enough I/O to get the job done. More importantly, the 370C is low power enough to be powered from solar."

Travis A.

Water+Energy: Changing the Status Quo

In 2014, the World Bank announced that modern water and energy production systems were on a collision course. Keys steps have been implemented to improve the codependent relationship since that announcement.

The Role of Energy in Water Management

Along the path that water takes from source to tap or bottle, energy plays a role in every step. Primarily, it is in the form of electricity, but energy may be consumed via natural gas or fuel. Here are a few ways energy shows up in the consumer water cycle:

Water Transportation

Water gets taken from various sources such as streams, rivers and springs. Often, these freshwater sources are remote and removed from accessible infrastructure like roads. Frequently, water gets sourced from former glacial areas or mountainous regions with snow-fed water systems.

Throughout the extraction process, fuel is used to transport vehicles to the source, to processing and treatment centers and then to distribution centers for consumption. Often these tankers are not electric vehicles nor are they fuel efficient. Moreover, the water must be stored in tanks that are subject to issues such as leaks or contamination. Some trips may be futile due to these issues.

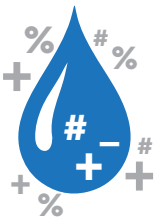
Beyond actual vehicles, water transportation includes electric pumping systems in water districts around the world. Pumping water through pipes requires energy, and distribution is a tricky task made complicated by water pressure requirements. Monitoring this distribution system can take extra power.

Water Heating

For consumers, hot water is essential. It sanitizes, cleans and soothes. Hot water occurs naturally in hot springs and other geothermal areas, but it takes electricity or natural gas to heat water in homes and businesses. According to the Alliance for Water Efficiency, 15% of household energy use can be attributed to heating water. One five-minute hot water stream from the faucet uses the same energy that a 60W incandescent bulb does in 14 hours.

Imagine this water heating on an industrial scale. Industries that use hundreds of gallons of water a day such as textiles, some manufacturing and plastics can attribute substantial energy waste to the inefficient and frequent heating of water. It's difficult, as well, to re-use hot water because it is usually contaminated or polluted, which means it must be transported elsewhere – requiring more energy – before it can be returned.

Water+Energy: Changing the Status Quo



Water Treating

Without wastewater treatment, water would be almost gone from many developed countries. Sewage treatment keeps what little freshwater the world has available in usable condition, repeatedly. However, water to be treated must be pumped in and out of the plant. Plants are not centrally located, which means lines to them may be several miles long. According to the EPA sustainable water infrastructure program, water and wastewater plants consumer 30-40% of a municipality's total energy consumed.

Moreover, once the water arrives, the treatment processes are equally energy intensive. Filtration, aeration and chemical treatment all require pumps, hydraulics, gates and other non-mechanical systems. Furthermore, the water must be treated by individuals in these plants, creating hefty overhead costs related to maintaining safe, well-lit and tolerable working conditions. A European study of 23 treatment plants showed that all of them could easily reduce power consumption by 20%-80%.

Using IIoT for Conservation & Cost Cutting Initiatives

Water is an essential resource. With the earth's growing population and changing climate, the availability of safe drinking water is even more critical. The use of IIoT at wastewater treatment plants can significantly improve water conservation and cut costs through predictive maintenance and increased plant efficiency.

Reinventing Water Pressure Checks

Traditionally, a plant employee checks water pressure by hand, examining each meter on a routinely scheduled inspection. In this way, a water leak can go undetected for hours and lead to significant damage and losses in revenue. Additionally, a leak of untreated water spreads pollution into oceans, rivers and groundwater. With IoT sensors, operators can be alerted of potential leaks as soon as any drop in pressure is detected. IoT can also provide remote shutoff capabilities, so a leak can be stopped before a technician is able to arrive on site.

Last year, Le-ax Water District in southeastern Ohio installed industrial IoT SeaConnect 370 devices to monitor pressure at valve stations throughout the district. Previously, the district was usually unaware of an issue until a homeowner or business called. SeaConnect 370 devices allow for remote monitoring of each station and the ability for the facility to react quickly and oftentimes proactively to any issues.

IIoT for Water Treatment & Delivery

Beyond pressure changes, IIoT can assist in the more efficient treatment of water by instantly measuring properties such as temperature, pH, chlorine and the levels of other chemicals. More consistent water purity has huge benefits not just for consumers but many other industries reliant on water use, such as farming, food, healthcare and pharmaceuticals.

IIoT can assist not only in water treatment but also in other water delivery systems. Smart irrigation for farming or city parks measures the soil moisture and the current weather

Using IIoT for Conservation & Cost Cutting Initiatives

to determine if and when water is needed. This reduces waste but also increases the retention of crops by preventing over or under-watering. Sewer management can also be alerted to and proactively plan for potential flooding due to overflow, especially due to stormy weather.

On a consumer level, IoT meters installed in homes allow consumers to see their water usage in real time and give them the power to make informed choices about personal water conservation or to alert them of an outage or system repair.
When it comes to water management and conservation, IIoT is a technology with wide-reaching effects.

An Unlikely Source for Monitoring COVID-19: Wastewater

Since the outbreak of COVID-19, wastewater has garnered attention as a testing source for monitoring the virus. Wastewater management is also undergoing rapid changes for remote operations

Wastewater Testing for COVID-19

When someone is infected with COVID-19, some of the RNA from the virus's cells passes through their body and is excreted. IoT devices uses electrochemical and optical sensors to detect RNA in wastewater. An automatic sampler may also collect wastewater for further lab analysis. The collected data helps scientists determine if a community infection is present and estimate the number of people infected.

This method of detection is faster and more comprehensive than clinical testing as it may be weeks before COVID-19 symptoms present themselves and an individual is tested for the disease. Tests can also take up to a week to produce results. Someone with mild symptoms or who is asymptomatic might not get tested at all, and some communities may have limited testing available. Sensors can detect the virus in wastewater quickly and reliably. This allows city officials to control the spread in specific areas without shutting down entire communities.

In August, the University of Arizona utilized wastewater testing to identify and stop the spread of COVID-19 among its students. The University tested wastewater from campus dormitories and detected the virus in one location. Clinical tests were done on students living in the dormitory and two asymptomatic students were identified and able to continue learning through online classes.

In South Carolina, Clemson University has been testing wastewater for COVID-19 since May. The University of South Carolina is working with the South Carolina Department of Health and Environmental Control and the Center for Disease Control in Atlanta to test wastewater locally. As programs like this gain traction, the Department of Health and Human Services plans to implement wastewater testing throughout 30% of the United States.

An Unlikely Source for Monitoring COVID-19: Wastewater

Digital Wastewater Management

With the outbreak of COVID-19 came the need for social distancing. Many workplaces have moved to remote operations to prevent the spread. In wastewater management, IoT allows for the remote operation of pressure gauges, pumps, heating, ventilation and lighting. IoT can also monitor chemicals in water treatment to prevent waste and sewer levels to prevent overflow, resulting in cost savings.