Moving Toward a Data-Driven Future

IoT and smart automation will transform the Metropolitan Water Reclamation District of Greater Chicago.

Until recently, checking the levels of Chicago-area waterways often required staff at the Metropolitan Water Reclamation District of Greater Chicago (MWRD) to climb into row boats and physically read measurement equipment. Now, the district uses internet-connected sensors to automatically check water levels and send the data to the cloud, where it can be shared and analyzed.

Automating these measurements, which began as a small pilot project and has grown considerably, is just the start of Internet of Things (IoT) deployment for the massive district, which treats wastewater and manages stormwater for the greater Chicago region. John Sudduth, the district's CIO, says IoT and other forms of digital technology are poised to revolutionize utilities.

"The utility industry as a whole is ripe for disruption," Sudduth says. "There are so many efficiencies that can be gained, particularly with these IoT devices."

Along with automating data collection processes, the district is finding new ways to share that information and engage with citizens.

For instance, a new MWRD Geohub gives citizens and others a central web portal to access geographic information collected and published by the district. The site offers an array of interactive maps showing water quality, fish populations, watershed planning and more. There's also a growing number of apps, including a recently released service that lets residents report and track the resolution of incidents like water pollution. Citizens can download a mobile version of the reporting app to their smartphones.

"That was kind of our breakthrough on citizen engagement," Sudduth says. "We wanted to communicate with them more effectively, so we built an iOS application. That opened the floodgates, no pun intended, and people wanted more engagement and more data for public consumption."

To satisfy that demand, the district will evolve toward offering more raw data that can be consumed by universities and other organizations for environmental modeling, to support business decisions or for other purposes. Sudduth also expects the district itself to become more data driven as it adopts smart sensors and analytics that will generate new insights to support infrastructure maintenance.

"There are devices out there right now that can monitor the health of infrastructure," Sudduth says. "They can predict where a pipe is going to break based on the vibration that's coming through the pipe. That type of technology will allow us to be a lot more proactive."

Innovating Securely

IoT-driven innovations like these will help utilities improve efficiency and performance, says AT&T Principal Architect David Leach, but implementing them requires sophisticated security strategies to address new risks. That's because industrial control systems (ICS) — the specialized standalone systems traditionally used to turn on valves and other industrial equipment — inevitably will move closer to general business IT systems that are connected to the internet. As these technologies start to converge, utility districts will need new security tools and techniques.

"Utilities aren't going to want to keep completely replicating systems on the control operations and IT side. From an efficiency standpoint, they'll want to start bringing these systems together," Leach says. "But

you can't consider that until you have a solid, mature security posture."

Among other things, districts will need strong identity and access controls to ensure only authorized users can access critical functions and information, as well as sophisticated monitoring systems to detect suspicious activities. Leach recommends adopting a "zero-trust" approach that requires users and devices to authenticate themselves every time they perform an action or transaction.

Leach anticipates that convergence of control operations and IT will happen first with monitoring systems, adding it may take "a very long time" for actual control systems to make such a move. But development of sophisticated security policies and postures — which will require both strong internal security talent and partnerships with third-party security specialists — puts districts in a position to evolve their systems in this direction.

"In this case, information security solutions and policies will be business enablers," he says.

Leach also predicts utilities will benefit from new network technologies as they expand their IoT adoption. The combination of 5G and software-defined networks, for instance, will let districts securely connect growing sensor arrays without deploying new network infrastructure to remote locations.

"These technologies create networks that are ubiquitous and secure," he says, "so you can make your business decisions based on what you need to get done, versus how you're going to connect it."

Managing Change

IoT adoption already is driving changes within MWRD, Sudduth says. For instance, although the district has separate staffs to support operating technology and IT, security issues are prompting these groups to collaborate.

Market Overview:
Wastewater Districts

WASTEWATER DISTRICTS ANTICIPATE SIGNIFICANT BENEFITS from technologies that let them automate data collection and analyze that information more effectively. The most immediate gains will come from eliminating manual data collection processes through the deployment of network-connected sensors. Longer-term — and potentially even bigger — gains will come from using these data streams to predict costly and disruptive events such as pipe breaks and wastewater overflows.

The National Association of Clean Water Agencies notes that data-driven technologies will help wastewater utilities cope with rising regulatory costs, contain maintenance expenses for aging infrastructure and proactively manage risk.[1] Using data analytics to address these growing costs will play an important role in meeting public demand for affordable wastewater service.

Results from the 2019 Special Districts Survey show that wastewater districts are evaluating new technologies that support data-driven approaches. Predictive analytics ranked among the top three emerging technologies being investigated by district leaders. More than a third of respondents said they're evaluating drones, which can be used to monitor environmental conditions and infrastructure health.

"The operating staff doesn't have the cybersecurity skills to ensure these new connected devices are secure," he says. "That's really driving our operations department to work closely with our IT department."

In addition, the district is helping employees cope with the impact of IoT and automation.

"Change is not easy for anyone, but when you're talking about changing an organization that in our case has been in existence for 130 years, it becomes a pretty daunting task," Sudduth says. "We have to reassure people that this isn't going to take their jobs — they just may work a little differently."

This evolution, while disruptive, positions the district to become more efficient and customer-centric. Today, MWRD is automating data collection from rain gauges and other measurement equipment. In the future, Sudduth envisions adding intelligence to systems that can make recommendations or take actions based on the data they're collecting — whether that's actuating stormwater valves to prevent overflows or predicting broken pipes before they happen. At the same time, more data collected by intelligent systems will be shared with citizens and businesses, giving them new insights and helping them make better decisions.

"We want to be good partners to the citizens of Cook County," Sudduth says. "We want to use the technology that's out there to make our operation more efficient to better serve our constituents."

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[1]https://www.nacwa.org/docs/default-source/news-publications/White-Papers/2017-08-01digitalutilityfuture.pdf?sfvrsn=8