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EDITOR'S LETTER

By Kevin Westerling
Chief Editor, editor@wateronline.com

Sustainability In Times Of Stress — A 'Bottom Line' Endeavor

What's your company's "bottom line?" If "sustainable water management" is your first answer, you probably work in municipal water.

More and more, however, industrial operators must also consider sustainable water management as an essential function — even if they primarily see the "bottom line" in terms of profit margin. That's because, as water becomes scarcer in the face of climate change and population growth, the ability to efficiently manage it within heavy-use industries can either lift or sink profits — not to mention the impact on surrounding communities.

To understand the business, human, and environmental challenges of water management and how to surmount them, I spoke with Emilio Tenuta, senior vice president of corporate sustainability for Ecolab. A 36-year veteran at the company, he explains the role of smart technology for saving water (and money), and how Ecolab has expanded its stake in water stewardship by partnering to supply communities in need across the globe.

And, as if ongoing water and climate concerns weren't enough, all of our collective vulnerabilities worsened with the onset of the COVID-19 pandemic. In the following Q&A, Tenuta tackles this varied, intertwined set of issues, while keeping focus on the true "bottom line" — water for all.

What were the global trends regarding water use, availability, and climate impacts before the pandemic?

Prior to the pandemic, the world was already grappling with the growing threat of water stress. The demand for water is rising with our growing population, and [water] is needed to fuel industry and produce resources to feed the world. At the same time, climate change is drastically altering the dynamics of hydrological cycles around the world, resulting in increased droughts and flooding events. Flooding in the American Midwest has cost farmers their crop yields and caused billions in damage. And on the other end of the spectrum, in 2019 the City of Chennai, India, became the second city after Cape Town, South Africa, to declare a "Day Zero," a term used to reference the day when local water supplies reach a critically low point.

Global water stress is an incredibly complex situation, as water remains an unequal resource around the world. While some regions have plentiful supplies, others are struggling to meet the needs of their ecosystems, communities, and economies. As water stress issues persist, we've seen governments, NGOs [non-governmental organizations], and the private sector band together to take collective action in addressing this challenge.

At the start of 2020, the United Nations CEO Water Mandate launched the Water Resilience Coalition alongside founding members — including Ecolab, Microsoft, Cargill, AB InBev, and others — to take action with a private-public sector approach to local water issues. These collective efforts aim to address the uncertainty that many communities face around water quality, quantity, and access, which have been further exacerbated by the pandemic.

How has the pandemic affected the momentum and attention around climate action?

COVID-19 is a real test to the sustainability commitments and initiatives that we've seen from both government and business in recent years. The current pandemic has required our urgent attention, but even so, more and more companies are setting ambitious sustainability goals.

Geographies experiencing extreme water stress are at even higher risk during the pandemic, given the lack of water for use in basic hygiene. As we combat this pandemic and build a more resilient future, climate and water need to be considered as part of the solution to supporting healthy environments.

If we can come together in solidarity to turn the tide on this pandemic, we also have what it takes to achieve the action needed to address climate threats such as the water crisis. It's going to be a big job, but we know it can be done, because we've seen it in our own operations and in our work with our partners.

How can technology satisfy the demand for water without adding to our carbon footprint?

Investing in water-related technology doesn't mean sacrificing progress on reducing emissions. Digital and IoT [Internet of Things] technologies are practical applications for most industrial facilities to implement smart water management practices and to have better visibility into their water use. Technology has advanced to a point where we can now monitor, evaluate, and analyze water use in ways that we couldn't in the past, making it easier to identify risks. This technology enables a level of transparency that allows facility managers to identify and diagnose areas of their operations that can be made more efficient through better methods of water treatment, or simply avoiding using more water resources than are needed.

The insights we have today provide the data needed to make the business case for action, implement effective localized solutions, and report progress back to the boardroom.

Which sectors or applications should employ these technologies for greatest impact? How would you describe ROI, in most cases, for the adopters of sustainable solutions?

There are certain industries, such as energy production, the agriculture supply chain, and heavy manufacturing, that have an incredible opportunity for energy and cost savings by cutting their water use. Companies that are true leaders in these industries, both in financial performance and in operating sustainably, have invested in ways to reduce their water footprint.

Recently, we partnered with Exelon Generation to create savings of 1.56 billion cubic meters of water (412 billion gallons) and

eliminate the need for 11 million kilowatts due to shorter outages, saving close to $5 million. Ecolab helped them by using innovative chemistry for water treatment and implementing sophisticated automation technology to provide 24/7 monitoring and control of chemistry performance.

We worked with food and agriculture giant ADM to help them save 7 million cubic meters of water (1.8 billion gallons) and avoid 31,500 metric tons of CO2 emissions per year, saving $28 million. We partnered with them at 212 facilities around the globe to deploy systems that helped them better monitor and manage water use.

We also worked with one of the oldest steel mills in India to help upgrade its outdated water management technology. Now the facility is saving 1.45 million cubic meters of water (383 million gallons) and avoiding 3,000 metric tons of CO2 emissions per year, saving close to $8 million.

Implementing smart water management practices and technology leads to both short- and long-term savings. We're seeing major brands and leaders across industries, from tech companies to automakers, prioritize water management across their organizations, as it not only saves costs but makes their operations more resilient to climate change.

Is there pressure on private industry — financial, social, or otherwise — to adopt solutions that address water challenges in their communities?

There has certainly been more pressure from international bodies and activist movements, but we're seeing some of the most effective pressure come from the investment community. Environmental, social, and corporate governance (ESG) investing is up sharply. Major investment firms such as BlackRock are showing growing concern not just for the climate, but specifically for water. In July of this year, in the midst of the pandemic, BlackRock released their report on the financial risk of water,[1] and how most companies underestimate the threat.

With the frequency with which companies have started to make public commitments about climate action or announce goals, there has been a counterbalance of activists and NGOs holding businesses responsible. You cannot get away with greenwashing today, and a truly climate-concerned company will not only talk about sustainability but will also take action and advocate for change. A company's impact on water resources falls under this same scrutiny, particularly how their operations affect water availability and quality.

Since water is a local issue, we believe that it needs to be addressed as such, at the facility level. When we helped launch the Water Resilience Coalition earlier this year, we committed to finding solutions to achieve a net-positive water impact in water-stressed basins in which member companies operate.

Related to this effort, we're partnering with Water.org to help enable access to sustainable drinking water and improved sanitation for 100,000 people living in poverty in India, while contributing more than 26.4 million gallons of water per year to watershed health in extremely high-stress river basins in which Ecolab operates. Water.org works with microfinance institutions and other organizations to enable them to provide water loans to families so that they can invest in a water tap, rain catchment system, and/or toilet for their home or community.

We believe it's these types of partnerships that move the needle to reduce the risk water stress poses to the world. Businesses are starting to understand the risks, and leading global companies are actively working to manage and reduce their water footprint — but, in reality, corporate water use has been going up, not down, in recent years. There's much more work that needs to be done.

What impact, if any, do you think the change of U.S. presidential administrations will bring to water governance?

With the Biden administration we can anticipate heightened scrutiny around climate change going forward. We know that the United States will rejoin the Paris Climate agreement, which many major U.S.-based brands have already pledged to and adopted sustainability goals to match its ambitions.

With this, companies could face increased pressures and regulation around water quality, water use, and carbon emissions. There's an opportunity for businesses to change the way they view and use water in their operations. There's also an opportunity for business and government to work together to drive advancements in water governance, whether that takes the form of legislation or investments in infrastructure. Investments in infrastructure that support reuse and recycling of water, which enables companies to more efficiently use the water available to them, will help reduce water use on a national level. ■

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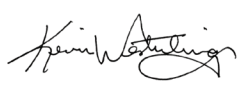

Water Innovations

101 Gibraltar Road, Suite 100
Horsham, PA 19044
PH: (215) 675-1800
FX: (814) 899-5587
Email: info@wateronline.com
Website: www.wateronline.com

CHIEF EDITOR
Kevin Westerling
(215) 675-1800 ext. 120
kwesterling@vertmarkets.com

PUBLISHER
Travis Kennedy
(215) 675-1800 ext. 122
tkennedy@vertmarkets.com

ASSOCIATE PUBLISHER
Patrick Gallagher
(215) 675-1800 ext. 129
pgallagher@vertmarkets.com

PRODUCT MANAGER
Bill King
(215) 675-1800 ext. 100
bking@vertmarkets.com

MANAGING EDITOR
Karen White
(814) 897-9000 ext. 316
kwhite@vertmarkets.com

PRODUCTION DIRECTOR
Lynn Netkowicz
(814) 897-9000 ext. 205
lnetkowicz@vertmarkets.com

CREATIVE DIRECTOR
William Pompilii
(215) 675-1800 ext. 145
bpompilii@vertmarkets.com

PRODUCTION MANAGER
Susan Day
(215) 675-1800 ext. 101
sday@vertmarkets.com

DIRECTOR OF AUDIENCE DEVELOPMENT
Martin Zapolski
(814) 897-9000 ext. 337
mzapolski@vertmarkets.com

DIRECTOR OF ONLINE DEVELOPMENT
Art Glenn
aglenn@vertmarkets.com

Reprints, Eprints, and NXTprints
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The Retirement Wave Is Coming:

How Will Your Utility Manage?

Digital transformation, but also diversity and inclusion, will be essential for recruiting the next generation of utility workers.

By Ali Barsamian

Our lives depend on access to running water and reliable gas and electricity. It is hard to imagine a day without a steady flow and, luckily, in America, it is rare that we have to consider the possibility. For that security, we must be thankful for the hardworking utility professionals who spend their days ensuring that we have continued access to safe and reliable drinking water. Particularly as we continue to be faced with the challenges of the COVID-19 pandemic, utility professionals continue to deliver on their essential work. These professionals play a vital role in protecting public health. And, for this reason, maintaining a consistent and reliable workforce is absolutely crucial. Thus, a substantial wave of impending retirements in an industry facing recruiting challenges should be cause for concern.

It is projected that, in the next 10 years, 37 percent of utility workers will retire.[1] This is a substantial percentage of the workforce needing to be replenished. No matter the size of a utility, retirements will be felt as desks are left empty and tasks and responsibilities are left without owners. As a result, utility senior management teams must be prepared to do one of two things: do more with a smaller team, and/or implement programs that will help attract and recruit young talent to their organizations to meet current and future needs. And, as a utility considers its recruiting and onboarding process, today, more than ever, diversity and inclusion must be top of mind.

Option 1: Doing More With Less

As senior management strategizes, they must consider their internal resources. The challenge to replace retirees will acutely affect smaller utilities, which have fewer resources for recruiting employees, providing professional development training once they are hired, and supporting extensive knowledge transfer between newly hired and current employees. Ultimately, these utilities need to accept the challenge to accomplish their work with fewer labor resources. How can they do such a thing? By implementing solutions that digitize and automate previously laborious, manual processes, utilities can do more, despite having fewer team members to handle the work.

One prime area, prone for improvement, is a utility's leak identification and management process. Many utilities report spending hours on end manually monitoring consumption data to identify customer leaks, communicate alerts to their customers, and subsequently handle leak abatement requests. The Village of Glenview, IL,[2] reported having to spend one full-time employee (FTE) day per week on just mailing leak alerts to their customers. Conversely, WaterSmart's leak detection, alerting, and resolution platform[3] automatically identifies leaks based upon predetermined parameters, and sends a personalized leak alert to the customer by mail, e-mail, SMS text message, or automated voice call. By implementing the WaterSmart solution, the South Tahoe Public Utility District[4] similarly experienced 10 hours of time saved per week, plus they were able to reduce their spend on managing their leak abatement program by 30 percent. That is valuable time back in their week that the team can use to fill any gaps left behind by retiring colleagues, and potential capital available to be spent on recruiting efforts.

Option 2: Attracting And Recruiting Young Talent To The Water Industry

The U.S. EPA, states, and industry organizations are working to promote careers in the utility sector with campaigns like Work for Water[5] in an attempt to build interest and recruit fresh, new talent. However, building interest amongst Millennials and Generation Z workers may be difficult in a historically "behind the times" industry. A recent survey found that 91 percent of Generation Z,[6] the generation that's just beginning to enter the workforce, has said that technological sophistication would impact their interest in working at a company. This is a huge revelation, which suggests that companies lagging behind technologically are missing out on the upcoming future talent.

Adapting to the digital transformation of utilities will be a critical component of recruiting young talent. VertexOne's 200-plus utility partners and other utility leaders who embrace the value of software solutions and the digital technological evolution will be the first to reap the rewards of a bright, youthful, and innovative workforce prepared to tackle the many challenges that stand in front of the water industry.

Building An Inclusive And Diverse Workforce

As utilities prepare to recruit and onboard new employees, they must take some time to be introspective and really consider whether their workforce culture embodies inclusivity and diversity. Organizations and employers of all kinds are having these important, long-overdue, and challenging conversations following too many years of ignoring and brushing racism, ageism, sexism, and more under the rug. At VertexOne, we developed our Diversity & Inclusion Council this year to do just that. Experts share that progress and improvement start at the top, and thus, all management staff must begin to walk the walk and talk the talk of inclusion and diversity as soon as possible. For those seeking additional guidance on what they can do internally, this webinar provides deep insights from experienced utility professionals on what they have seen work.

The time is now for senior management to strategize and prepare to answer those "Hey, who is in charge of …," "Does anyone have time to handle ...," and "Who is going to take over this project …" questions. As each utility starts to define a plan around your shifting workforce, VertexOne is ready to help with time-saving, automated solutions and industry expertise. Visit https://www.vertexone.net/demo to learn more today. ■

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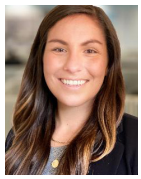
About The Author



Ali Barsamian has worked closely with the marketing, operations, and policy teams at VertexOne and WaterSmart to advocate for software solutions as a tool to address utility affordability concerns and evolving customer expectations. She oversees VertexOne's marketing activities and works closely aligned with the Sales and Business Development teams. Ali completed the Water Education Foundation's Water Leaders program in 2017. Prior to joining the team, Ali worked with the cities and non-profits to manage zoning code enforcement, general plan composition, and open space conservation. Ali received a B.S. in Environmental Policy Analysis and Planning with a focus on Advanced Policy Analysis from the University of California, Davis.

PANDEMIC ADDS NEW RESILIENCY CONCERNS FOR WATER PROVIDERS

A survey reveals what COVID-19 has wrought at utilities, and what actions may be necessary to prepare for future events.

By Karen Burgi, Jo Ann Jackson, Kevin Laptos, Ed Rectenwald, and Jim Schlaman

Water utilities historically have delivered clean, dependable water for generations, so reliably that in the U.S., it's often been taken for granted and considered an expectation. But resilience concerns are growing, given aging infrastructure, population growth, and stresses on existing supplies.

Now, add COVID-19 to that mix — the latest unforeseen event to challenge the industry over the past two decades.

After the September 2001 terrorist attacks, regulators pressed U.S. water providers to address bioterrorism and cybersecurity in their operations. Ensuing worries about climate change have brought into sharper focus threats posed by everything from drought cycles to higher rainfall intensity events, sea-level rise, and its resulting migration of higher-salinity water into groundwater aquifers.

With the pandemic comes an opportunity for the industry to critically rethink its resiliency strategies as the surge of remote working has redistributed water demand from urban centers to the suburbs and beyond, potentially straining those outlying infrastructures with higher peak demands. All the while, managers of utilities have become more isolated as social distancing has limited the number of people who can be in operational centers at any given time, changing and sometimes complicating decision-making procedures.

Already, even as the full sweep of the ongoing pandemic's impacts on the industry continue to emerge, lessons are being learned, including about how to continue distributing water even with a utility's workforce more fragmented.

But a vexing question has surfaced: Does COVID-19 mean an inflection point for utilities to now incorporate pandemics into their resilience planning? Is the pandemic driving new concerns around health, safety, and workforce continuity planning? Does this drive financial and capital reprioritization for the tens of thousands of U.S. water utilities, big and small?

The short answer is yes.

Resiliency: The More Contingency Plans, The Better

Without question, the water industry is an asset-intensive, rate-restricted industry that requires informed decision-making to effectively balance capital investment and rising operational expenses with resistance to rate increases. This makes the water sector notoriously complex, variable, and uncertain.

The COVID-19 pandemic amplified that, exposing weaknesses in utilities' resilience planning — or pressing water providers to finally develop a robust resilience blueprint if they lacked one in the first place.

Consider it a generational opportunity, grounded in the premise that the more contingencies you have planned for, the better.

Water utilities start in small, centralized locations, and grow as the communities they serve expand. Investment typically has gone into keeping up with municipal growth and daily operations.

Meanwhile, as the water system grows and grows, the pipes that have been in the ground generally only get attention when they're close to failure, as illustrated by a survey of hundreds of industry stakeholders for Black & Veatch's recent *2020 Strategic Directions: Water Report*.[1] Replacing that pipe is costly and disruptive.

For years, resilience-minded U.S. water utilities designed and planned their infrastructure systems based on certain demand patterns and diurnal peaking factors. In many areas, COVID-19 has turned those models on their heads, shifting demand to residential areas from urban commercial and industrial (C&I) areas that, in many cases, were disrupted by the pandemic, thereby stressing distribution systems in residential areas that may have infrastructure without enough hydraulic capacity to handle the increases in demands. All the while, formerly bustling urban centers face lower flows and potential water quality concerns.

Source: Black & Veatch "*2020 Strategic Directions: Water Report*"

So far, the issue of changing demand patterns is largely anecdotal, but, for many communities, it has been telling.

In Wellington, CO, with 6,300 residents, water demand spiked 46 percent in May over the highest total ever recorded for that month, Bob Gowing, the city's public works director, told the *Loveland Reporter-Herald* in October. That trend, he added, pressed on through the summer, "easily attributable to more folks staying at home and changing their daily patterns," straining staff and wastewater systems so much that Wellington ended bulk water sales for construction while limiting its use for irrigation.

What's perplexing is gauging the permanence of such shifts in water demands — or whether this constitutes the new normal, at least for the coming year or two, as C&I customers continue to rethink the way they do business and, by extension, use water.

Given such pandemic-prompted changes, utilities would be wise to assess whether their pumping facilities serving residential areas are undersized and in need of upgrades. Is there a need for additional water storage in those areas? Are there, or will there be, water quality issues in some commercial areas because demand there is now lower, given the dramatic change in the system's performance?

Without question, it's a moving target in need of being addressed.

COVID And The Water Utility Workforce

Some utilities already may be ahead of the game in resilience planning, if for no other reason than because of their geographies. In Florida and much of the Gulf Coast, for instance, water utilities may be more capable of weathering such challenges as the pandemic because they already have rigorous resiliency and emergency frameworks in place to mitigate the effects of hurricanes and other extreme wet-weather events.

More than 80 percent of respondents to Black & Veatch's recent survey listed natural or man-made disasters as their top resilience concerns. Catastrophic infrastructure failure was a distant second (56 percent), followed by another climate change-related category — extended drought and supply restrictions — at 38 percent.

Such utilities, for example, already may have entrenched "backup" protocols for addressing shifting staffing demands at times when hurricanes force their operations managers to work remotely while sheltered in place. The COVID-19 pandemic may have complicated that, given social distancing directives meant to minimize exposure across the workforce.

In short, utilities would be well-served giving thoughtful deliberation about key questions that, at least recently, have had them scrambling to answer. When it comes to better future-proofing a master plan, how can essential workers be accommodated without compromising services when a sudden event arises? Which employees can work remotely? What precise roles can be done from home?

The America's Water Infrastructure Act,[2] signed into law in 2018, may help provide at least a basic framework to build upon, requiring community water systems serving at least 3,300 people to develop or update risk assessments and emergency response plans.

Source: Black & Veatch "*2020 Strategic Directions: Water Report*"

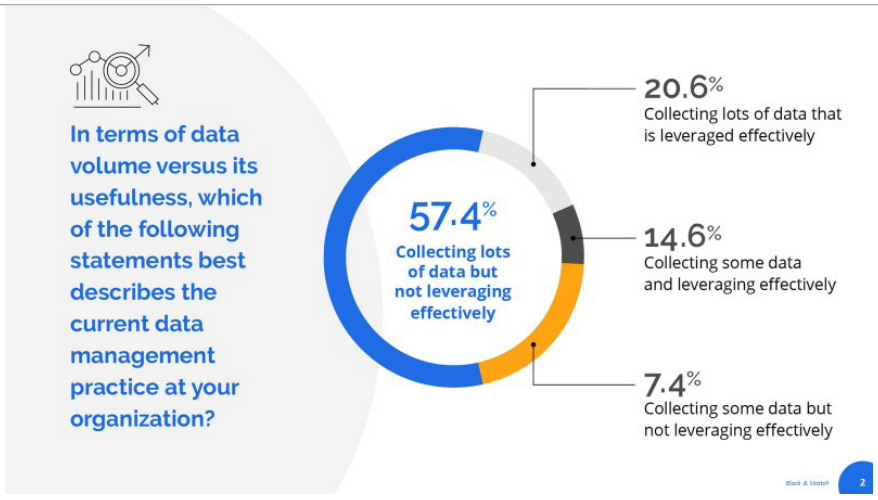
Matters Of Finances, Investment, And Data

To no one's surprise, as Black & Veatch's *2020 Strategic Directions: Water Report* pointed out in June, U.S. water utilities have taken an operational and financial hit from the pandemic as some of their biggest clients — C&I users — halted operations and tens of millions of layoffs of U.S. workers stymied the ability of households to pay their utility bills, undercutting revenue and cash flows to water and energy providers. Around the country, water providers suspended water and wastewater shutoffs to delinquent accounts, in both the interest of humanity, and as an affirmation of the importance of water and sanitation in trying to contain the virus.

Industry observers predicted that operators of drinking water, clean water, and water recycling systems faced billions

of dollars in lost revenue, fueling the prospect that without taxpayer help, those financial shortfalls could be passed on to water customers in subsequent years and lead to future rate increases.

Regardless, the industry would be wise to creatively find ways to modernize through innovation in strategies, operations, and funding to protect human health and the environment and to empower the economic engine that comes from infrastructure investment.



Source: Black & Veatch "*2020 Strategic Directions: Water Report*"

Even though infrastructure investment has taken a back seat to other priorities, much of it is doable without great cost. Water utilities and municipalities, for example, could bolster their embrace of the power of data — "digital water" — to gain insight about when, where, and how much to invest in their systems. The opportunity to gather and integrate data using current data collection systems — combined with evolving next-generation, cost-effective sensors and smart devices — provides the input to allow for the predictive analytics to detect leaks, forecast usage, reduce costs, and everything in between.

Asked about their data's meaningfulness, nearly 60 percent of respondents to Black & Veatch's survey reported that, while they were collecting "lots" of data, it wasn't being leveraged to actionable information. Just 20 percent said they were making the most of their data, with only 15 percent admitting they were corralling "some" data and using it effectively. Siloed data amounts to lost opportunity, costing operators the vast benefits of expansive data harvesting that can give meaningful insights about their entire water ecosystem.

Investment should be thoughtful, with utilities carefully assessing demand trends in making sure that such things as new pipelines or substations are slotted for the right places before any ground is broken on such projects.

Utilities also might consider upgrading their operational networking. Many may have lacked remote access (VPN) that would have allowed them to tap into their systems, crimping their ability to monitor assets or to collaborate. Such distance and disconnect between operations staff and their bosses can delay reaction time when it's needed most.

Getting commercial insurance also may be an option for water utilities as a resilience hedge against future unforeseen disruptions and the absence of federal financial assistance.

The Time To Act Is Now

Across the industry, no matter the utility's location, the trend is to become more proactive when it comes to building resilient water supplies — and to invest in a future need not yet entirely realized. Many of these efforts are regional.

And, while the added complication of COVID-19 has further strained the bottom lines of many water utilities, this moment presents the opportunity to accelerate innovation in strategy, operations, and funding to propel sustainable, resilient systems.

Only with time will the extent of COVID-19's financial implications on the industry become clearer. But the current pandemic situation demonstrates firsthand the critical need for water utilities to continue to evaluate and plan for vulnerabilities and potential system failures to mitigate against a changing, uncertain future.

Whether it's a global pandemic, catastrophic droughts, raging wildfires, or destructive floods, utilities must make their systems reliable and resilient to meet the challenges. ■

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About The Authors


Karen Burgi is a regional planning lead for Black & Veatch's water business.


Kevin Laptos is the national distribution and collection system planning practice leader for Black & Veatch's water business.


Jim Schlaman is the director of planning and water resources for Black & Veatch's water business and serves on the One Water Council for the U.S. Water Alliance.


Jo Ann Jackson leads Black & Veatch's national "One Water" planning practice.


Ed Rectenwald is a hydrogeology national practice lead for Black & Veatch's water business.

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Statistical Modeling In Support Of Lead Service Line Identification, Inventory, And Replacement

One of the most high-profile, pressing, and complicated infrastructure problems gets chopped down to size with the help of data-driven analysis.

By Jake Abernethy and Eric Schwartz

Replacing lead service lines (LSLs) is a public health and infrastructure priority that can be a costly and time-consuming endeavor for municipalities. Statistical modeling allows for faster, more accurate identification of LSLs, equipping decision-makers with the information they need to plan and prioritize replacement work.

The EPA estimates that there are between 6 million to 10 million LSLs in the U.S., and the Robert Wood Johnson Foundation and The Pew Charitable Trust report that removing LSLs from homes of children born only in 2018 would protect more than 350,000 children and yield more than $2.7 billion in future benefits.

The American Water Works Association (AWWA) estimates that replacement costs could be as high as $30 billion. Uncertainty around the number and location of LSLs makes it difficult to execute efficient replacement programs. Statistical modeling has been proven to have significant positive impacts in the identification, inventory, and replacement of LSLs, reducing the time and cost of replacement.

Compared to a conventional approach, the statistical model allowed the replacement crews to better target homes for replacement, empowering decision-makers with data to save tens of millions of dollars and accelerate the removal of lead pipes.

Conventional Methods vs. Statistical Modeling

The processes that water systems use to budget and prioritize their replacement projects carry significant public health and utility costs, and they are often using incomplete, inaccurate, and unreliable historical records to make these decisions. It is these uncertainties that statistical modeling is focused on reducing. Data-driven analyses, powered by fundamental statistical methods and machine learning, can allow communities to accurately inventory LSLs and accelerate their removal in the most efficient and cost-effective way.

BlueConduit, a water data analytics company that helps cities reduce uncertainty around LSL inventory and location, has seen this firsthand. One city the team worked with had initially estimated that 10 to 20 percent of its pipes contained lead. However,

a statistical analysis that included a representative set of inspections estimated that roughly 37 percent of active water accounts contained lead. After 25,000 inspections, the true proportion of lead in the community was 38 percent. This accuracy allowed the city to request the appropriate funding to remediate the problem and target the homes most likely to have lead lines. The same data challenges due to misleading or outdated records are shared by many municipalities and water utilities.

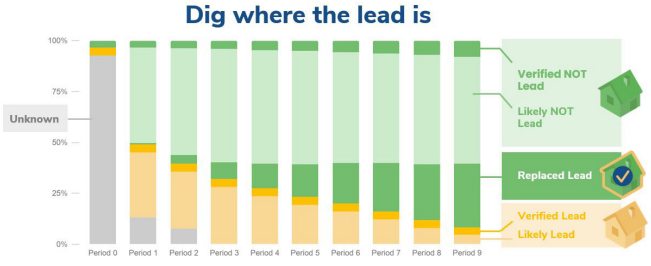
Compared to a conventional approach, the statistical model allowed the replacement crews to better target homes for replacement, empowering decision-makers with data to save tens of millions of dollars and accelerate the removal of lead pipes.

While statistical methods can help all types of communities, they provide the greatest benefits in cities with greater uncertainty.

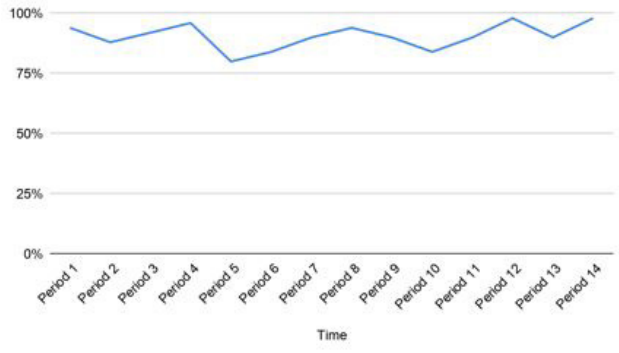
While statistical methods can help all types of communities, they provide the greatest benefits in cities with greater uncertainty.

How It Works

Statistical modeling uses information that is known (e.g., location, year built, water-main size and material, construction records, etc.) to make an initial prediction about something that is not known with certainty — in this case, service line material. The utility gathers data on service line material at a representative set of homes. Combining that data with the previously known information, the model assigns a material likelihood (that is, a probability of lead between 0 to 100 percent) to parcels with "Unknown" SL materials. As those unknown materials become verified, the statistical model incorporates this new information and updates the likelihoods. These parcel-level likelihoods help municipalities "dig where the lead is," saving time and money while eliminating negative environmental health impact.



In a recent project, BlueConduit's model's accuracy outperformed the city's previous partner by more than 25 percentage points. Over time, the hit-rate accuracy consistently remained above 75 percent.

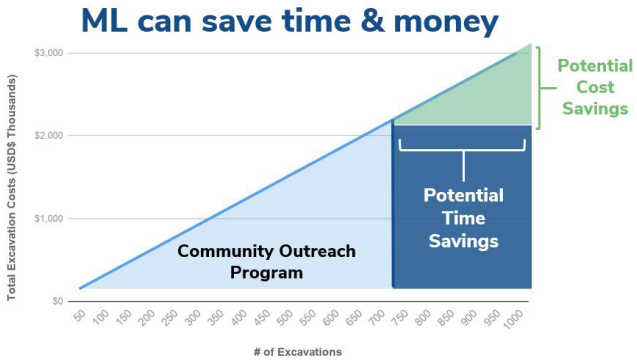


Key Benefits Of Statistical Modeling

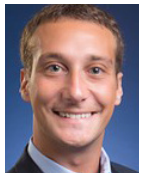
The accuracy of this model drives three primary benefits. First, a municipality saves time by avoiding unneeded excavations. For example, for a municipality targeting 500 service line replacements in a given timeframe, the statistical model would suggest excavating 725 sites while the baseline model would suggest excavating 1,000 sites. This more accurate inventory provided by statistical modeling helps a city better plan and budget for the pipes that may need to be replaced.

Second, when addressing the "Unknowns," using a conservative 70 percent statistical model accuracy rate compared to 50 percent, the statistical model could generate more than 25 percent in savings. Using the above example, which saved 275 excavations, at an estimated cost per excavation of $3,000, the statistical model would save $825,000.

Finally, the quick identification of those parcels most likely to have an LSL enables municipalities to proactively engage in community outreach and adopt a program (e.g., water filter distribution) to reduce potential lead exposure before any excavation begins. ■



About The Authors



Jake Abernethy and Eric Schwartz are the co-founders of BlueConduit. Additionally, Abernethy is an associate professor in computer science at the Georgia Institute of Technology, and Schwartz is an associate professor of marketing at the University of Michigan. They have pioneered the use of machine learning to help municipalities and utilities identify and inventory lead service lines, helping municipalities save millions of dollars and accelerating the remediation of this critical health issue. Initially working with Flint, MI, BlueConduit now works with municipalities across the United States and Canada. Recognized as a leader in its field, BlueConduit has provided legislative policy development support and has had its work recognized by several media outlets (https://www.blueconduit.com/blog).

IN THE GREEN:

Embracing Innovation To Finance The New Localized Water Infrastructure

An uncommon financing model is proving effective at resolving an all-too-common issue throughout the U.S. — underfunded water infrastructure needs.

By Cynthia Koehler

It is a shiny new year and a brand new day in the water sector. An increased focus on water equity and affordability is coinciding with emerging finance mechanisms for unconventional water strategies. This article briefly explores these trends and highlights several communities and utilities leading the way.

One of the more exciting innovations that WaterNow has successfully advocated for is expanding financing opportunities for localized water infrastructure. Increasingly, utilities are turning to localized options to supplement and extend conventional built systems. Localized strategies being implemented on public and private properties in multiple U.S. communities include water use efficiency, green stormwater installations, and private lead service line (LSL) replacements, among others. These projects perform the same functions as conventional water infrastructure — extending water supply, managing stormwater, and eliminating pollutants — often more affordably and equitably. Typically, they also provide critical cobenefits such as improved climate resilience, local green space, and jobs creation.

The challenge is often finding the funds to bring these strategies to scale. Most utilities pay for green stormwater infrastructure (GSI) or efficiency programs, for example, out of tightly constrained operating budgets or by pursuing limited grant opportunities. As utilities start thinking about deploying these approaches at large scale, access to capital markets will be key, with tax-exempt municipal bonds typically the most cost-effective borrowing option. It has long been assumed that bond proceeds are available only to finance utility-owned and -controlled assets, like pipes, pump stations, and tunnels. However, a 2018 rule clarification issued by the Governmental Accounting Standards Board (GASB) has opened up a new universe of opportunity.

The new GASB guidance involves a technical rule applying to most public utilities called "Regulated Operations" that, boiled down, establishes that public spending on localized water programs qualifies for capital treatment. This means that utilities can invest in GSI or efficiency measures on par with conventional infrastructure, including this decentralized infrastructure in capital plans and amortizing costs over time. Practically, this clarification is a game changer, empowering utilities to access municipal bond dollars for a host of localized water programs.

Related to this development, utilities are also increasingly open to pay-for-performance financing. Environmental Impact Bonds (EIBs), for example, are designed to accomplish social or environmental objectives while providing a meaningful return to investors. EIBs leverage private investment using a "pay for success" approach where investors provide up-front capital for projects, and utilities repay investors based on achievement of agreed-upon project outcomes, creating new paths for utilities to invest in innovative water strategies while limiting the risk to ratepayers. Public utilities can and should leverage debt to finance water strategies that are more sustainable and address pressing equity and affordability concerns. The opportunity to take these solutions to scale will be transformational in securing a more climate resilient and inclusive water future. Cities in the vanguard are effectively demonstrating how to get there.

Denver Leading On Lead Reduction With A Little Help From GASB

Denver Water has been a leader in addressing the public health scourge of lead in drinking water, launching an ambitious Lead Reduction Program to replace private lead lines affecting 64,000 to 84,000 properties. To accelerate implementation, Denver made the bold decision to capitalize this program, the largest public health initiative in its history, committing to spend roughly $600 million over 15 years.

What puts this decision on the cutting edge is that Denver Water will be the first public utility to pay for a major private property lead line replacement program with municipal bonds, using the Regulated Operations approach. In the process, it will substantially accelerate delivery of critical health benefits to the community. Denver's program is trailblazing also for its focus on equity by addressing a dangerous health risk that impacts primarily vulnerable communities. It plans to prioritize implementation based on populations most at-risk from lead exposure and is expected to reach 95 percent of affected households. With 9 million lead service lines in the U.S., Denver Water will be setting a key precedent demonstrating the efficacy of the new GASB Regulated Operations approach to facilitate capital financing for large-scale decentralized water infrastructure on private property.

New Orleans Leveraging Homeowner Dollars To Scale GSI

Facing serial environmental shocks and floods, which will be exacerbated by climate change, New Orleans has made an intentional pivot in its approach to stormwater. Rather than fighting it, the City has decided to embrace "living with water," re-envisioning infrastructure to include almost every aspect of the urban environment from parks to schoolyards to streets to rooftops.

GSI is central to New Orleans' vision for its future as a key element supporting public health, economic development, and improved quality of life. To help meet this challenge, Finance New Orleans (FNO), the city's housing and development finance agency, has been investigating options for steering capital to GSI on private as well as public property. FNO has been working with Quantified Ventures, an outcomes-based capital firm, to set up a green mortgage program that would support green infrastructure installations on single-family homes. FNO's vision includes adding programs from other sectors to create a Green Finance Business Model with a fund that can support projects across single-family, multi-family, commercial, and municipal property. This fund could be capitalized through EIBs or other green bonds.

FNO's initiative is particularly exciting because it will include down payment assistance, in addition to capital for stormwater and other retrofits, for low- and moderate-income homeowners. The green mortgages could also pay for renewable energy projects and energy efficiency retrofits, enabling New Orleans to leverage the financial power of homeowners to accelerate and expand GSI on private properties. With rain gardens, permeable pavements, and green roofs, homeowners can help lead environmentally sustainable water management change, capturing stormwater to abate urban flooding and extending the life of, and taking stress off, over-taxed sewers, treatment facilities, and water supply systems.

The green mortgage initiative would make FNO the first municipal finance authority that we are aware of to position mortgages as financing products for resilience initiatives. Leveraging residential mortgages, a wholly different and potentially constant source of financing, to catalyze investment in GSI could be invaluable in scaling wider adoption of these strategies in urban areas. This unique approach is only one of the things that makes New Orleans a center of innovative thinking around resilience, but it may well be a key model for communities looking to expand their financing options for GSI nationwide.

Centering Equity To Achieve Even More

Ensuring equitable and affordable access to all types of water services for everyone is a financial challenge for many, if not most, water utilities. The COVID-19 pandemic has magnified these issues, bringing home the vital role of water in promoting community health and well-being. It has also underscored the reality that people of color are disproportionately harmed by limited access to safe and secure drinking water supplies and sanitation. This fact adds urgency to addressing equity and affordability issues at the utility level. The opportunity for utility engagement in equity and affordability issues is one of the most promising

developments in the water space, along with the growth of creative partnerships to expand their capacity to address these issues. Programs in Cleveland, OH, and Santa Rosa, CA, exemplify opportunities to build more equitable, affordable water approaches in 2021 and beyond.

The opportunity for utility engagement in equity and affordability issues is one of the most promising developments in the water space, along with the growth of creative partnerships to expand their capacity to address these issues.

Cleveland's Water Champions program is a partnership between the city's Division of Water, the regional sewer district, and CHN Housing Partners, a local nonprofit, to connect Cleveland's residents to affordability assistance programs. Cleveland has one of the highest poverty rates among U.S. cities, making it difficult for ratepayers to keep up with water and sewer bills. Local utilities have developed a number of affordability programs, including discount programs for vulnerable populations and bill assistance for major life events or crises. However, only about half of eligible residents participate in these programs.

Under the new program, two full-time Water Champions will leverage their community outreach and organizing skills to connect directly with residents in low-income communities. The Champions will help residents sign up for affordability programs and ensure that people know who to call with water quality concerns and questions about utility bills. By better understanding community needs and priorities, and identifying roadblocks to accessing affordability programs, the Water Champions will gather information to ensure that affordability offerings are designed to meet residents' needs over the long term. With the Water Champions program, Cleveland's utilities are going beyond offering assistance — they will also be ensuring that community members have the support required to engage with these programs, as well as a voice in shaping them to increase their effectiveness.

Santa Rosa is facing somewhat different but related challenges in connecting with a critical minority population. In drought-prone California, conserving water is a vital strategy for ensuring water supply reliability, and Santa Rosa offers a host of programs ranging from rebates to water audits. However, utility managers are unsure about whether these programs are reaching the city's Latinx community, which comprises about one-third of the local population. To address this, Santa Rosa has launched an initiative to analyze Latinx participation in water use efficiency programs and the extent to which they are engaging with these offerings at the same pace as other communities. This data will be the basis for developing a new campaign and outreach strategy to connect more effectively with Latinx communities and enable all residents to take advantage of water efficiency programs and water and cost savings. Engaging the Latinx population will help Santa Rosa advance community equity by increasing residents' awareness of the opportunities to participate in and save costs through these programs. Wider program participation will also help the City meet its overall efficiency objectives.

The deep dives that Cleveland and Santa Rosa are making to connect with their disadvantaged populations signal an increased awareness for water utilities and a growing appreciation for the role they have in addressing local inequities. These initiatives also demonstrate that centering equity can boost a multitude of objectives such as affordability, sustainability, and public health efforts in an effective and forward-thinking way.

Momentum Is On The Side Of Innovation

Looking ahead to 2021, the trend toward expanding innovation in decentralized and localized water strategies is likely to only increase and pick up steam. The water-tech sector is exploding with new ideas and strategies, particularly around resilience and efficiency. And utilities, facing multiple pressures from climate change, the pandemic, and ratepayer anxiety, are increasingly open to new solutions and the new financial paths needed to pay for them.

In 2020, WaterNow was privileged to work with American Rivers and Corona Environmental Consulting in conducting a training series for 10 communities exploring new avenues to finance GSI on private properties. The training covered when and how municipal bond proceeds can be accessed for these purposes as well as stormwater credit trading, a funding mechanism of growing interest and adoption. But the most telling aspect of the training series was the diversity of the participant cohort — from Milwaukee to Tucson to Greensboro to Eugene to Atlanta to San Mateo — a testament to the breadth of interest in innovative financing options for unconventional water infrastructure.

This is reflected as well in WaterNow's Tap into Resilience (TiR) initiative, which provides training, informational resources, and technical support to communities starting to explore how they can take better advantage of the benefits of various types of localized water infrastructure. To date, we have trained hundreds of utility leaders, and several thousand have accessed TiR resources.

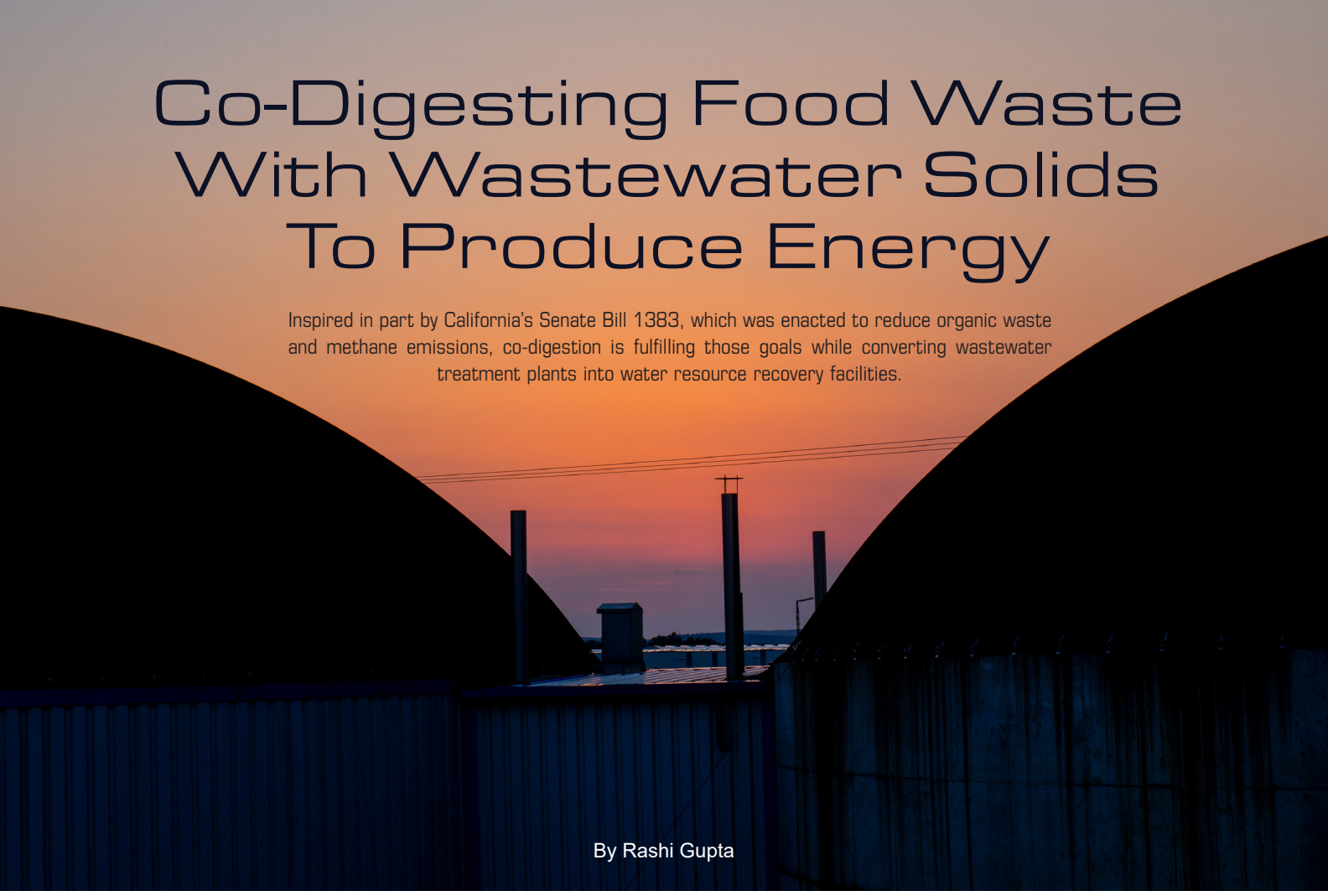
The opportunity is now. We look forward to working across the water sector on innovative financing for localized water infrastructure and related strategies advancing equity, affordability, and sustainability as the promise of 2021 unfolds. ■

About The Author

Cynthia Koehler is an environmental attorney and water policy expert with 30 years of experience working on federal and state water and natural resource issues. She is the cofounder and executive director of WaterNow Alliance, a nonprofit network of local water leaders dedicated to advancing sustainable, equitable, and climate-resilient water solutions nationwide. She is an appointed member of the U.S. EPA's Environmental Financial Advisory Board. She has also served for the last 14 years as an elected member of her local water district, serving a population of about 200,000. Cynthia holds a Bachelor of Arts degree from Pomona College and a Juris Doctor and Environmental Law Certificate from the University of Oregon School of Law.

Co-Digesting Food Waste With Wastewater Solids To Produce Energy

Inspired in part by California's Senate Bill 1383, which was enacted to reduce organic waste and methane emissions, co-digestion is fulfilling those goals while converting wastewater treatment plants into water resource recovery facilities.



By Rashi Gupta

With each passing year, the effects of climate change become harder to ignore. The U.S. West Coast has borne the brunt of many such effects: Scientists continue to connect drier, windier, and warmer climates to the ever-increasing number of wildfires observed, especially in California. In the past year alone, the state experienced over 9,200 wildfire events that ravaged close to 4.2 million acres of land — 26 times the total acreage burned in 2019 — prompting Governor Gavin Newsom to describe the devastation as a "climate damn emergency."

To protect the state from the reverberating ecological, economic, and health consequences of climate change, California passed several aggressive environmental policies, one of which is Senate Bill 1383 (SB 1383). Adopted in 2016, this bill establishes specific targets and timelines to reduce the level of organic waste disposed of in landfills and, thus, reduce methane emissions statewide.

When organic materials in landfills decompose, they release greenhouse gases (GHG). While carbon dioxide (CO_2) is widely known as the most abundant GHG, its runner-up, methane, is a short-lived climate pollutant that is approximately 25 times more powerful than CO_2 in terms of its warming effect on the atmosphere.

The majority of California's methane emissions come from the production and transport of fossil fuels and agricultural practices; however, at least 20 percent is generated from decomposing organics, particularly food waste, which makes up 18 percent of the state's municipal solid waste (MSW) and 30 percent of its total organic waste. To effectively reduce emissions from this source, SB 1383 set two primary targets: 1) divert 75 percent of organics away from landfills by 2025 and 2) ultimately reduce methane levels by 40 percent (relative to 2013 levels) by 2030.

One cogent strategy for targeted organics diversion includes leveraging and enhancing current wastewater treatment practices: co-digesting food waste with wastewater solids in existing anaerobic digesters to produce, capture, and utilize resulting biogas. By

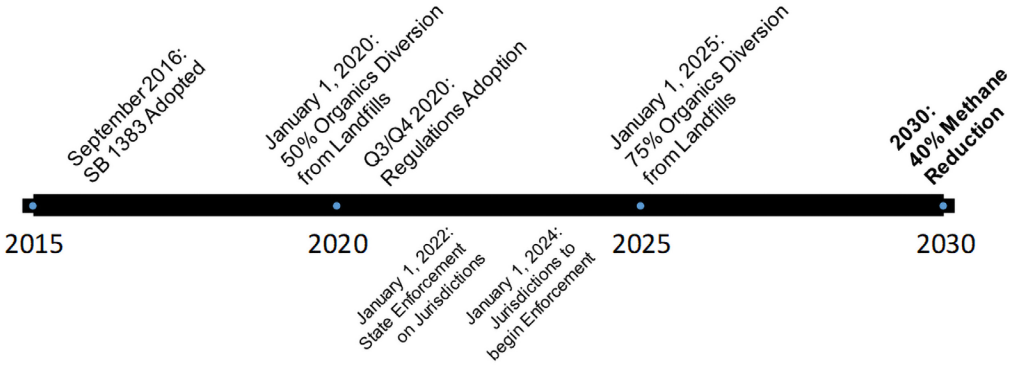


Figure 1. SB 1383's key goals and timelines

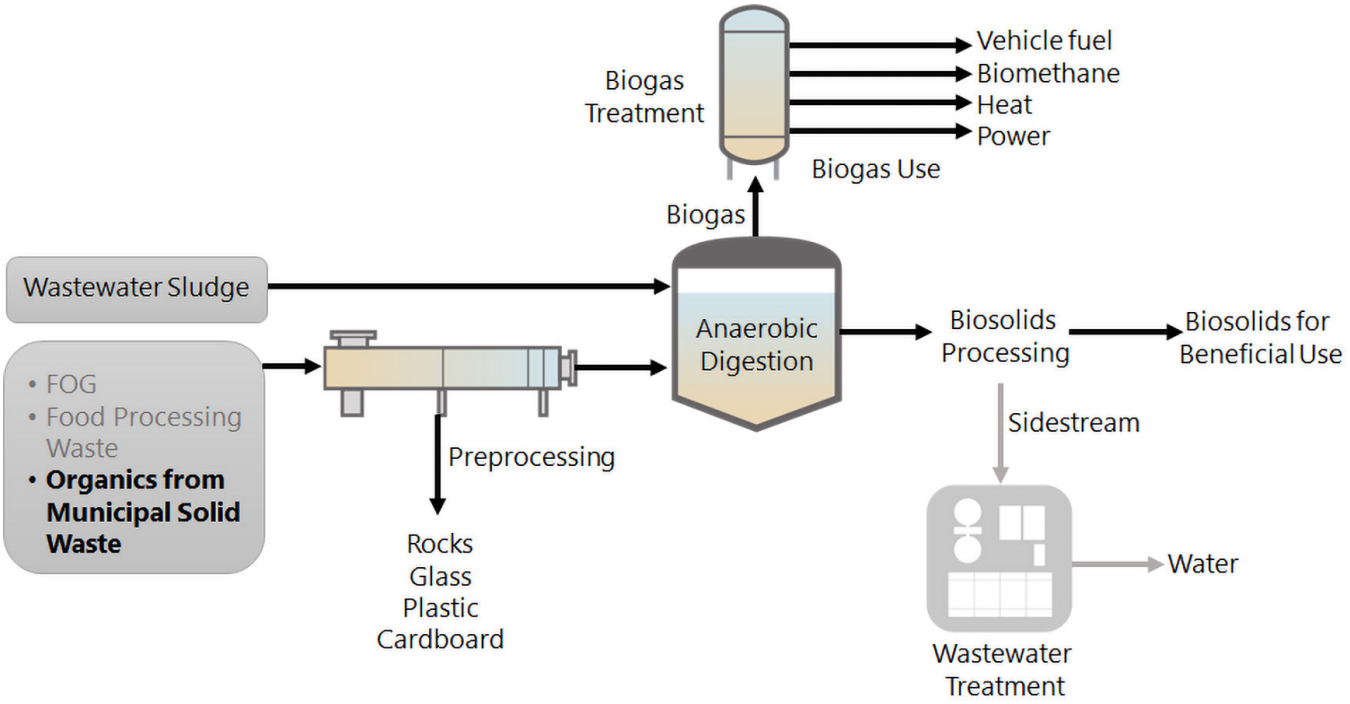


Figure 2. How co-digestion works

implementing this increasingly practiced process, municipal water resource recovery facilities (WRRFs) can not only accept organics that would've otherwise been landfilled, thus shoring up SB 1383's objectives, but also produce and beneficially reuse biogas, a renewable energy source, and biosolids, a nutrient-rich resource for depleted soils.

Here are all the reasons why utilities in California (and other states) are choosing to incorporate co-digestion into their WRRFs.

A "Big Picture" That Supports SB 1383's Sustainability Goals

Co-digestion's promise is simple: Food waste in landfills releases large amounts of methane, so divert it for anaerobic digestion and, in turn, produce renewable energy and soil nutrients. In this way, co-digestion and the beneficial reuse of its byproducts go hand-in-hand.

In 2017, Californians disposed of 37.5 million short wet tons in MSW to landfills, of which 18.1 percent or 6.8 million short wet tons consisted of food waste. Translated into methane emissions, this amount of food waste generates approximately 8.6 million metric tons of CO_2 equivalents ($MTCO_2$). Again, SB 1383's ultimate goal is to reduce this value by 40 percent, or 4 million $MTCO_2$, by 2030.

The California State Water Resources Control Board (State Water Board) received a grant from the U.S. EPA to analyze co-digestion capacity at WRRFs in California, and subsequently selected Carollo Engineers, Inc. to conduct the study. The team projected per-capita food waste in 2030 and analyzed whether or not municipal WRRFs in California have the capacity to co-digest these quantities as well as dewater resulting biosolids and beneficially use biogas. The projections considered population growth by county and a 10 percent decrease in per-capita waste generation, which has been on-trend with consumer behaviors since 1999.

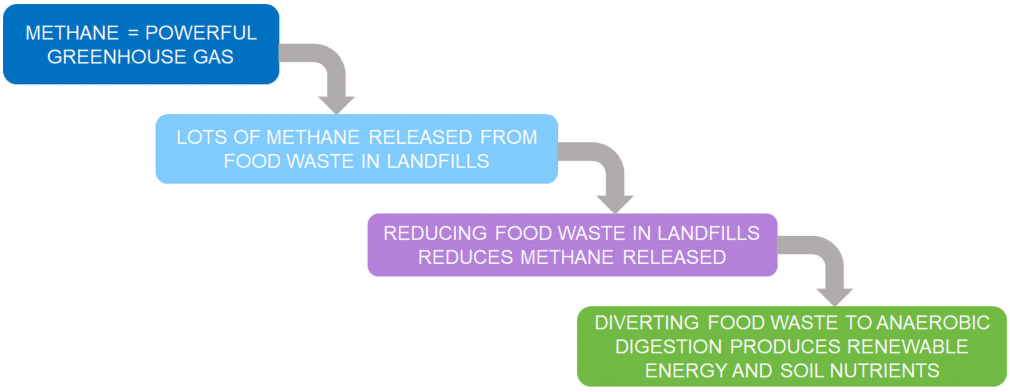


Figure 3. Big-picture benefits of organics diversion to co-digestion

The resulting report, *Co-Digestion Capacity in California*, projected that per-capita food waste disposal will remain constant through 2030 at around 6.82 million short wet tons but that approximately 50 percent — 3.41 million short wet tons — will be recoverable and digestible at WRRFs.

The report went on to estimate that if the statewide use of existing digester capacities were maximized to allow diversion of the 3.41 million

wet tons for co-digestion and beneficial use of biogas, greenhouse gas emissions would be reduced by up to 2.4 million $MTCO_2E$ — 60 percent of the state's goal to reduce landfill emissions by 4 million $MTCO_2E$ in 2030.

Making Use Of What We Have

How exactly does California and its WRRFs maximize their use of existing excess digester capacities?

As part of the report, Carollo developed and distributed a comprehensive survey on solids and biogas systems to 223 permitted WRRFs in California and received responses from 99 of them. This sample size consisted of a balanced mix of small, medium, and large facilities that represent approximately 80 percent of the state's existing treatment capacity.

Comparing current and projected food waste loads against system capacities determined from the survey data analysis, the team estimated that the statewide excess anaerobic digestion capacity could accommodate 2.4 million to 8.6 million short wet tons of diverted food waste per year, depending on how conservatively the digesters are operated and if their capacities are maximized. This means that, as they exist, WRRFs that employ anaerobic digestion have more than enough excess digester capacities to handle 70 to 100 percent of the state's diverted food waste in 2030. No expansion is required.

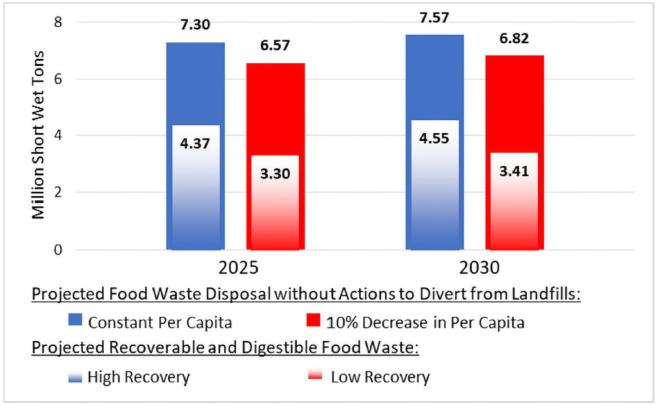


Figure 4. Food waste projections and anticipated recovery in 2025 and 2030

This isn't to say that WRRFs can immediately begin accepting food waste: As can be seen in Figure 5, most WRRFs in California lack the ancillary processes — organic waste receiving and biogas conditioning, utilization, and flaring — required for co-digestion and the safe, beneficial reuse of biogas. Only seven WRRFs currently have or will soon have all the necessary system components, and even these have limiting processes that hold down the collectively receivable quantities of food waste to approximately 118,000 short wet tons per year.

With that said, if appropriate investments were targeted to increase these processes' capacities to match those of the digesters, these seven WRRFs alone will be able to accept between 846,000 and 2.2 million short wet tons of food waste per year. That's 25 to 64 percent of what the state expects to see in food waste through the next decade, a considerable portion of SB 1383's target to divert 75 percent of organic waste from landfills in 2025.

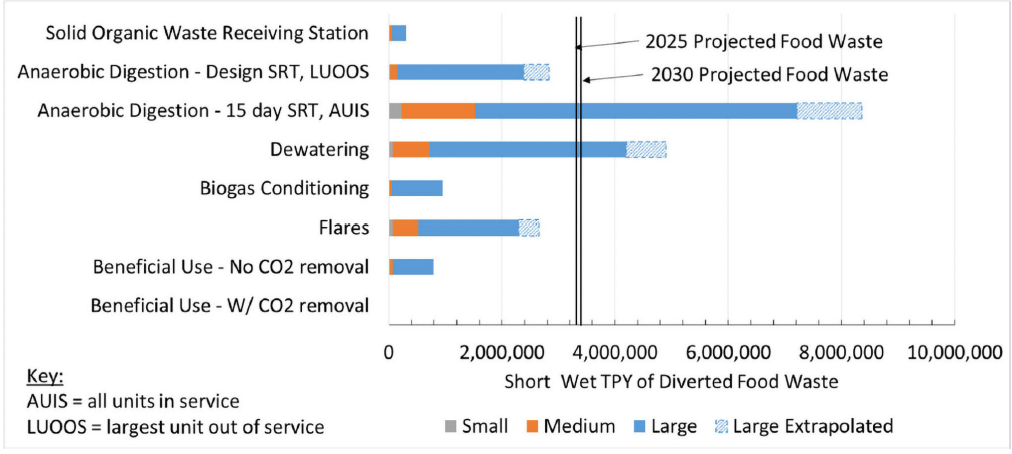


Figure 5. Statewide total existing excess capacity of key systems required for co-digestion and beneficial use of biogas

Reducing Methane Emissions Through Co-Digestion Can Produce Revenue For WRRFs

Now that investments have been mentioned, how much will it cost to construct or expand the ancillary infrastructure needed for co-digestion, and is it worth it?

The State Water Board's report estimated the statewide costs for co-digestion under two scenarios: 1) Using the conservative estimate of California's anaerobic digestion capacity for 2.4 million short wet tons in diverted food waste per year and 2) maximizing the use of digestion

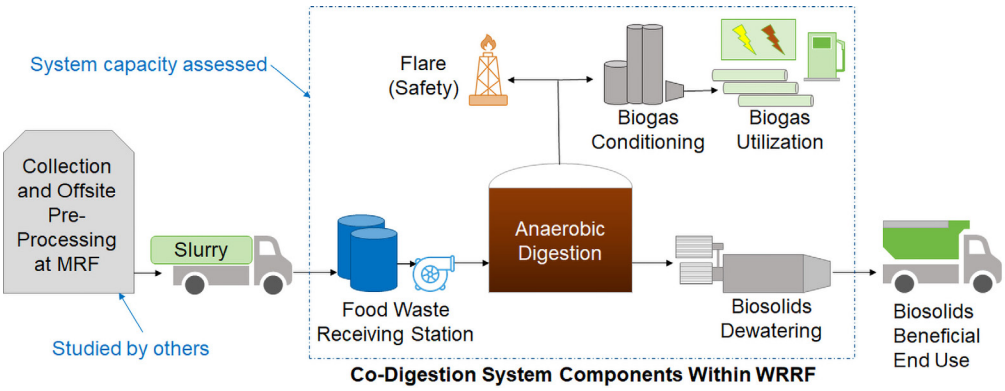


Figure 6. Key processes required to co-digest food waste at a WRRF

capacity to handle all 3.4 million short wet tons of recoverable food waste projected to be generated in 2030. Results showed that, to maximize co-digestion and beneficial reuse potentials, the state must invest between $968 million and $1.44 billion in capital costs and between $98 million and $138 million in annual O&M costs for Scenario 1 and Scenario 2, respectively.

While these upfront and ongoing costs seem daunting, the promise of co-digestion includes both sustainability and economic viability. In California, co-digestion and biogas can offer WRRFs multiple revenue sources depending on utility agreements and biogas end uses. These include tipping fees, credits through the federal Renewable Fuel Standard's D5 Renewable Identification Numbers (RINs), the state's Low Carbon Fuel Standard (LCFS) and Self-Generation Incentive Program, and direct revenue or cost offsets from three primary end-use options for biogas: on-site cogeneration and renewable natural gas (RNG)/renewable compressed natural gas (CNG) for pipeline injection and vehicle fuel.

According to Carollo's sensitivity analyses of various biogas utilization options, California's renewable energy incentives currently encourage CNG/RNG-based options. However, cogeneration remains the best and most viable option for many utilities. If the state's WRRFs were to split biogas use equally amongst the three primary biogas end uses and make full use of the currently available revenue streams, they could anticipate a statewide annual revenue of $278 million per year under Scenario 1 and $393 million per year under Scenario 2 — figures that are much greater than estimated statewide O&M costs.

According to these estimated capital and operating costs as well as the potential revenue streams, the simple payback period for the state on these investments for co-digestion would be less than six years.

While the benefits of co-digestion seem apparent, whether or not it makes sense for every WRRF must be carefully evaluated on a case-by-case basis.

Is Co-Digestion Right For Your WRRF?

While the benefits of co-digestion seem apparent, whether or not it makes sense for every WRRF must be carefully evaluated on a case-by-case basis. Especially when it comes to finances, the State Water Board's report clearly states that large and medium WRRFs can expect to see the most returns on investments. Still, the economics of a co-digestion project at any WRRF, regardless of size, will be heavily influenced by its specific operations and conditions, biogas and biosolids management strategies, and volume of food waste accepted as well as the ebbing and flowing value of tipping fees, renewable energy prices, and renewable energy credits (e.g., RINs, LCFS, Self-Generation Incentive Program).

To get a general idea of the costs and revenues that a WRRF could accrue by implementing co-digestion, consider this example: A large WRRF with anaerobic digestion decides to expand its ancillary processes to co-digest 45,000 short wet tons of diverted food waste per year. To do so, the utility would invest an estimated $22.4 million in capital costs and $1.8 million in annual O&M costs. In turn, through tipping fees and credits associated with CNG/RNG for vehicle fueling, it could earn an estimated revenue of $7.3 million per year.

This is, of course, the paragon. And although achievable, every WRRF must weigh the following key factors that either facilitate or impede co-digestion before taking the leap toward implementation:

Case	Wet Tons Diverted Food Waste/Year	Coverage	Estimated Capital Cost, $M	Estimated O&M Cost, $M/Year	Estimated Revenue, $M/Year	Biogas Use
Scenario 1	2,400,000	Statewide	968	97.6	278	Split
Scenario 2	3,400,000	Statewide	1436	138	393	Split

Figure 7. Summary of estimated costs and revenues under Scenarios 1 and 2

Case	Wet Tons Diverted Food Waste/Year	Coverage	Estimated Capital Cost, $M	Estimated O&M Cost, $M/Year	Estimated Revenue, $M/Year	Biogas Use
Illustrative Facility	45,000	For Facility	22.4	1.8	7.3	CNG Vehicle Fuel

Figure 8. Summary of estimated costs and revenues for an illustrative facility

- **State laws and regulations:** While certain legislative mandates, such as SB 1383, drive the need for co-digestion projects, other regulatory considerations can affect economic viability. Stringent nitrogen limits for effluent can be negatively impacted by increased ammonia loads and necessitate additional investment in sidestream treatment. Meanwhile, air/biogas permitting requirements or utility-imposed restrictions can make beneficially using biogas difficult. Finally, restrictions on local land application of biosolids can increase operating costs for biosolids management.

- **Funding:** Without appropriate financial assistance, utilities must depend exclusively on their ratepayers to cover the high capital costs required to execute full-scale co-digestion projects, which is not only risky but reduces public and stakeholder support. This is especially true for economically disadvantaged or under-resourced communities that cannot weather rate increases. Some funding opportunities exist in the form of government grants and low-interest loans, such as those offered through the California Department of Resources Recycling and Recovery's Organics Grant Program and the Clean Water State Revolving Fund. In some cases, public/private partnerships allow multiple parties to finance a co-digestion project, thus taking the financial burden off a single WRRF. With that being said, larger-scale financial assistance will be required to cover investment costs and broadly implement co-digestion.

- **Revenue sources:** Renewable energy credits and tipping fees received for accepting food waste contribute enormously to a WRRF's net-positive investment in co-digestion. However, these revenue sources are susceptible to changes or sudden drops, thus making them relatively uncertain. Co-digestion is not feasible or sustainable if costs exceed revenues.

- **Planning and feasibility studies:** Every WRRF serves a unique population with specific needs and differences that affect the feasibility of various biogas utilization and energy management options. Robust planning and feasibility studies are cardinal to mitigating risks, assessing key parameters such as regulatory hurdles, capacity limitations, and costs/revenue, and developing support from WRRF O&M staff and the broader community in general. Insufficient planning can waylay co-digestion projects after they have started because of unforeseen obstacles, wasting time and stakeholder funds.

Renewable energy credits and tipping fees received for accepting food waste contribute enormously to a WRRF's net-positive investment in co-digestion.

Carollo's extensive decision-support tool can help WRRFs decide whether co-digestion is right for them. This tool is readily available within the State Water Board's report appendices, the first part of which is shown in Figure 9.

The Future Of Co-Digestion In California And Beyond

Co-digestion is now an established process that allows municipal WRRFs in California to play an integral role in reducing statewide methane emissions, thus meeting the objectives of SB 1383 and other GHG-reduction mandates. Already, several small, medium, and large WRRFs in populous regions of the state are operating or are in the process of planning full-scale food waste co-digestion efforts. Six of these facilities are presented as case studies within the State Water Board's report to help other utilities now understand how to successfully implement a sustainable co-digestion program.

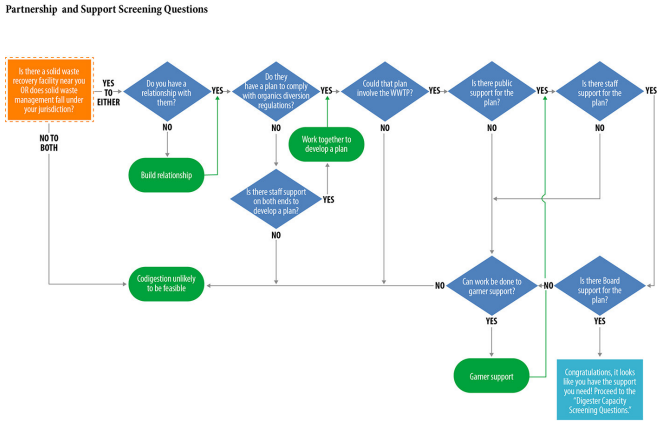
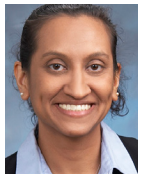


Figure 9. First step of Carollo's co-digestion decision-support tool

As more states set targets to reduce GHG emissions in the coming years, co-digestion can be expected to take center stage on a national scale. For its successful adoption and long-term financial viability, the wastewater industry must work closely with municipalities and state and local regulatory agencies to incrementally tackle challenges that WRRFs will face and leverage the full potential of existing assets to co-digest. ■

About The Author



As a vice president and project manager with Carollo Engineers, Rashi Gupta has specialized in delivering sustainable solutions for biosolids management and wastewater treatment throughout her 17-year career. She obtained her BS in Civil Engineering from the University of California, Davis, and her MS from the University of Texas at Austin. Gupta is a licensed civil engineer in California and serves as Carollo's national biosolids technology integration lead. She is a member of the WEF Residuals and Biosolids Committee, where she serves as the chair of the Solids Separation Sub-Committee.

Greener Pastures Ahead For Pumps

Energy-saving pumps will be ever more present in 2021 as investment in eco-friendly infrastructure continues to grow.

By Michael Michaud

Before we heard "Build back better" as a slogan in the 2020 election, it was a popular catchphrase used by organizations around the world to encourage the improvement — not just replacement — of equipment or critical systems, especially in post-disaster recovery. As water infrastructure continues to receive a D grade on the American Society of Civil Engineers' (ASCE) Infrastructure Report Card, now is a good time to apply that principle. For years, sustainability has been a prerogative of communities and businesses that have implemented energy-saving solutions, incentive programs, and goals to reduce carbon footprint across a wide range of industries.

Meanwhile, pumps are often overlooked as a key source of energy savings. With today's advancements in pumps and related equipment, as well as growing support for green infrastructure, 2021 could mark a rise in interest and implementation of energy-saving pump systems.

Why Now?

News out of Washington suggests infrastructure investment is a bipartisan priority. The upcoming appropriation bill could be one of the few pieces of legislation that passes during the lame duck session. There is a growing bipartisan expectation that a historic "infrastructure investment – job creation bill" will be a priority for the Biden administration and the 117th Congress in 2021. Increased funding for water infrastructure will be one of the centerpieces of this legislation. Federal funding for Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) infrastructure, including pumps and pumping systems, will be increased from $2.5 billion annually to over $12 billion annually. Committees in both the House and the Senate are supportive of "green infrastructure" set asides of up to 15 percent. This includes energy-efficient pumps and pumping systems.

Industry experts agree that, nationally, water and wastewater projects will continue to exceed 2018-19 levels over the next 18 to 24 months. Projects in place remain above 2019 numbers, with wastewater projects up 5 percent and water projects up 21 percent. These numbers are expected to hold through 2021, as most projects are on a 12- to 18-month timeline. The long project timeline also means that many of the pumping systems have already been designed.

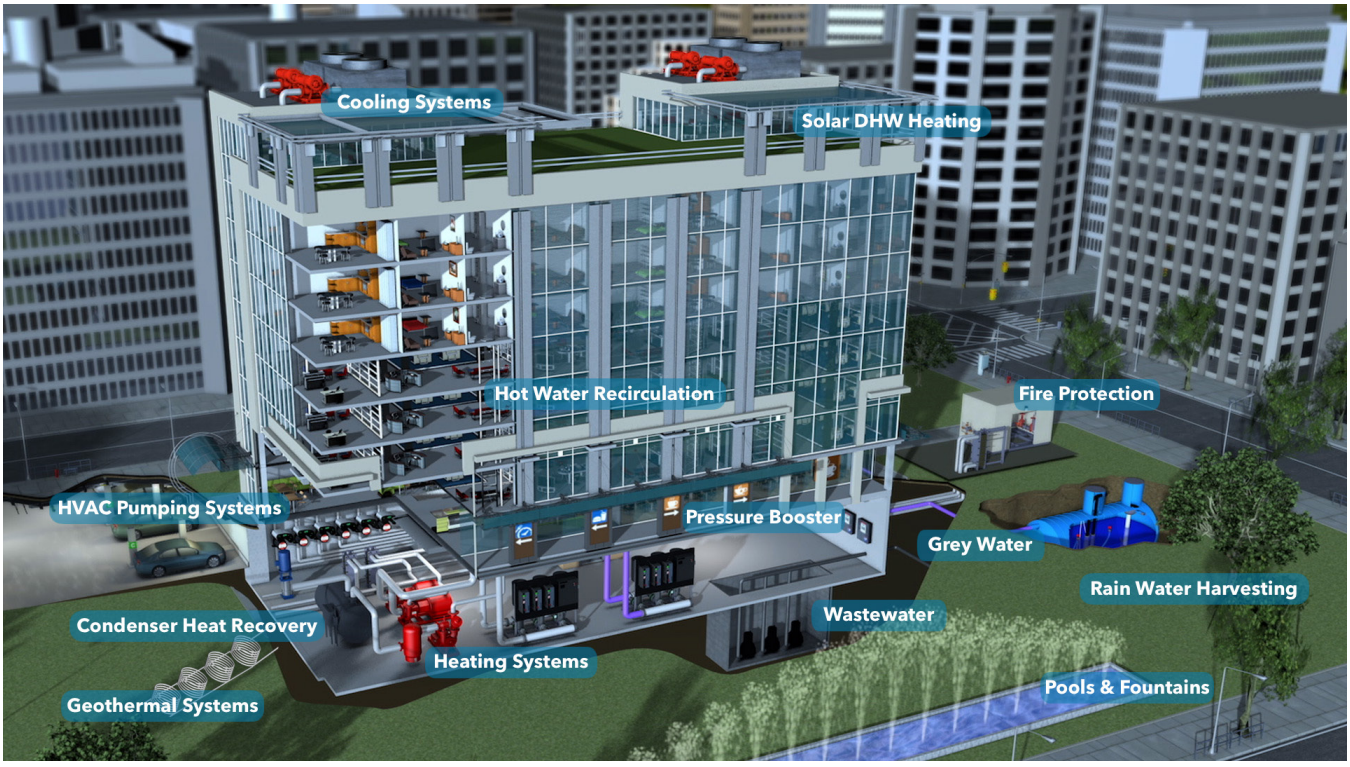
More Than A Trend: A New Energy-Savings Gold Mine

Pumps can account for 40 percent of energy usage in industrial fluid systems, and when it comes to water infrastructure, investment in energy-saving pumps can go a long way. The U.S. Department of Energy's 2002 Motor Market Assessment established that pumping systems offer the greatest optimization potential of all types of fluid systems, offering savings of up to 75 percent with an average net savings of over 20 percent. Few other technologies could have as big an impact, and that's important considering that one of the largest single expense items for a water treatment plant can be its utility bill.

Pumps reside in water and wastewater systems of all types and sizes, using energy to move fluids. While reliability comes first in pump system design, there is obviously a cost savings incentive for stakeholders to improve the energy efficiency of pump systems. Roughly 65 percent of the total cost of ownership for pumps is related to energy and maintenance, while the initial cost of purchasing and installing a new pump accounts for just 10 percent of the total lifetime costs. Utilizing pumps with greater energy efficiency can reduce total cost of ownership for pumps and whole pump systems.

Identifying Opportunities To Gain Efficiencies

One misconception around energy efficiency in pumps is that it has to come at the cost of performance and/or reliability. However,



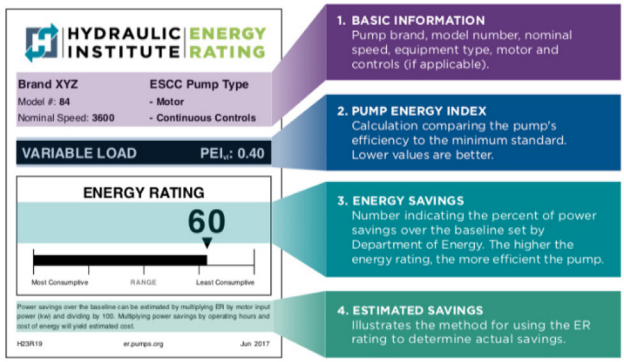
The HI Energy Rating Program allows users to view and verify data on pumps that indicates the power savings obtained from upgrades and changes.

this assumption is incorrect. There is often the opportunity to improve performance, efficiency, and reliability of a system — all in tandem with many pump options, accessories, and best practices to optimize design. Solutions don't have to be complicated. Sometimes it's as simple as deciding to utilize smart pumps that integrate a variable frequency drive (VFD) that has the pump performance programmed in from the factory, instead of retrofitting with a separate VFD.

To help identify the most efficient pump(s) for system requirements, the Hydraulic Institute (HI) offers an Energy Rating Program for select pump types below 200 horsepower, as well as its Pump Savings Calculator.[1] This tool assists specifiers and end users in determining the most energy- and cost-efficient pump systems for their applications by factoring the impacts of potential energy savings, based on the HI Energy Rating, alongside other variables like initial cost, installation, maintenance, etc. The calculator draws on HI's Energy Rating (ER) Program[2] database of rated pumps to calculate potential energy savings and incremental cost increases for different Energy Ratings available on specific pumps and add-ons like variable speed controls that can be installed on constant speed pumps.

Make An Energy-Savings Resolution

While more government infrastructure funding would be a nice boost in 2021, there is no need to wait for the incentive to think about "green infrastructure." The savings from installing efficient pumping systems today will be felt for 20 or more years. We can start building better systems now by installing more efficient pumps and designing more efficient pumping systems. With today's increased awareness and understanding of energy efficiency, let's not miss out on the opportunity to build a better system. There may still be time to reexamine the pumping system to ensure it is designed to reduce energy costs. ■



For more information on the Hydraulic Institute, visit www.pumps.org.

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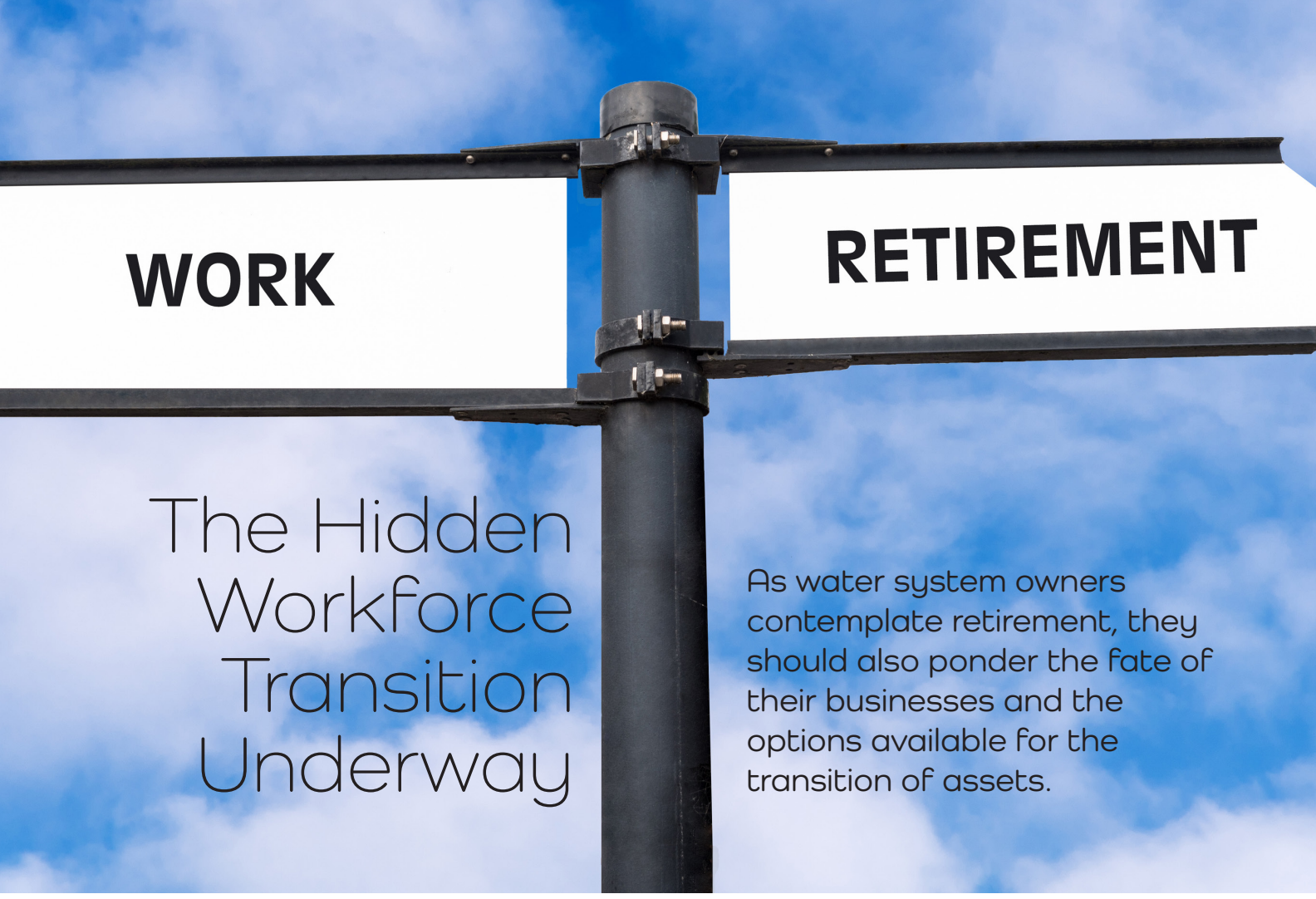
2. http://www.pumps.org/EnergyEfficiency/Energy_Rating.aspx

About The Author

Michael B. Michaud is the executive director of the Hydraulic Institute, the largest association of pump industry manufacturers in North America. Since joining HI in 2015, Michaud has expanded the institute's portfolio of efficiency programs by launching the HI Energy Rating Label and the Pump System Assessment Professional (PSAP) Certification. Prior to joining the Hydraulic Institute, Michaud spent 19 years in leadership positions at the American Society of Mechanical Engineers (ASME), where he was responsible for developing and implementing global strategy, managing the International Gas Turbine and Petroleum Institutes, and growing professional development and training activities around the world.



The Hidden Workforce Transition Underway

As water system owners contemplate retirement, they should also ponder the fate of their businesses and the options available for the transition of assets.

By Peter Brooks

We are in the middle of the greatest transition of wealth, power, and leadership in the history of humanity. The retirement of the Baby Boomer generation is upending industries globally and the water and wastewater industry is no exception. In fact, it's hitting our industry more than others. The water industry has a greater demographic challenge facing it than many other industries due to the nature of our regulatory history; the Clean Water Act and Safe Drinking Water Act have passed their 40-year anniversaries and the generation of water and wastewater professionals ushered into the industry by these momentous acts have reached retirement age. While there are tremendous efforts underway to support this transition for utilities from groups such as Baywork in the San Francisco Bay Area and the inclusion of water workforce funding support in the America's Water Infrastructure Act of 2018, there is a whole other segment of this industry that often falls under the radar: the thousands of small businesses that supply, manufacture, service, and maintain our industrial, commercial, and municipal water infrastructure.

If you are a facility owner or utility manager, now is the time to start the succession planning — not just for your staff, but also for your suppliers and service providers.

Across the U.S. economy, Boomers are expected to bequeath $10 trillion worth of assets over the next decade or two and across 12 million private businesses. These small businesses are spread throughout all industries, but many thousands provide mission-critical services to the water and wastewater industries. These services are

often unsung or underappreciated until the service provider on the other end of the phone doesn't answer.

Impacts Of The Transition

The results of this demographic shift are already rippling across the industry. The reality is that, for many water utilities or industrial water users, the local, reliable, 30-year-old company that you call to provide you treatment equipment, repair your valves and pumps, troubleshoot your SCADA, repair your distribution system, or supply you with critical consumables might not be around in a few years, leaving utility and facility managers scrambling for alternatives.

The speed of retirements of senior water and wastewater subject matter experts is only accelerating due to, among other things, COVID-19, a volatile economy, and the growing challenges of managing a modern, digital workforce.

Competitive market theory says that other companies will step in to meet any customer need, but some amount of dislocation is bound to happen, and dislocation, service interruption, and operational downtime is not an option when you're talking about delivering clean water or treating wastewater. Moreover, there's no guarantee that the next-best firm will provide the same quality, responsive service, and, in any event, this will require utilities and industrials to rebid or even rebuild systems to adapt to new suppliers.

Succession Planning — For Your Whole Supply Chain

We've known about this transition for a while; the thing about demographics is that you can see them coming a few decades in advance. But knowing that it will happen and planning for the reality are two different things.

If you are a facility owner or utility manager, now is the time to start the succession planning — not just for your staff, but also for your suppliers and service providers. What happens if your biosolids hauler or GIS-system provider or coagulant supplier goes away? What is your product obsolescence strategy after the warranty on your new system expires and if the replacement parts aren't available anymore? Who would you call if your go-to subject matter expert retires?

None of these is an insurmountable challenge in and of itself, but the compounding impact of multiple retirements internally and externally could leave facility owners and operators in a tough spot. The response still requires diligence, scenario planning, and rehearsing as much as any internal succession plan or emergency response plan would.

If you are the owner of one of these businesses, the questions are even more existential: How do you want to define your legacy? What dreams do you have for the future of the business after you retire and for the team and brand and reputation you've developed? How do you maintain the decades-long relationships with customers even after you leave?

There are a number of options available to water industry businesses with owners approaching retirement who lack a clear succession plan, some more desirable than others. Among them: liquidating and closing down, selling to a competitor or a large strategic, or selling to a financial investor. Each of these strategies has its drawbacks. Liquidation is unlikely to have a good outcome for anyone besides the buyer if the business is of high quality. Selling to a competitor or a large strategic in the industry gives owners little assurance of any respect for company culture, staff job security, or brand stewardship. And selling to pure financial investors may still require owners to stay on the job to meet lofty financial projections, but suddenly as an employee for the first time in decades. As an alternative, we at Sylmar Group offer a different path for great water and wastewater services businesses that we hope becomes the norm: We combine patient capital and water industry experience to cement the legacy of the founders of great water and wastewater service businesses, while providing management for the future growth of the business.

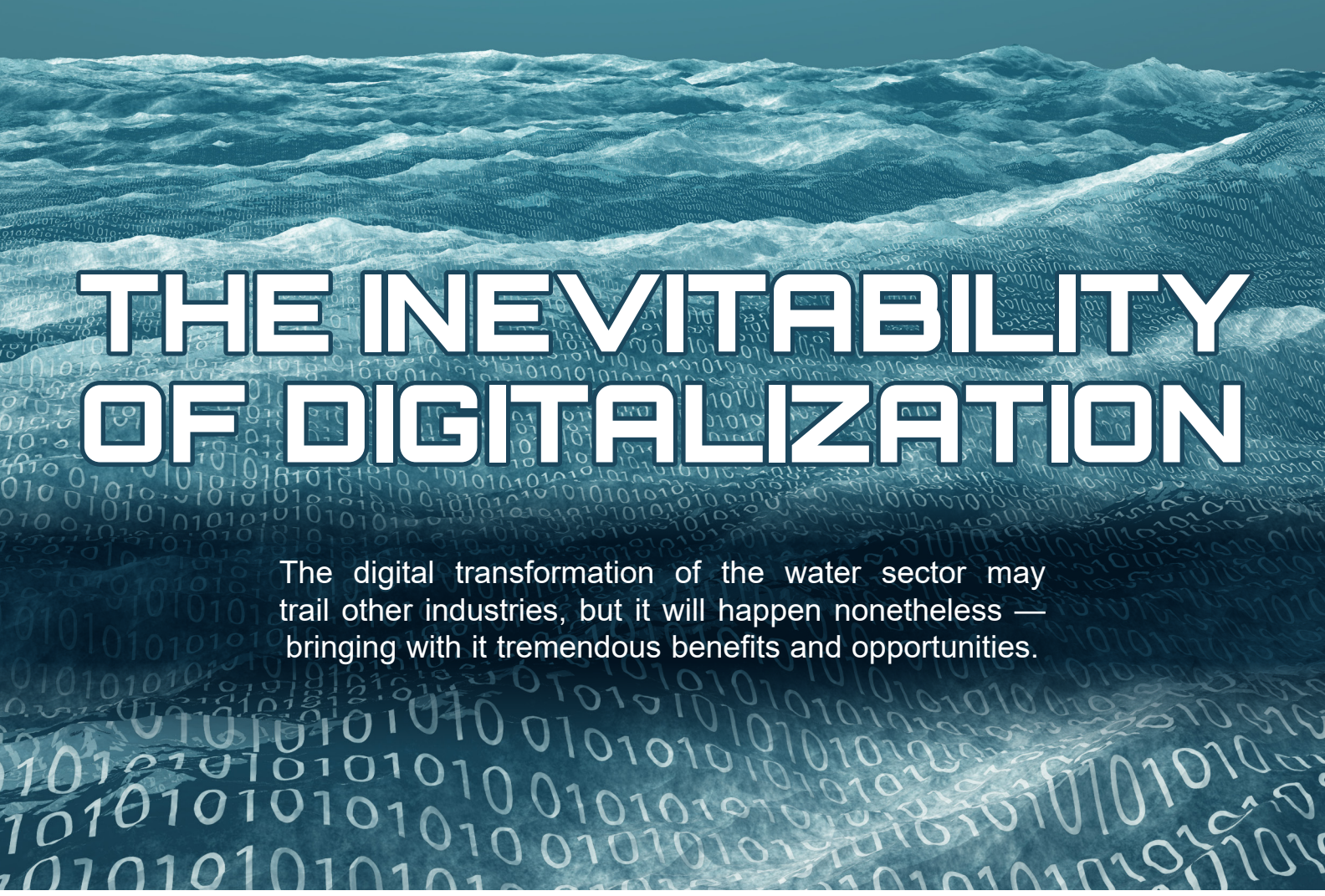
Whatever the path for the thousands of Baby Boomer small-business owners in the water and wastewater industry at or approaching the challenge of the transition, now is the time to start planning and communicating this plan to customers who might be concerned about your firm's longevity.

Conclusion

Demography is destiny, and we are living through the reality of this demographic fate right now. The speed of retirements of senior water and wastewater subject matter experts is only accelerating due to, among other things, COVID-19, a volatile economy, and the growing challenges of managing a modern, digital workforce. This transition shows no sign of slowing down. Our industry has faced such challenges before, but never to this extent and so suddenly. The risks of water and wastewater service dislocation, interruption, and downtime are growing, and it is the responsibility of water and wastewater utility leaders, industrial manufacturers, facility operators, and small-business owners to plan ahead and work collaboratively to make sure we don't fall short of our duty to protect public health and the environment through the stable, reliable management of critical water resources and infrastructure. ■

About The Author

Peter Brooks, a member of the *Water Online*'s Water Intelligence Panel, is CEO and cofounder of Sylmar Group, a company that buys and builds legacy water and wastewater services businesses.



THE INEVITABILITY OF DIGITALIZATION

The digital transformation of the water sector may trail other industries, but it will happen nonetheless — bringing with it tremendous benefits and opportunities.

By Anthony T. Jones

Years ago, I took a workshop on strategic foresight — a fancy term for studying the future. As everyone knows, you can't predict the future, but you can envision scenarios based on past and current events and trends and where they are likely to lead. From those scenarios, you can imagine a path forward. For the water and wastewater sector, my vision is for a future where water is valued, data drive decisions, analytics inform operations, and energy efficiency is king.

Industry 4.0

Klaus Schwab, founder and executive chair of the World Economic Forum, identified the next industrial revolution in his 2016 book, *The Fourth Industrial Revolution*. Schwab rationalizes that this next transformation is different in scope, scale, and complexity from previous major industrial shifts.

Also labeled Industry 4.0, this revolution melds smart platforms for manufacturing with widespread deployment of miniature microelectromechanical (and nano-) sensors, superior wireless communication networks, expanded automation, "smart" machines that can self-optimize and self-diagnose, as well as data, data, data. Key design elements are interconnection, information transparency, decentralized decisions, and information assistance to operators and management in decision-making.

Where Is The Water And Wastewater Sector In This Evolution?

From my perspective, the sector is behind other industries in uptake of purely digital operations. Autonomous electric cars are in the news and significant resources are flowing into developing driverless cars. Why not design and build autonomous water and wastewater treatment systems that are managed by skilled operators, but where the rote work is carried out by computers and robots?

While digital technologies and their implementation are not new to water and wastewater facilities, their integration into our lives and work is sophisticated and complex, resulting in a transformed world around us. Every stage in the value creation is impacted by the shift toward a digital world. I believe the water and wastewater sectors lag other industrial sectors in adoption of a purely digital operation.

Where Are We Now?

Across the U.S., more than 54,000 organizations are involved in treating water and wastewater. Each water authority has unique challenges in terms of supply, demand, geography, and jurisdictional restrictions on discharge into the natural environment, yet the basic principles of physics, chemistry, and biology still apply. The set of treatment processes and systems are common, and innovation has been incremental. The biggest invention in the last 50 years has been membranes.

Treating water of any kind requires energy. Annually, a total of 30 terawatt-hours of electricity is required to process water and wastewater, representing between 25 to 40 percent of operating costs for operators. The source of the electricity has implications

on potential carbon footprint. Optimizing the performance of the equipment leads to energy efficiency and reduction in operating costs, but you need to monitor and collect the data. The portfolio of energy use is shifting toward renewables. The UK water industry has set an ambitious target for net-zero carbon emissions by 2030. Monitoring energy consumption will be required to know that efficiencies have been achieved.

Why not design and build autonomous water and wastewater treatment systems that are managed by skilled operators, but where the rote work is carried out by computers and robots?

A healthy population and a healthy environment require essential infrastructure to support water and wastewater treatment. To ensure a healthy economy, these vital water services are required. Yet water authorities and sanitation districts struggle to keep up with maintenance — much of it deferred. Legacy collection and distribution networks are at the end of their life, requiring capital to retrofit or rebuild. Rethinking how to move water and wastewater in a congested built environment could lead to unique solutions.

Digital Transformation Initiative

The World Economic Forum that hosts the famous Davos confab organized a Digital Transformation Initiative (DTI) a few years back "to serve as the focal point for new opportunities and themes arising from the latest development in the digitalization of business and society." According to the executive summary, the digital transformation would unlock $100 trillion for business and society over the next decade.

The DTI recognized that "the falling cost of advanced technologies is a defining characteristic of the digital revolution. It is playing a major role in accelerating innovation." Eight billion devices are connected to the internet; by 2030, the forecast is that number will grow to 1 trillion devices. Water sensor networks will be in that mix.

An accounting firm reported in the DTI that, for the mining and metals industry, digital first movers exhibited improved earnings of 70 to 200 percent (as measured as EBITDA, or Earnings Before Interest, Taxes, Depreciation, and Amortization) over the digital laggards during the study period. The adopters will survive in competitive markets.

There are parallels with the water and wastewater sector. Interactions with frontline employees are shifting toward using mobile devices to garner the latest information on operations, material lookups, flow rates, maintenance procedures, and other environmental data to support their tasks. Maintenance will be predictive, not reactive, reducing costs, lowering workforce requirements, and identifying when and where work is needed. Information and parts to repair assemblies will be delivered prior to the part failure. Devices that listen to the rotating machines can be trained to alert staff of shifts in performance characteristics that indicate imminent failure.

Outcomes Of Digital Transformation

One of the outcomes of the DTI analysis was the need for next-generation analytics and decision support tools. A framework or architecture is needed to place all the streaming data in context, providing understanding of the processes and systems along with insight to make mission-critical decisions on crucial infrastructure. Data analytics allows interpretation of robust data collected, encrypted, and stored on the cloud. Fundamental algorithms for most treatment processes have been established. Numerical simulation offers results to problems encountered by operators and informs them of options to proceed. The same set of simulation tools can be used to remodel, refurbish, or extend capacity. Manufacturers' specifications can be compared with field operating equipment. A closer collaboration will yield a better, safer workplace with superior quality in the products and services provided. But data are required for this future.

The Water Research Foundation recognized the need for such a framework for transformation of water utilities by awarding a study in 2020 titled "Definition of a Smart Utility – How to Be a Digital Utility and the Framework for an Intelligent Water System." The awardee's press release stated that "The technologies and data platforms available to water utilities create countless benefits across various business processes. Water supply management, water treatment, water distribution, customer engagement, internal customers, wastewater collection, wastewater reclamation, and watershed protection are all components of water and wastewater utilities that can reap the benefits of digital infrastructure and concepts."

Conclusion

We may know that things are going digital, yet there is resistance to change in our institutions and in one's own psychology. For the water and wastewater sector, in general, there are low technology adoption rates across agencies. Public health concerns, regulatory drivers, and conservative agency cultures prevent uptake of innovative technologies, newfangled business practices, or novel business revenue models.

The primary driver for large companies to invest in new technologies is new efficiencies. There is opportunity for them to use these technologies to improve existing business processes and optimize assets and resources, thereby reducing their costs and enabling savings for their customers and, hopefully, sustainability. ■

About The Author

Trained as an oceanographer, Anthony T. Jones, PhD, cofounded Waterhound Futures in 2019 to tap into the data from water and wastewater treatment processes to predict the effluent from discharge pipes. Through a predictive model, insight to optimize plant performance, aid regulatory compliance, and reduce freshwater contamination is provided to subscribers. Dr. Jones holds a doctorate in oceanography from the University of Hawaii and has published in the fields of marine geology, marine biology, and oceanography. Dr. Jones has extensive international experience in the field of desalination. He can be contacted at Tony.jones@waterhoundfutures.com.

How Acoustic Water Leak Detection Is Used To Tackle Water Loss

Italy's biggest multi-utility, A2A S.p.A., like many water utilities in North America and around the world, had to corral water loss to sustain efficient operations. A2A piloted acoustic leak detection as a potential solution, achieving A+ results.

By Oded Fruchtman

Water loss is one of the major challenges for water utilities, especially as the global shortage of this critical resource increases. One of the main reasons for water loss is due to the creation of leaks in unseen pipes, which usually develop and expand over a long period of time. Water pipe deterioration leads to a constant increase in operational costs for leak repair, pipe replacement, water waste, and energy waste. Catastrophic bursts are much more expensive to repair than scheduled repairs of background leaks that are detected before surfacing.

Proactive detection and repair of background leaks have huge operational benefits as enormous amounts of water and energy are saved. Furthermore, identifying 1 to 2 percent of critical pipe sections that cause over 80 percent of bursts and replacing them can be cost-effective in the long run.

Proactive detection and repair of background leaks have huge operational benefits as enormous amounts of water and energy are saved.

Acoustic Leak Detection

One of the most successful methods for detecting and locating water leaks that frequently develop in the depths of buried piping is acoustics. In this method, acoustic sensors are permanently installed on the water distribution network and automatically record samples of noises obtained from the water flow in the pipes. In case there are any disturbances such as holes in the piping — i.e., leaks — various noises will be received to indicate this. Different types of pipes and leaks will produce different noises (small vs. large leak, small vs. large diameters, pressure levels, iron vs. plastic pipes, asbestos cement, etc.). Combining acoustic correlation sensors with appropriate analysis algorithms will achieve reliable results that distinguish between different noises and findings. The sensors must be highly sensitive on the one hand — so that they can pick up abnormal noises in the piping — and on the other hand, they must be able to filter background noises outside the pipeline (such as irrigation systems, truck traffic, and more).

An Israeli innovative company, Aquarius Spectrum, developed acoustic solutions that enable water utilities to perform proactive monitoring of their underground assets and hence detect background leaks in their initial stages of development and fix them before they surface and cause serious damage. These solutions, based on sensitive correlating fixed and mobile sensors, can be applied in all types of pipes.

Each night, the sensors record the noise on the pipes and send this information to a cloud-based server. The signals are processed, correlation algorithms are executed, and alerts are issued to the utility regarding leaks or malfunctioning appurtenances, such as hydrants and valves. Analyzed findings are displayed via a user-friendly browser-based display. To date, the company's technology is monitoring thousands of miles of municipal water pipelines worldwide, helping water utilities reduce their non-revenue water (NRW) and their operations and maintenance (O&M) costs.

How A2A Tackles Its Water Leaks

Founded in 2008, A2A S.p.A. is considered the biggest multi-

The sensors must be highly sensitive on the one hand — so that they can pick up abnormal noises in the piping — and on the other hand, they must be able to filter background noises outside the pipeline.

utility in Italy, with more than 12,000 employees and €6.5B in annual revenue. It generates, distributes, and markets renewable energy, electricity, gas, integrated water supply, and waste management services. From its headquarters in Brescia, Italy, A2A Ciclo Idrico (a company of the A2A Group) operates more than 3,000 kilometers (1,864 miles) of iron water pipes, serving citizens in the municipalities of Brescia and neighboring towns (https://www.a2a.eu/en).

As part of A2A's intensive efforts to increase their efficiency, they have looked for advanced technologies that will enable them to reduce their water loss and energy costs.

During September 2019, the company initiated a leak-detection pilot with Aquarius, carried out in Brescia City. Based on A2A's GIS data, 39 acoustic correlating sensors have been installed to cover around 15 km (~9 miles) of pipes (See Figure 1).

It should be noted that the pilot site is close to Brescia's football stadium and despite heavy traffic disruptions due to an important match, within two days all 39 sensors were installed and activated (See Figure 2).

During the first week, 10 hidden leaks were found. One of them was a huge leak that had saturated the ground within a few hours from its time of detection. The final step of the pilot was verifying and pinpointing points of interest (POI) raised by the AQS-SYS fixed monitoring system supported by smartphone-based mobile leak detection equipment. In total, 20 leaks were verified and fixed in just a few months (See Figure 3).

Thanks to the successful pilot, the Italian utility has recently purchased 235 AQS acoustic sensors that will allow it to continue monitoring the current area and to expand to additional areas. The project continues to be accompanied by the support of Aquarius' technical team. ■

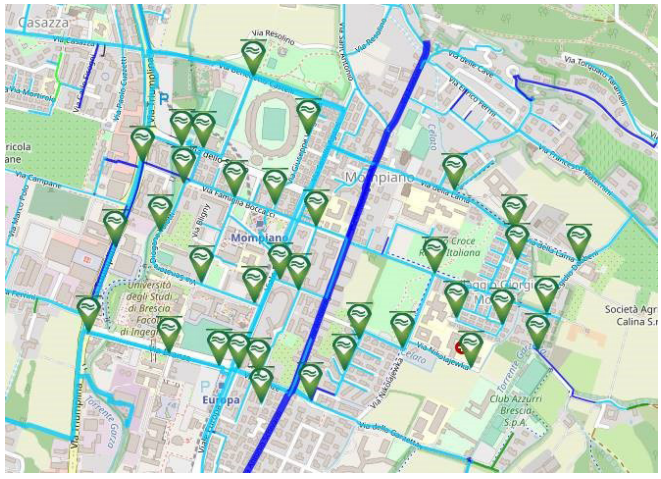


Figure 1. Sensor installation planning

Figure 2. AQS underground acoustic sensor installation

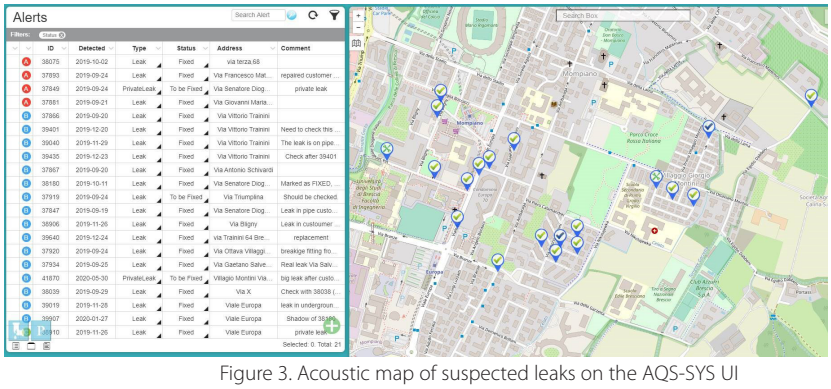


Figure 3. Acoustic map of suspected leaks on the AQS-SYS UI

About The Author

Oded Fruchtman, EVP of business development at Aquarius Spectrum, has vast experience in managing technology companies and promoting them around the world. He holds a BA in Computer Science and an MBA from the Hebrew University.

DIGITAL ASSET MANAGEMENT:
DANISH ANALYTICS PLATFORMS OFFER SOLUTION FOR U.S. UTILITIES

Over the past 25 years, Danish water professionals have taken a proactive approach to digital asset management and data-driven decision-making that peers around the world now can learn from to optimize CAPEX spending, reduce OPEX, and ensure efficient and resilient service.

By Frederikke Rørvang Mikkelsen

For water utilities, on average, a water main breaks every two minutes somewhere in the U.S. This means that utilities deal with approximately 250,000 to 300,000 breaks on an annual basis. According to a survey of U.S. wastewater utilities by the American Society of Civil Engineers (ASCE) from the 1990s, an average of 57.5 percent of the system's assets were reported to be between 21 and 100 years old — which means that they have exceeded the midpoint of their expected useful lives at present.[1]

Having a reliable water distribution system is not just a necessity for the private households. It also has a great impact on the industrial sector, which is heavily dependent on freshwater resources. As a direct or indirect consequence of future service disruptions, ASCE projects a cumulative decline of $2.9 trillion in gross domestic product by 2039 if the gap between required and actual investments in infrastructure is not addressed.[2]

The great need for investment in aging infrastructure as well as tight budgets are currently driving municipalities to not only replace network infrastructure but also modernize operation with data analytics in order to leverage smarter, predictive, and cost-effective technologies. Digital asset management and predictive analytics represent two subsectors of the crucial transformation; however, many professionals are unaware of its vast potential. In essence, digital asset management is a process that leverages data to manage long-term planning for the purchase, deployment, and decommissioning of infrastructure assets.

Predictive analytics is a tool used in digital asset management that gathers data through real-time machine learning, modeling, and data mining to interpret and forecast diverse scenarios. These prognostic planning frameworks inform utility decision-makers about possible challenges and opportunities that may arise as they evaluate lifecycle costing and value engineering.

> **In essence, digital asset management is a process that leverages data to manage long-term planning for the purchase, deployment, and decommissioning of infrastructure assets.**

In Denmark, Data-Driven Decisions Have Increased Utility Efficiency Significantly

Through extensive regulation, the Danish water sector has undergone a tremendous transition to become one of the most efficient and resilient in the world over the last 30 years. Most recently, in 2016, the Danish sector went from simply

benchmarking operating costs to a total financial benchmarking model (TOTEX). This approach includes both OPEX and CAPEX in order to also compare the utilities on financial efficiency.

Consequently, a large number of the utilities, with budgets and operations already cut to the bone, had to further reduce their infrastructure investments by at least 1.5 percent per year. Therefore, the need to prioritize and improve investment planning increased the need for asset management.

According to Lasse Thomassen, senior advisor of the Water Advisory at The Trade Council of Denmark in North America, data-driven decision-making has been essential to accomplish the regulatory requirements and prioritize readiness and longer life-span of the Danish infrastructure investments.

"It is a rule of thumb that up to 70 percent of the utility's assets are below the surface. Therefore, in order to maintain assets and sustain resilient operations, utilities need to collect data and make data-based decisions. Ultimately, the Danish experience is that digital asset management is not just an economical perk — it is a necessity for modern utilities to stay within regulatory requirements," Thomassen explains.

Best Practices From Denmark

The Danish utility ARWOS is a great example of how digital asset management and predictive analytics optimize service in the real world. The utility in the southern part of Denmark is experiencing many challenges similar to the reality in the U.S., such as changes in extreme weather events, increasingly poor infrastructure, and constrained budgets.

One of the most pressing concerns at the utility is to limit overflows and infiltration to decrease their OPEX, as the difference from a year with high precipitation compared to a year with low levels of rainfall is approximately USD $1.5 million. However, the cost itself is not the only challenge, as it can be difficult to identify the location. Therefore, as part of the solution, ARWOS has adopted the data-driven platform data|APX®, which supports the utility's decision-making and prioritization of reinvestment decisions. Through domain-specific analyses, the platform provides an overview of ARWOS assets based on their own existing data and public data.

Finn Reese, department manager at ARWOS, describes how they use the platform to assimilate multiple datasets such as GIS data, SCADA data, IoT data, and CCTV data — and thereby identify critical areas. This has helped to reduce inspection costs, minimize risk of failure for critical assets, and prioritize areas to refurbish.

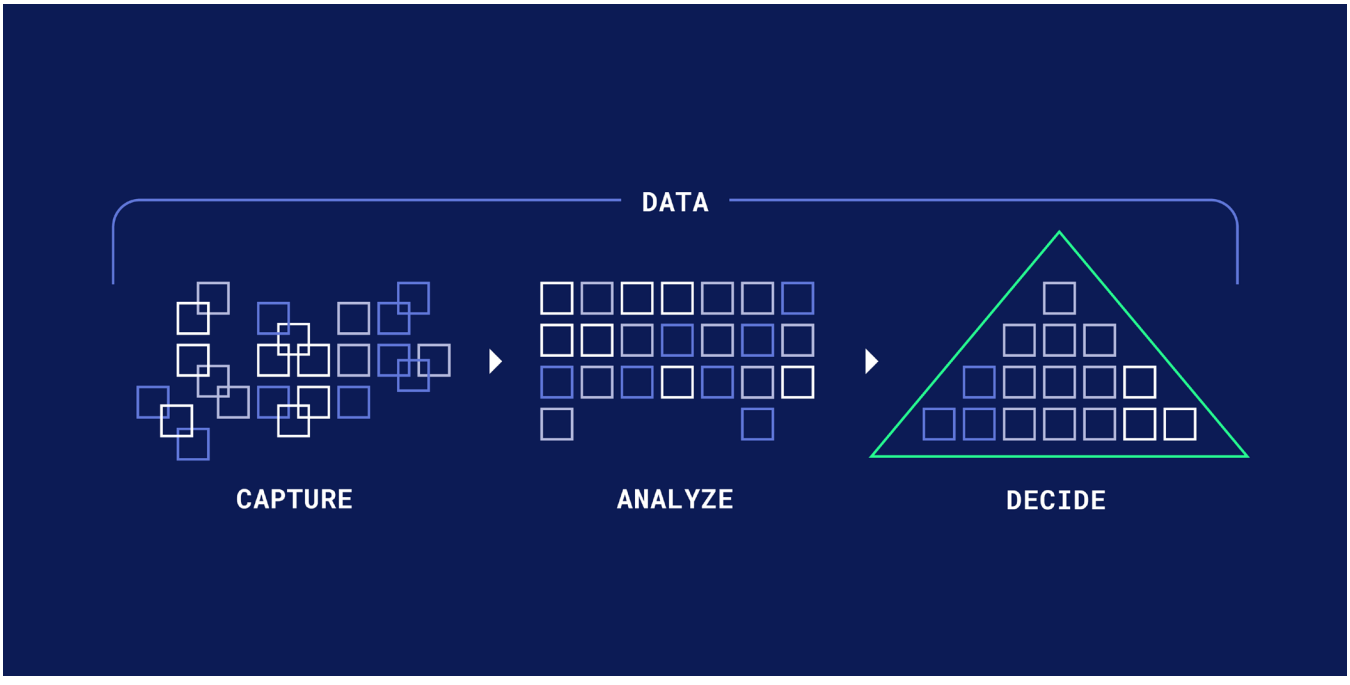
Finn Reese, department manager at ARWOS

"Through the data|APX solution alone, we estimate annual savings in operation and maintenance cost in the range of USD $250,000. One major contributor hereof is the identification of rainfall-derived inflow and infiltration water in our sewage system," Reese says.

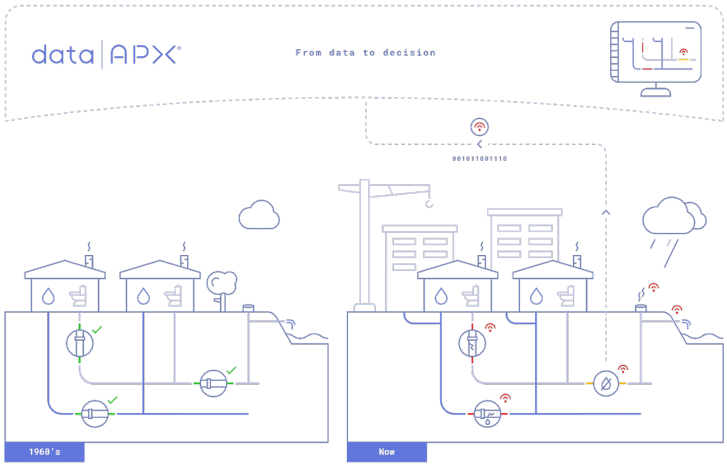
He furthermore explains how the complex data is simplified in a three-step process that 1) captures data, 2) analyzes data, and then 3) enhances those data insights so management and operators have proactive, dynamic, and actionable intelligence for precision reinvestment priorities.

Knowledge Sharing Is Essential In The Aftermath Of COVID-19

Since 2014, Danish and U.S. water professionals have been exchanging best practices and technologies in the water and



In a U.S. setting, where budgets are even more constrained than in Denmark, utilities should also take additional comfort because data analytics solutions are straightforward, cost effective, and flexible for incorporation.



wastewater sector. In Thomassen's opinion, digital asset management is one of the areas where U.S. utilities truly can benefit from the experiences in the Danish water sector — especially in light of COVID-19.

"It is my experience that U.S. utilities believe digital transformation is the best way to speedily and affordably upgrade their operations — a belief, it seems, accelerated due to the COVID-19 crisis. However, I also see an urgent need for visualization and fact-based decision support to improve the understanding of economy, risk, and prioritization," Thomassen says.

Ulrich Borup Hansen, CEO and cofounder at APX10, the company behind the solution applied at ARWOS, agrees. He explains that the tool was developed to present a simple and more intuitive approach to asset management among water professionals.

"We found that the many fragmented spreadsheets, personal know-how, and data siloes would benefit from a holistic tool that would allow for better-supported management decisions. Therefore, we actively involve our Nordic water utility leaders in the development of the solution, in order to secure their best practice being built into the solution. Thereby, utility leaders will be able to utilize the utility know-how and experience from Denmark, regardless of their location in the world," Hansen says.

In a U.S. setting, where budgets are even more constrained than in Denmark, utilities should also take additional comfort because data analytics solutions are straightforward, cost effective, and flexible for incorporation. They do not necessarily require complex reworking, numerous consultations, onboarding, or vast investments to get started. Simply leveraging existing data like CCTV data or other available data streams needed can gain the savings. The tools build upon deep understanding of utility data, which is essential to upgrade performance and ROI significantly, and they can thereby serve a fundamental role in the data-driven transformation of utilities in the U.S. ■

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About The Author

Frederikke Rørvang Mikkelsen is the PR and communications advisor of the Energy and Environment Team at The Trade Council of Denmark in North America. Based in Houston, she primarily supports the activities of the Danish public-private partnership, the Water Technology Alliance (WTA), which aims to share Danish know-how and foster collaboration. Prior to joining The Trade Council, Mikkelsen worked as a communications assistant at the Danish Society of Natural Conservation.