Water Technology Trends 2022

Redefining the utilities of the future

IDRICA

Contents

Foreword

Since the pandemic began, utilities have had no choice but to adapt to the new scenario of uncertainty. Over the last two years, we have learned about the importance of sound water management in our daily lives, and how innovation can open the floodgates to the future.

Our responsibility in the water industry is to ensure that future generations have access to clean drinking water and proper sanitation, in line with the UN Sustainable Development Goals. For this to happen, utilities will need to digitally transform water cycle management over the next few years.

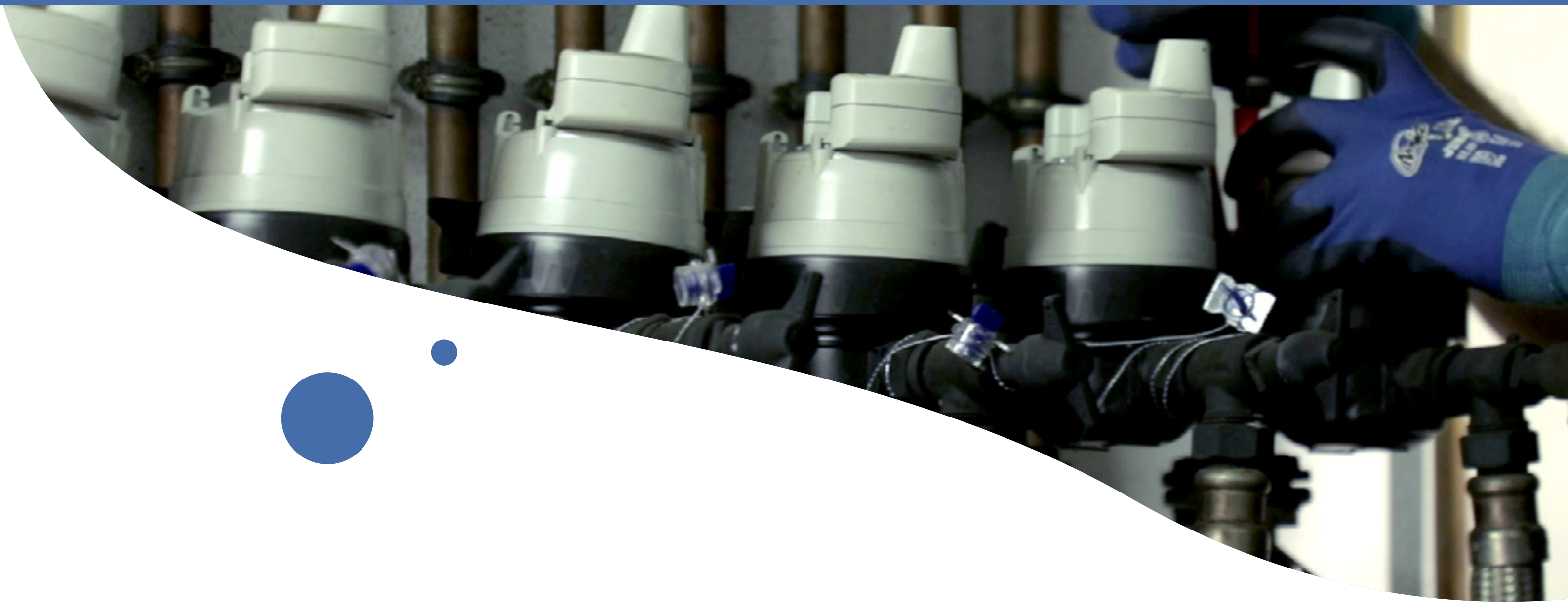
Citizens in the 21st century are demanding intelligent use of our most precious resource. In this sense, growing concerns about the environmental impact of processes will encourage the adoption of technologies that reduce our water, carbon and energy footprints. On the road to tackling these current challenges, we will only succeed if we have a solid business vision to guide the transformation of data into information for decision-making.

This is how utilities can determine the best way to move forward. The technology trends for 2022 reviewed in this whitepaper (Digital Twins, AMI, GIS, 5G, AI and intelligent asset management) will bring innovative use cases that will transform the industry.

The time to build a more sustainable world is now. The future of water is not only about technology, but also about people. Unlike machines, we can combine technologies and knowledge to transform today's management. The journey to unlocking value through digital transformation has just started, and the most innovative utilities are already on board.

Jaime Barba

CEO, Idrica



Trend #1

AMI: from meters to business intelligence

AMI (Advanced Metering Infrastructure) is fundamental in a world where data is the most valuable asset, given the amount of information it can produce. **More and more water utilities are realizing the value of measuring consumption beyond billing. These infrastructures can improve all business processes,** because of the large numbers of sensors deployed on them compared to other IoT systems in the water industry.

For some years now, water utilities have been investing in the digital transformation of micro-metering, not as an end in itself, but as a way to extract value from data and turn information into business intelligence. **Growing investment in AMI globally is intended to help businesses and consumers make better decisions**, not just reactive or corrective ones. They help them to predict.

The road to Big Data

Developments in meters are one of the most important advances of the last 50 years in the water industry. From the first innovations, centering on faster, remote reading (walk-by and drive-by), which was mainly geared towards billing, **the meter becomes an IoT sensor that transmits useful information to digitally transform all processes in AMI systems.**

Meters have become IoT sensors that help to digitally transform all processes.

If the term AMR (Automatic Meter Reading) refers to remote reading using smart meters connected to communication devices, AMI goes one step further. It focuses not only on data collection, but also on its integration and processing using Big Data technologies. **Platforms are a key element of these infrastructures, which are the most mature in the micro-metering field. Their aim is to offer value-added services and to manage water resources more efficiently**. For example, developing algorithms to detect leaks and predict demand.

To achieve this, AMI must ideally process consumption data on an hourly basis with optimum quality. Compared to proprietary protocols and LPWAN technologies, such as SigFox and Lora, **new communication protocols (NB-IoT, 5G) are helping to make this a reality due to their greater scope, penetration and coverage**. In addition, they enable more efficient battery management, which is essential if we take into account smart metering's need to frequently send data.

Benefits over and above billing

01

Increased operational efficiency

Connecting consumption data with other sources of information, such as SCADA, CMMS, ERP, GIS and IoT sensors, means that companies can optimize all their processes. Their integration into a digital twin, among other use cases, is essential to simulate scenarios accurately in order to gauge the network's response to events and make better decisions. It also reduces OPEX and helps to predict water demands in advance.

02

More sustainable use of resources

AMI deployment reduces the volume of unbilled water in the distribution network by conducting hourly water balances. This enables us to improve overall system efficiency by **detecting fraud and locating leaks at an early stage and notifying customers accordingly**. In addition, remote reading **helps to reduce energy consumption and the environmental impact of other processes,** such as operators having to travel around to take visual readings.

03

Value-added services for citizens

Data analysis opens the door to useful services such as **alerts for domestic leaks and notifications to social services after a change in the consumption patterns of vulnerable people.** Greater transparency in the relationship between utilities and the general public is another of the advantages. Thanks to AMI, **households can see the liters of water they use in real time to make better, more informed decisions.** In addition, billing based on actual, rather than estimated, readings increases satisfaction and brings down billing-related complaints.

2022: more metering for better management

We have recently witnessed water outages in countries such as the United States, which we thought would be spared from these disruptions, until now. These events, along with others caused by climate change, are driving a greater global awareness of water as a limited resource. **Today, society demands a commitment from companies and utilities to ensure responsible water consumption, in line with the Sustainable Development Goals.**

According to the World Bank, by 2030, there will be a 40% world shortfall between the forecast demand for water and the amount available. In the light of this situation, **governments and the different social partners are highly likely to support technologies that represent a step forward in terms of sustainability.**

AMI is one of these technologies, as it helps us to take the first step towards process improvement through metering. Given that it is the system that generates the largest amount of information in the industry, its impact ripples out to the entire business community. In this sense, **more and more utilities understand that these infrastructures not only facilitate billing**, but also serve to improve leak detection, forecast demand through algorithms, increase customer satisfaction, fine tune digital twin simulations and reduce CO2 emissions.

Digital transformation in the water industry will gather speed in the coming years. **The increased volume of available data will require the implementation of agnostic solutions, capable of integrating information from different sources**. Right now, many water utilities use different communication technologies (NB-IoT, LoRa, Sigfox, etc.) and meters manufactured by different vendors. Therefore, **Big Data platforms that standardize information and help us to convert it into business intelligence will be one of the main trends for 2022.**

The increased use of sensors we expect to see poses **one of the main challenges for AMI: the coexistence of smart metering with other smart devices**. Fortunately, 5G provides an answer to this problem, thanks to its ability to connect millions of devices in a small area (MIoT). We are still investigating the use cases linked to this new generation of technology, but we already know that it will help us to manage critical infrastructures and be more efficient.

AMI is also the direct interface between utilities and consumers, which is why **our commitment to this infrastructure means advancing transparency objectives for citizens.** By making consumption information available to them, we are helping to promote responsible water use. This is also true for companies, as this technology helps them to calculate their water footprint.

The search for water efficiency, both in water utilities and among citizens, will drive investment in AMI in the coming years. Therefore, awareness of how these infrastructures can transform both billing and all the processes related to the management of water, our most precious resource, will be fundamental.

Carlos Tejedor

Smart Metering & Instrumentation Specialist, Idrica

Trend #2

Digital Twins: transforming the real world through the virtual

When discussing the impact of digital twins in the water industry, not all experts do so from a common standpoint about this technology, though perhaps **the most widely accepted definition is that they are a virtual copy of the water supply system, simulating how it behaves.**

As a proxy for real behavior**, digital twins help us to make better decisions thanks to the holistic view they provide of the system and their ability to simulate real and fictitious scenarios.** They anticipate the response of the network to any circumstance affecting operations, whether it has occurred before or not, helping utilities to assess different scenarios. To do this, **both the physical and dynamic aspects of the system must be represented**, i.e., the virtual representation of physical assets must be combined with the simulation of their behavior in the digital environment.

A recent revolution in the water industry

The Digital Twin (DT) philosophy has been around since the 1960s when it was used by NASA to operate and maintain systems remotely. **In 2003, the concept was finally consolidated by Dr. Michael Grieves**, as a tool to optimize the management of a product's entire life cycle in an industrial environment.

Due to its potential, **DT technology has recently been implemented in other areas such as infrastructure management, including the water industry.** In fact, today we can find application cases in drinking water distribution systems where it has become easier to implement thanks to the large-scale deployment of sensors in recent years. Breakthroughs are also being made in this sense in irrigation and in sanitation and sewage systems.

Digital twins need large amounts of data and information from the physical system to function. In other words, **the development of use cases and practical applications depends on sensors and the information provided by the digital systems used, such as SCADAs, GIS and CMMS.** Today, many companies have this information, so the next challenge for them is to concentrate, combine and standardize it into a single platform, which serves to feed the digital twin with real-world data.

Digital twins promote two-way communication between utilities and citizens.

Why is there so much interest in digital twins?

It is no coincidence that the current scenario of uncertainty has accelerated the adoption of this technology. Some of the most interesting benefits of digital twins, which have gained special relevance in recent years, are the following:

01
Resilience

Digital twins improve the ability to adapt quickly and safely to any circumstance, whether it has happened before or not. This includes emergencies, health alerts and climate change-related events.

Testing new ideas and changes virtually, before making a decision in the real system, minimizes risks, time and costs. **Digital twins anticipate problems and identify the measures needed to prevent emergencies or minimize their consequences.** In short, they ensure that, even in critical situations and in complex distribution systems, the water supply will remain available 24/7.

02
Efficiency

Digital twins can help to optimize systems now and in the future from an operational and planning standpoint. Thanks to the holistic view they provide, **decisions are made by considering their impact on the different processes occurring in the system.**

For example, **energy costs can be reduced by establishing the best pumping schedules** taking into account the hourly price of energy, whilst also keeping the system's hydraulic parameters under control. **Energy consumption can also be reduced through more efficient asset operation and system planning**, taking into account energy use associated with the design of new infrastructure.

03
Customer-centric management

Twenty-first-century citizens are demanding more information and better service, and they are also an essential part of the management of water distribution systems. Accordingly, **digital twins need to engage citizens in order to provide them with information and to adapt water system management to cater for their needs. Thus, they can receive information on service disruptions in advance,** whether due to planned interventions in the network or to an emergency. In addition, the operation of the system can be adapted depending **on the needs of critical users, such as hospitals, to ensure supply in** any possible scenario.

Yet that is not all: the challenges we are currently facing, such as increased demand due to urban growth and the scarcity of water, require water utilities and citizens as end users to work together. For example, **providing users with access to detailed information about their consumption will lead to better actions and awareness of responsible water use policies.**

04
Sustainability

There is strong support for the new concept of sustainable cities. Their objective is to adapt to climate change through planning, optimal infrastructure management and citizen participation. **The technology used in urban water systems means that they can be operated safely and efficiently, with the aim of reducing water and energy consumption. They also promote two-way communication between utilities and citizens,** who can now address new challenges and receive information on how their actions improve resource management.

2022: the future is now

Interest in digital twins is growing, with new success stories being added every year. **The most innovative international utilities have already included them in their strategic plans.** They are no longer just a good idea for the future, and many utilities have already put specific actions down on paper.

This ties in with the commitment to digital transformation. **Once processes have been digitally transformed and infrastructures have been equipped with sensors, the next logical step is to extract value from all this data. Digital twins are one of the best tools to do this,** as they deliver a holistic, cross-cutting vision of all the data they compile.

Their commissioning must include the following components: a platform integrating all the information collected from assets and infrastructure, hydraulic models and advanced analytics, and a powerful, user-friendly dashboard system. Digital twins go way beyond simply simulating scenarios: **one of their main features is the development of use cases, understood as the ability to solve problems and optimize day-to-day operations.**

Their successful deployment will require utilities to overcome a number of challenges in the coming years, which may act as a barrier to market uptake. For example, insufficient data quality and its location in isolated systems that are difficult to connect, or the intrinsic complexity of running a simulation model that must be kept permanently up-to-date and must operate in real time. In addition, **the investment must be coupled with an innovative organization and culture if it is to be successful.** If there is something implicit in digital twins, it is a new way of working.

At international level, more and more working groups are focusing on this technology. **In short, in 2022 and beyond, digital twins will be one of the tools most commonly used to tackle the new challenges facing the water industry.**

Pilar Conejos

Digital Twin Manager, Idrica

Trend #3

Intelligent asset management: the key to sustainability

The water industry has always had to deal with the challenge of proper asset management and has used different policies and practices to maintain and renew them over the years.

In recent years, leading water utilities have been building intelligent asset management into their processes. As a result of the deployment of sensors on their infrastructure and the implementation of other technologies such as micro-metering, GIS and SCADAs, **utilities have an ever-increasing volume of information available on their assets. In this context, intelligent management integrates and organizes all this data in order to make better decisions.** It advances on the conventional approach, which is characterized by corrective maintenance.

Today, **the water industry is adding intelligent management with the ultimate goal of maximizing efficiency**. Although utilities have varying degrees of digital maturity, there is a definite trend towards moving in this direction.

Based on experience, **the application of technology paves the way for different use cases.** For example, the history of work orders carried out on an asset can help assess the risk of failure and determine when it should be replaced. Thus, **utilities can extend the lifetime of assets, anticipate replacements, adjust maintenance tasks and prevent outages**. In addition, these systems help to pinpoint the most problematic materials, making real preventive maintenance possible and even guiding future investments. In addition, the management of pumps and other operating elements can optimize their energy consumption and provide better service.

In short, **more efficient resource management brings significant economic and environmental benefits** by reducing costs and energy consumption. **It also optimizes productivity, ensures service availability and reduces downtimes.**

Management inputs

There are a number of essential inputs required for sound asset management. First of all, **operators must have a comprehensive list of the master data involved in the production process.** This inventory includes the characteristics associated with each asset: economic (acquisition and replacement cost, cumulative depreciation, etc.), technical (inherent to each type of device, such as power) and operational (theoretical operating conditions, tolerances, estimated availability, curves, etc.). **The relationships between assets,** such as topological connections and asset hierarchies, **must also be recorded**.

Transactional data are another key input. They contain different types of data, for example, that obtained from micro-metering and sensor technology, which are closely related to the Internet of Things (IoT). They also include information on incidents, such as their cost, downtimes and idle times, by their cause and origin. This group of elements also includes consumption estimates, generated by a mathematical model based on predicted or simulated conditions, together with a log of the work conducted on the assets in a CMMS system.

This information is used by Artificial Intelligence (AI) and Machine Learning (ML) based algorithmic modules to suggest the most appropriate actions to be taken. The circle closes as the results of these actions become a new input for the system, feeding the AI and ML engines.

CMMS are an essential tool in the introduction of best practices.

Smart CMMS: taking maintenance to the next level

Automated Computerized Maintenance Management Systems (CMMS) are the best example of the application of technology to management and maintenance when combined with intelligent management. **They have already become an essential tool in the introduction of best practices and are valuable in addressing resource scarcity.** In addition, they help utilities to obtain certifications related to new environmental and organizational standards, such as ISO 55000.

There are numerous benefits to implementing these systems, thus guaranteeing ROI. **The investment implies improved safety for facility and equipment users. It also enhances product quality,** reducing costs and giving the utility a competitive advantage. By increasing production capacity and decreasing the probability of failures in systems and facilities, **service availability is boosted and, by extension, the satisfaction of internal and end users increases.**

In addition, **utilities can optimize their administration processes by directly managing work orders using a mobile tool and drawing on the administrative support provided by the CMMS.** This streamlines the management, organization and planning of maintenance work. In terms of costs, **the reduction in the use of spare parts and the increased productivity of the facilities frees up working hours and cuts down idle times**. Thus, cash flow improves, and profitability rises.

Moreover, the optimization of preventive maintenance on facility elements usually **reduces the energy used by mechanical equipment by 5% to 10%.** Ensuring they are in good working order and monitoring their consumption enables proactive, automatic action to be taken in the event of any deviations. This is particularly important in a context marked by global warming, since **improvements in energy efficiency help to mitigate the impact of the activities** that need to be carried out.

A key part of CMMS is the automation of supply procurement in the warehouse. This enables the system to place the necessary orders to ensure facility maintenance, according to previously established minimum indicators. This reduces downtimes when replacing parts as stock is available.

Finally, it is important to highlight how **the mobility tool included in these systems increases maintenance management efficiency.** The geolocation of fleets, together with the optimization of maintenance routes, leads to a reduction in travel time and distances, leading to a smaller carbon footprint and reducing related costs.

In general, these tools increase productivity, reduce administration time, and collect field data in digital format. **They also serve to train new technical staff** by providing them with different procedures, manuals, videos and photographs of work orders that have already been completed.

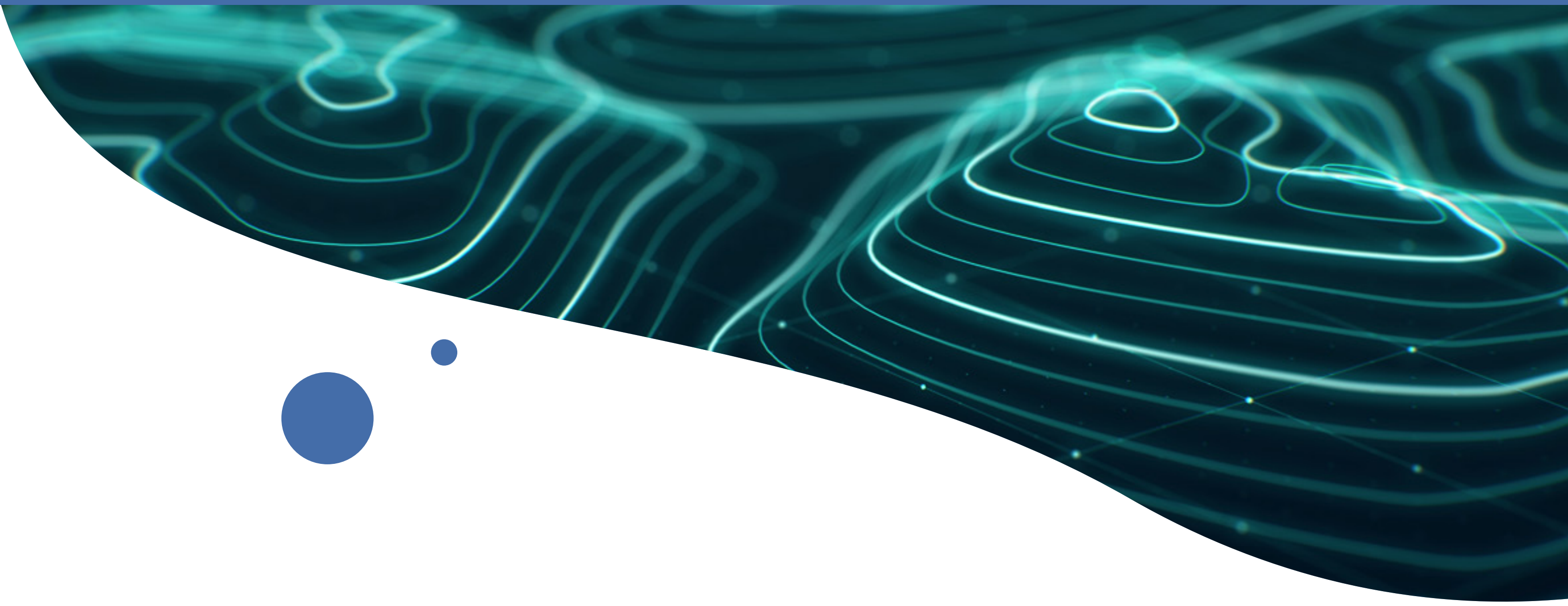
Roadmap for 2022

Over the next few years, intelligent asset management is set to grow dramatically in the water industry. In a world that is increasingly concerned about environmental sustainability, the **larger amounts of data available, provided by infrastructure sensors, will enable companies to progress towards more efficient resource management.**

One of the main challenges lies in overcoming the technological complexity inherent to this project, as smaller utilities do not usually have sufficient technical and financial resources to tackle this issue. These utilities will need to rely on the support of external partners that combine technology and expertise, if they are to succeed. In addition, **concerns about cybersecurity will lead the industry to demand appropriate security mechanisms** to protect facilities and production processes from unauthorized access.

Globally, we expect an upsurge in projects related to productivity and optimal resource consumption in 2022. **Intelligent asset management will be mainstreamed by the most innovative utilities, given the potential it has to boost efficiency and guarantee service availability.**

Rafael Rubio
Head of IT Operations, Idrica



Trend #4

Geographic Information Systems (GIS): data at the service of efficiency

In recent years, **Geographic Information Systems (GIS) have become an essential tool for water utilities**. These systems enable companies to integrate and represent an ever-increasing flow of information, driven by digital transformation and advances in infrastructure sensors, although this is not an end in itself. **The ultimate goal is to manage water more efficiently and effectively.**

In practice, **any data with geospatial content can be represented in a GIS,** including satellite and drone images, sensor information and vector data. **This enables us to bring together the value of the location and its information in a single tool, where it can be centrally managed.** Visualization is dynamic and collaborative, since maps can be shared and distributed on different platforms.

GIS help to understand patterns and trends, and to analyze data and establish relationships between them. They also help to monitor changes that water utilities make to their infrastructure. **The data insights they provide help managers solve problems on the road to greater sustainability.** Any geolocated data multiplies its original value by three, since visualizing alphanumerical data in a location provides the user with crucial information to guide real actions.

In short, thanks to these systems, companies can extract value from their data to improve their business processes.

From data to efficient water management

Good geospatial orientation in data interpretation, performed by a GIS specialist, makes for better decisions in the water industry. For example, proper understanding of a terrain's orography makes it easier to choose the best location for pipelines and the connections between them.

In terms of the creation of typologies, **GIS help with the layout of different hydraulic elements (valves, nodes, filters, plugs...) so that they comply with topological rules.** Although they can be adapted to each company's needs, there are a series of minimum requirements that must be taken into account, such as the calculation of the volume of water to be carried by each pipe according to its diameter and nodes. This is just one example of how GIS help to manage water.

The figure of the GIS specialist is gaining in importance in water utilities, thanks to their analyses, interpretation and spatial management of data. **But once the data is available, what can utilities do with it to be more efficient? This is the question we must answer in every scenario.**

Innovative use cases in the water industry

The popularity of GIS in the water industry ties in with the capabilities it delivers across the entire water cycle. Some of the most innovative use cases we are already seeing in the industry include:

Drinking water

GIS help utilities minimize water service interruptions following interventions in the distribution network. The information they provide about the branches and pipes affected by repair work or a leak determines which assets need to be shut down to minimize any negative effects. **They also identify and alert users when their water supply has to be cut off.**

These systems also collect vital information to prevent network failures, such as the material the pipes are made of or the date they were installed. **By combining data with the geographic element in the geospatial analysis of the pipes, it is possible to intelligently guide inspections** and even detect branches in use that should no longer be operational. **The geolocation of field work is another important use case** in this area, from the mapping and tracking of routes to generating information about the task performed together with its location.

Wastewater

GIS are the perfect partner for wastewater-based epidemiology, which has come to the fore during the coronavirus crisis. The analysis of the presence of certain viruses in the population, combined with geolocated information from pipes, connections and sewerage branches, **enables us to draw maps of contagion in cities, and provides us with information about the areas with the highest virus incidence,** together with other data such as population density and age, which can assist the health authorities in the measures they need to take.

Another use case in which these systems are useful is flood prevention in cities. Thanks to remote sensors, **possible blockages and poor sewer drainage capacity can be pinpointed. This enables municipalities to take action to prevent flooding** after a heavy rainfall event.

Irrigation

In the current context of environmental concerns, GIS are essential for efficient irrigation. When combined with technologies such as sensors (Internet of Things), remote sensing and satellite imagery, **irrigation associations can visualize the volume of water at each location on their plots in real time**. If it is higher than desired, the farmer receives an alarm to adjust the irrigation flow, or to check whether there is a leak in a drip irrigation element. The same thing happens if the flow rate is lower than expected, which could signal a blocked pipe.

In addition, the geolocated inventory of pipes, with information about what they are made of and the date they were installed, is key to preventing bursts and assessing damage. **Thanks to GIS, irrigation associations can prioritize which assets need to be replaced before they begin to fail. Other preventive areas include soil preparation** if soil moisture remains too high due to the presence of fertilizers or nitrates. Irrigation can also be suspended if the water level is too high.

2022: committed to the geolocation of all processes

Water utilities are committed to implementing GIS and linking them to their corporate systems and tools to solve key aspects of day-to-day management. **It is no longer just a matter of geolocating infrastructure elements and obtaining information about them. Instead, advanced use cases are being developed**, such as real-time monitoring of field work through operator-managed mobile applications. Integration with GPS systems and mathematical models is already a reality in leading utilities. In addition, work is being done to achieve optimum water quality by adjusting pipeline parameters and predictive models.

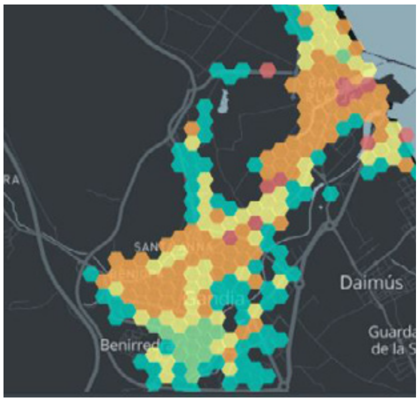
3D visualization of data will be a key area over the next few years. It will enable users, for example, to see which floor of a building the water pressure reaches without having to use a pump, or to obtain a 3D map **showing the depth of the different hydraulic elements that make up the drinking water and wastewater systems**, such as pipes, manhole covers and valves. Thus, any work can take into account their position to prevent duplications, and to focus interventions on the right areas. This is a very important step forward in usability.

Other GIS trends include cloud developments, autonomous vehicle-driving, Building Information Modeling (BIM) and the Internet of Things (IoT). In irrigation, advances will continue to be made in prevention, water volume adjustments and early crop pest detection, always based on a collaborative approach and on cultural change in companies.

On the other hand, **advances in 5G-NR will transform the way data is visualized and interpreted, making it immediately available**. This will facilitate the development of algorithms and functional and statistical calculations. By working on instantaneous data, **companies and users will be able to receive real-time alarms** for events in hydraulic elements, such as meters. We will be able to link an image or a button on a map so that the element can be remotely managed by interacting with it. This low-latency interconnection will enable utilities to continue to drive water efficiency.

Companies are already moving towards greater use of GIS, which will become easier to interpret as more information becomes available. The quest for greater customer usability will shape the roadmap for new GIS use cases in industry. **We will be able to use water more intelligently and make more accurate predictions about the future, if we know precisely what is happening in the infrastructure.**

Geolocated data multiplies its original value by three.



Sergio Aznar

GIS Department Director, Idrica

Trend #5

Artificial Intelligence: building learning into processes

More and more water utilities are adding Artificial Intelligence (AI) to their processes. **This science, which aims to replicate human cognitive functions through machines, provides more sustainable management of water resources.**

Within AI, **Machine Learning (ML) has huge potential in the industry.** This discipline focuses on the development of techniques and algorithms that help a machine to learn, that is, to acquire increasingly accurate knowledge from an external data source. **Other branches of AI, which are also being applied to water, are voice and vision recognition systems, expert systems, Natural Language Processing (NLP) and robots.**

One of the main advantages of ML is that it automates processes that are costly to manage manually. This is done by means of agnostic systems, i.e., which are data-driven and not based on subjective analyses. This improves the accuracy of the results, which are calculated at high computational speed thanks to the infrastructure that underpins them. Thus, **utilities can make better decisions because they have real-time information about what is happening in the infrastructures.**

Four types of machine learning

The water industry handles vast amounts of data, which makes it essential to extract its value. Utilities have access to different fields of machine learning to transform data into useful information.

Supervised

In this type of learning, **prior knowledge of the problem is used as the valid hypothesis to be able to characterize new cases in the future.** For example, if we have data on customers who have had leaks in the past, and information about their characteristics, we can build a model that categorizes new customers to anticipate further water losses.

Unsupervised

When **there is no previous knowledge about the issue to be solved, but there is information about its characteristics**, unsupervised learning is used. Continuing on from the previous example, if we have a database of customers, we can study which ones have abnormal consumption in order to identify possible leaks.

Semi-supervised

In this case, **we have data that gives us prior knowledge of the problem and other data that does not. Both sets enrich the information needed to solve the problem.** Similarly, if we have data from clients who have had leaks, others who have not, and some whose situation is unknown, the combination of all these sources helps us to detect new cases more accurately. To do this, a number of assumptions are made about data distributions.

By reinforcement

Unlike the other fields of machine learning, this one differs in that **it is rule-based and deals with action/reaction type information to be modeled, the objective of which is to maximize the reward function.** Reinforcement learning is used, for example, to perform simulations in a development environment, generating software capable of preventing the collision of autonomous vehicles in real-life situations.

Use cases applied to water

Regardless of the type of learning applied, **AI provides innovative answers to some of the major challenges facing utilities. For example, the detection of fraud through machine-learning-based models**. Although these systems can be applied in any business environment, they are particularly relevant in our industry because they manage a resource that is essential for life. **The same applies to early leak detection, as this has a major impact on water savings.**

In general, **AI improves the efficiency and quality of our water supply. Algorithms can estimate and anticipate consumption and predict water quality.** They are also instrumental in improving irrigation systems and optimizing energy use in pumping systems.

In wastewater, this science **helps to detect overflows in sewage networks, and can even prevent them** by implementing preventive cleaning in trouble spots. Another innovative use case is the **detection of pathogens in sewage systems**, which helps to monitor the evolution of epidemics or pandemics, as is currently the case.

Other applications, such as **automatic report generation and social media sentiment analysis**, are useful to ascertain not only the status of processes, but also citizen satisfaction with the water services provided.

As part of this commitment to greater transparency and citizen orientation, **chatbots have recently been included in various utilities' customer service departments**. These automatic response chatbots, based on NLP, help to solve consumers' problems more quickly. **Automatic reading of water meters through vision recognition systems is another of the advances we are already seeing** in water services.

2022: machines driving sustainability

Sustainability is driving the evolution of AI products in the water industry. Continuous improvements in technology will lead to increasingly optimized energy supplies and consumption, more accurate leak detection processes, and lower maintenance costs. On the back of these advances, total CO2 emissions will also fall, leading to smarter management of the entire water cycle.

We also expect to see an increase in the use of edge devices in 2022. While the on-premise server computing paradigm has already been replaced by cloud technologies, improvements in edge device processors will lead to direct computing on edge devices without the need for a server. **Users will have AI models implemented in an application on their device, with real-time access to their behavioral data and various forecasts.** In the water industry, these advances will yield different practical applications, such as autonomous driving of vehicles and robots.

For this to take place, **some related challenges need to be solved**. First, scalability, as it is easier to pool data in a single storage center, such as a physical server or in the cloud, than in all the edge devices. In addition, an infrastructure is needed to manage failures and configuration errors. The second much more critical issue is security. With edge devices, **the entire process is located in a place that is not readily accessible to the organization, so more investment is needed to make the system secure.**

Over the next few years, **utilities will be adding different AI use cases to their operations. New lines of research that could emerge include systems for detecting long-term weather patterns**. These systems could be designed to improve the efficiency of water resource management in the event of droughts or floods, in order to mitigate the effects of climate change. The water industry, as a provider of an essential service, could spearhead these developments.

In short, **more sustainable management of the entire water cycle requires the introduction of AI in the utilities of the future.**

Manuel García
Data Scientist, Idrica

Trend #6

5G: turning the future into reality

5G is not just another new generation of communication. It is a veritable revolution in how mobile networks are designed and used. A few years ago, 4G networks overcame the connectivity and speed issues encountered in previous generations (2G, 3G), and accelerated person-to-person communication. **5G technology is not just another small step along this road; instead it opens up radically new business opportunities that were not previously possible.**

Until now, the same physical infrastructure has had to serve a wide variety of use cases, although these have very different requirements. However, **the ultra-flexibility of 5G networks means that they can be sliced or configured in a variety of ways to cater to the needs of telecommunications infrastructure users.**

We can compare this idea to highway infrastructures, which are characterized by their inflexibility. When we want to adapt them to external circumstances (an ambulance that needs to get through, closing or opening lanes depending on the volume of traffic, etc.), an external manager modifies them in an attempt to cater for these new uses, with varying degrees of success.

Conversely, if we apply the 5G concept, we would have smart infrastructures monitoring what is going on and taking swift action when needed. For example, they could open up a new lane, transfer lanes from one direction to another, light up the road or change to a more rugged road surface in the event of rain. Similarly, 5G will be able to create virtual corporate networks within the network itself, or respond to use cases with different bandwidth requirements, response speed and number of connected devices, among other functionalities.

This is how **5G can help us to build different use cases on its networks.** The intelligence of the network makes it suitable for services that require high bandwidth and good coverage (enhanced Mobile Broadband - eMBB), low latency and very high reliability (Ultra Reliable Low Latency Communications - URLLC), as well as for securely connecting a large number of devices (Massive Internet of Things - MIoT).

5G-NR's evolution across the world

The world's major powers, such as China, the United States and Korea, have been vying to lead the development of 5G since 2019, and are adopting different strategies to push forward with the implementation of the most disruptive use cases.

So far, commercial deployments have been based on the Non-Standalone version, which is more limited in terms of its benefits. However, **there is huge interest in moving forward, so during 2022 we expect to see the first Standalone deployments**. In addition, some countries are already rolling out private networks in industrial environments and reserving part of the spectrum for their businesses, and **we are even starting to see the first smart factory projects in Europe, with processes managed through 5G.**

After completing the pilot testing phase and current partial deployments, **the forecast is that in a couple of years' time, 5G coverage will reach similar levels to those of current 4G networks.** By that time, we will have moved to the commercial model, and **it is reasonable to expect the water industry to take part in this change.**

Some hurdles must first be overcome for this to happen, such as the limited availability of coverage and radio spectrum for industry, the global shortage of chips and the high cost of IoT devices. **Full 5G coverage is expected to be reached by 2025, thanks in part to the support of governments,** who see this technology as an economic driver capable of creating new jobs.

5G is set to liberate and democratize data.

Innovative use cases in the water industry

The innovation brought by 5G comprises both the technology's capabilities and the new use cases that it will enable. Although its full potential is still being explored in several pilot projects, there are a number of innovations that are worth taking into account.

One of the most important is the connection of millions of devices per km2, thanks to MIoT (Massive Internet of Things). 5G will ensure the coexistence of smart meters with the digital transformation of other devices, which is key in a world where there will soon be 26 billion devices connected.

For sensors to be compatible with economic and environmental sustainability, their useful life must be extended. **5G can reduce battery consumption by up to 50% compared to current levels**. This technology also ensures that the digital transformation of infrastructures is secure, thanks to **improved security protocols to protect against cyber-attacks and the ubiquity of the network,** i.e. uninterrupted coverage.

In addition, **5G's network slicing is essential for the management of critical infrastructures.** The main change is that the network will adapt to the needs of businesses, and not the other way around, thanks to the definition of virtually independent networks with guaranteed quality of service.

These slices will enable remote control in real time. The autonomous operation of plants, the driving of robots and the piloting of drones to inspect and monitor critical infrastructures, are just some of the examples that will become commonplace. **Ultra-low latency will enable machines to inspect dangerous or difficult-to-access areas, such as sewers, and improve predictive asset maintenance.** In addition, the farming industry is exploring the use of autonomous tractors for sowing and harvesting.

Another of the main practical applications also involves avoiding unnecessary travel and facilitating access to difficult spaces: **remote assistance will speed up access to specialized knowledge to enhance incident resolution in the water industry.**

2022: the water management revolution

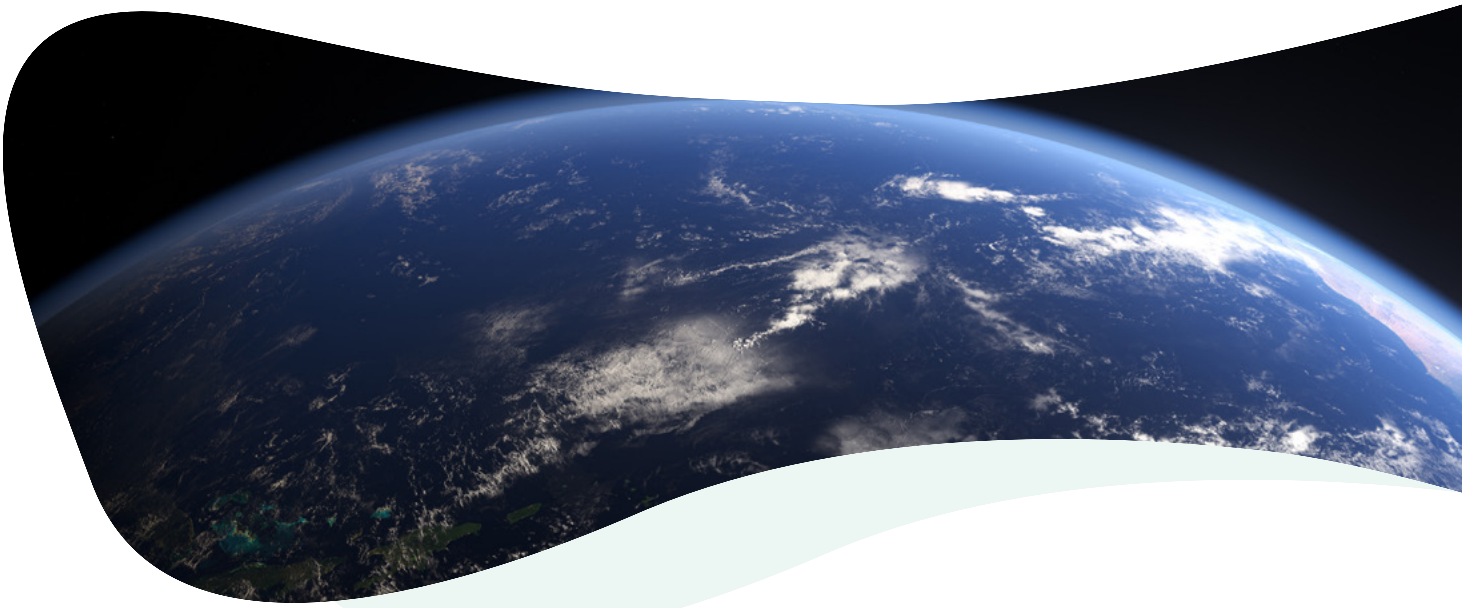
Global water utilities are transforming their processes as a means to achieve greater water and energy efficiency. This journey includes leveraging the value of the data obtained from sensors, and doing so securely, in order to make better decisions.

Thanks to its low latency and its ability to connect millions of devices, 5G will become a key ally for these utilities. Moreover, **against a background of increased transparency, this technology will help to liberate and democratize data, making it more accessible.** The 21st century citizen not only wants to know how much water they have consumed, but also how much is left in the reservoirs, or the quality of the water they are using, in real time. 5G can provide the answer to these questions.

These citizen demands, and others related to environmental sustainability, are also shared by government and are on the roadmap of water utilities. Consequently, 5G, as an enabler of innovative use cases, will receive firm support for its deployment and adoption. **In the coming year, the water industry has a unique opportunity to further transform the management of its most precious resource through the advantages brought by 5G.** The range of available technologies will benefit all water utilities, regardless of their degree of digital transformation.

Chema Nebot
Business Development Director, Idrica

Conclusions



Today, 2.2 billion people lack access to safely managed drinking water services (WHO/UNICEF 2019), and almost twice as many lack adequate sanitation (Id. 2020). Against this background, the industry's continued commitment to ensuring the right to water and sanitation for all, as recognized by the United Nations General Assembly in July 2010, is essential.

The technologies featured in this whitepaper are some of the must-have tools for ensuring the availability and sustainable management of water, in line with Sustainable Development Goal (SDG) 6. **The digital transformation of processes is no longer an option**; it is simply the road we must follow to offer the quality service demanded by 21st century citizens.

Climate change and water scarcity, which already affects 40% of the population, are challenges that need to be addressed as soon as possible. **In 2022, and over the next few years, utilities will continue to optimize their management** thanks to digital twins, the deployment of AMI (Advanced Metering Infrastructure), Geographic Information Systems, intelligent asset management, Artificial Intelligence and the new generation of 5G-NR communications, among other developments.

These trends pave the way for use cases that drive process automation, remote and real-time control, the anticipation of events and improved field work. They also contribute to customer-centric management by delivering value-added services. In short, they are geared towards achieving more sustainable, more secure management, based on better decision-making.

The future depends on digital transformation. However, this should not be conceived as an end in itself, but as a way of extracting value from data and converting information into business intelligence. This is the only way we will be able to tackle the challenges of the coming decades.

About Idrica

Idrica is a leading company specializing in water cycle management. Its unique value proposition is based on the efficiency and quality of its services and on the GoAigua technological solution used for the digital transformation of the industry.
Contact us for an analysis of the challenges facing your organization and learn how the GoAigua technology is helping its customers in the water industry.

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