Water Technology Trends 2023

Transforming utilities through innovation

IDRICA

Contents

Foreword	3
Pre-emption and prevention	5
Security	8
Water reuse	12
Automation	15
Optimization	18
Water planning	22
Conclusions	26

FOREWORD

In recent months, the water sector has attracted international attention. Both public and private stakeholders, non-governmental organizations, and even financial entities and investment funds, have stressed that better water management has been and continues to be a trend.

2023 poses new challenges in terms of population growth, changes in the economy and the quickening pace of climate change. As climate change becomes increasingly visible, taking center stage at the recent COP27 meetings in Egypt, and at the ninth World Water Forum in Senegal, people are becoming more aware of how water stress and extreme events are here to stay. In fact, the UN panel of climate change specialists warns that phenomena that used to occur once every ten years will now happen 1.3 times during the same period.

The consequences of these episodes will affect billions of people, in a world that has already surpassed the eight-billion mark in terms of population.

Climate change is no longer just another concern. It is the concern and the trends for 2023 revolve around implementing measures to adapt to it. Over the next few years, the most innovative utilities will be deploying technological solutions to become more resilient, such as introducing early warning systems to help prevent overflows and floods.

At the same time, the focus will continue to be on making better use of water, as a vital element in the water-food-energy triangle. In this regard, it should be noted that 70% of the water extracted in the world is used in farming, and 72% of freshwater is used in the agri-food industry.

Water is vital for more efficient food production, not only because crops need irrigation, but also because it is used as a resource in industrial food production processes. Agribusiness and water efficiency will therefore be watchwords in 2023.

Another trend that is set to gain greater traction is the commitment to water circularity. Reusing treated water to reduce the net consumption of drinking water in irrigation and industrial processes is one of the most promising areas of development for the coming years. In addition, further progress will be made in energy optimization and the use of artificial intelligence techniques over the next few years to extract the maximum value from data.

Technologies that develop and strengthen improvements in management, increase efficiency, automate processes, reduce supply losses, provide early warnings, detect overflows, and consolidate compliance with the environmental objectives set by water planning and international regulations will be increasingly in demand in the coming year. At the same time, the importance of offline and online security, both in terms of guaranteeing proper water supply and protecting citizens' data, will remain paramount.

Finally, in 2023, water utilities will strive to reduce their carbon footprint. Considering that the bottled water footprint is about 200 grams per 1.5-liter bottle, it is imperative that our industry makes progress in reducing these emissions to achieve the 2030 Agenda goals. Certification for companies that reduce emissions will generate a positive impact on consumers, supporting both the sustainable use of this resource and the purchase of products manufactured by environmentally aware organizations.

Around the world, numerous governments are approving plans and offering financial support to boost water efficiency and resilience through digital transformation. The European Next Generation funds, the Spanish PERTE for the digital transformation of the water cycle, the U.S. water infrastructure investment plan, and the projects promoted within the framework of Saudi Arabia's Vision 2030 are just a few examples. This is a great opportunity for water utilities to deploy digital transformation projects, incorporate new technologies and promote the circular economy, building on water planning that ensures sound water management.

Trend #1

PRE-EMPTION AND PREVENTION

According to UN data, **water and climate-related events have accounted for half of the human and economic damage caused by disasters over the last fifty years.** Figures show that, during this period, weather, climate and water hazards accounted for 45% of recorded deaths (1.3 million people) and 74% of global economic losses. **World Meteorological Organization studies have also put droughts, storms and floods at the top of the most devastating catastrophes list.**

It is therefore essential to reduce the adverse consequences of these phenomena, especially since their frequency and intensity are increasing due to climate change combined with other factors. These **adverse effects include damage to public health, property, the environment, cultural heritage, the economy and infrastructures.**

Technology can help in the fight against climate change by pre-empting and forecasting these phenomena. According to the Global Commission on Adaptation, **early warning systems offer a 10-fold plus return on investment. As a result, in 2023 and beyond, utilities and river basin water authorities are set to increase their investments in these types of systems.** The Global Commission, a non-profit, non-governmental body founded in 2018, estimates that storm and heatwave damage can be mitigated by up to 30% if predicted 24 hours in advance.

In short, **early warning systems stand to play a key role in risk management through the forecasting of overflows and floods.** Their deployment, together with the implementation of monitoring and management solutions for sanitation systems, will reduce the consequences of these floods through the advanced analysis and integration of existing data.

SANITARY SEWER OVERFLOWS

Sanitary Sewer Overflows (SSOs) occur when untreated water is dumped into the environment causing **issues such as water eutrophication, the increase of pathogens, and the contamination of groundwater, seas and oceans.** They also lead to heavy administrative fines for utilities.

Most SSOs occur during rainfall events, when the sanitation system is unable to decant and treat all the water it collects. In a context where all **climate change models are forecasting more extreme and more unpredictable rainfall episodes, it is essential to have an early warning system** that takes into account real-time monitoring of system assets to predict these events, and thus pre-empt decision-making and shorten the response time to react to potential issues.

In addition to SSOs during rain events, these overflows also increase in **dry weather every year in cities, mainly due to clogging, excess infiltration and/or broken sewers.** They increase for dietary reasons (fast food and fatty foods are discharged into sewers), wipes being flushed down the toilet, and aging assets. Therefore, system monitoring to **detect sedimentation, infiltration and blockages in sewer systems is the first step to prevent** this phenomenon.

Utilities will continue to rely on digital platforms that integrate and analyze the data sent by sewer level and quality sensors, together with information on the state of the WWTP's sewers, pumping stations and relief points.

One of the main outcomes will be to **design risk-based preventive maintenance plans for each asset, rather than scheduled cleaning operations.** These plans will deliver the ideal cleaning programs, based on historical and real-time information from integrated data and systems (previous SSOs, most recent preventive and reactive work orders, GIS, etc.), and the application of statistical models based on risk analysis.

Digital platforms will also be an essential tool to **assess the risk of overflows based on detecting sensor anomalies** (sewers, assets and manholes), as well as to **calculate the location and the minimum number of sensors needed** to prevent SSOs using AI algorithms.

URBAN FLOODING

Early warning systems will increasingly be relied upon to pre-empt urban flooding during rainy periods, thanks to the monitoring of key points in urban drainage and sewer networks, and the integration of information from weather forecasting.

Over the next few years, **more extensive deployment of sensors in sewers** will provide greater amounts of real-time data, which will undoubtedly enhance the rollout of these systems. In addition, early warning will go hand in hand with **flood prevention recommendations,** based on the state of the sanitation and urban drainage networks, and on rainfall forecasts. For example, this technology will make it **easier to concentrate preventive sewer cleaning work** where it is actually needed.

RIVER AND RAIN-RELATED FLOODS

According to the World Bank, **floods and droughts have been among the most devastating consequences of the climate crisis over the past two decades,** affecting three billion people and causing economic losses averaging more than US$200 billion annually. Climate change, together with economic development, population growth and rapid urbanization of high-risk areas, are exacerbating flood risk around the world. This phenomenon is **caused by river overflows, rainfall, snowmelt, flash floods and/or tidal surges** above normal levels.

In this context, early flood warning systems are crucial. In Europe alone, it is estimated that this technology has the potential to reduce damage costs by 25%, saving an estimated €30 billion over the next 20 years.

Early warning systems are based on real-time observational data and weather forecasts which, in conjunction with integrated hydrological and hydraulic simulation models, can anticipate potential flooding even in places that have high variations. These systems, which use historical and real-time data, trigger alarms when the thresholds of different variables are exceeded, thus providing hydrological warnings. In short, they reduce the damage caused by this phenomenon through pre-emption and prevention.

Trend #2

SECURITY

In 2021, drinking water facilities located in Tampa, Florida, suffered a cyberattack that sought to poison the population by increasing the amount of sodium hydroxide in the system. In 2020, pumping stations and water management facilities in Israel were targeted by cyberattacks, whilst in 2018, the Swiss city of Ebikon's water supply received thousands of malware requests. Fortunately, all the threats were dealt with, thanks to the expertise of operators and the security systems in place.

These are just a few examples of known cases that have come to public attention, but **the number of attacks on water facilities is increasing every year.** Often, these attacks have no repercussions, and even infrastructure managers pay little attention to this serious issue that needs to be tackled. **This problem is common to other similar essential service-related infrastructures, such as those that supply electricity,** which are comparable in terms of their type and scope.

Digital transformation has brought with it an increase in exposure to cyberattacks, which ultimately put the health and development of society at risk. The hyperconnectivity stemming from this digital world, though undoubtedly beneficial, also entails risks and, in recent years, as has occurred in other sectors such as banking and energy, **utilities have begun to invest more time, effort and money in strengthening their cybersecurity.** Digital transformation, which is a must for water utilities, also needs to ensure robust cybersecurity, especially in a sector that is vital for society's survival and development.

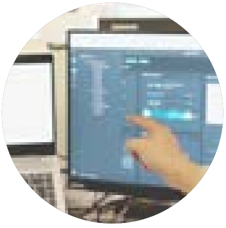
In any case, **there is a need to go beyond cybersecurity** by implementing technological solutions to tackle the problem from a holistic perspective.

How does improving security in the water sector pay off?

Implementing an effective security policy in water utilities brings major advantages:

WATER CONSERVATION

This is the first and most important element to safeguard. As previously mentioned, **implementing online and offline security measures guarantees access to water, a commodity as necessary as it is scarce.** Of course, when we talk about a safe and secure supply, we also mean sufficient amounts of quality water.



IMPROVED PRODUCTIVITY

Updated and protected infrastructures and systems **reduce unscheduled downtimes** caused by a security breach or attack, with the ensuing increase in productivity.

DATA PRESERVATION

At a time when data has become a major issue, being able to fully protect it is a priority, especially in a sector such as water, which handles sensitive user information (personal data, financial data for billing, etc.). **The risk does not only involve the theft of confidential information, but also the loss of business data** and the serious issues that this entails.

BUSINESS REPUTATION

As mentioned above, a system that complies with online and offline security standards means utilities can **offer a trustworthy brand image, resulting in increased customer loyalty.** Security problems are currently a potential cause of lost business reputation in all sectors, with all the consequences that this brings.

Security issues to consider

Issues related to security, and more specifically cybersecurity, have been watchwords in many sectors for years. In an essential public service such as the supply of water, this takes on special relevance, as previously mentioned. However, cybersecurity needs to be approached from a broader standpoint, including other aspects that will be on trend in 2023. Sometimes these are basic situations and measures which, unfortunately, have not been resolved and continue to pose risks:

01 Physical security of facilities

A simple remote-control station in a distribution tank, without proper monitoring and without appropriate anti-intrusion systems, could be the source of an attack entailing significant risks for users. **All system assets, without exception, must be part of a global security strategy.** In addition, it is easier to provide a swift, agile response to an incident if security and control systems are connected to operational monitoring systems.

02 Updates and modernization

Secondly, in water utilities (and in other sectors, of course), **system monitoring and control relies on SCADA systems.** In some cases, these systems have been in operation for decades, using protocols and configurations which did not originally have security as their main concern, as they were designed as stand-alone systems, which are now compromised. As a result, obsolete operating systems continue to exist. These cannot be updated, and no security patches can be installed in the face of new threats. **Upgrading and modernizing them should be one of the main lines of action for utilities this year.** In this case, the use of latest-generation, cloud-based SCADA applications (either in the client's own dedicated data center or in a suitably secured third-party data center) can be of great help.

03 Consolidating system perimeter security

Systems must be separated from all other corporate systems, establishing one or more DMZ (Demilitarized Zones) or another similar approach. Where systems do not support this, a change of strategy should be considered.

04 Gateways

The same applies to communications security. In view of the growing number and type of new devices that are progressively being added to systems, **it is important to ensure that gateways are not only scalable, but also encrypted using TLS or similar.** In this regard, cloud providers' IoT platforms offer a good alternative.

05 Secure hosting

Systems must be hosted in intrinsically secure locations and configurations. On this point, **the advent of cloud providers has brought about a real revolution,** and the range of solutions and alternatives they offer means easy configuration of servers with redundancy in different geographical areas, highly configurable backup and disaster recovery systems. Some of these security measures were beyond the reach of most companies a few years ago but are now accessible and affordable. Despite this**, there are a large number of on-premise systems in place,** with their own specific needs (physical security, hardware and software maintenance and updates, possible outages, sabotage, etc.), **which can make them the weak link in a utility's IT infrastructure.** In this case, **we should consider hybrid systems as a possible alternative,** for example, backing up sensitive information hosted locally on securely backed-up cloud servers.

*In short, **security in water utilities has become a key issue that must be addressed alongside the company's digital transformation process.** This implies cybersecurity concerns, which must be approached holistically, updating infrastructures, improving IT systems, taking advantage of the latest technologies available, and, of course, training and awareness-raising throughout the organization.*

06 Corporate culture

Finally, it is important to talk about corporate systems in general, both those which are exposed to third parties (users, etc.) and those which are used internally within the organization. Fortunately, t**he progressive implementation of state-of-the-art security systems provides a wide range of tools and resources to combat threats.** However, they need to be integrated into the company's culture through training and awareness-raising efforts for all staff, not just the IT team. In this sense, **corporate efforts should be directed at security systems that are certified according to internationally recognized standards.** These must start to be seen as a requirement in the sector and be led by a specialized figure in the utility working solely on this area.

Trend #3

WATER REUSE

Approximately **3.5 billion people will be living in water-scarce areas by 2025,** while water demand is expected to soar by 30% by 2050. The current situation calls for thought to be given to efficient alternatives that reduce the water footprint and optimize resource management.

Consumers are also beginning to insist that companies should adopt environmental sustainability policies and actions. In fact, the "Leading the way to a global circular economy: state of play and outlook" study conducted by the European Commission highlights the need to focus on a circular, more sustainable economy, given the expected increase in the world's population, the emergence of a new middle class in emerging countries and rapid urbanization.

In line with this social imperative, **the UN Sustainable Development Goals, in goal number 6 - Clean Water and Sanitation - have already included water as an asset to be protected** in the 2030 Agenda.

For all these reasons, **water reuse is a growing trend that supports the circular economy,** reducing the water footprint and contributing to reaching the SDGs.

Along these lines, **wastewater treatment for reuse plays a central role as "part of the solution to water scarcity and pollution problems,"** according to Jennifer Sara, Global Director, World Bank Water Global Practice. In turn, Diego Juan Rodríguez, co-author of the report "Wastewater: From Waste to Resource", and a Senior Water Resources Management Specialist at the same organization, focuses on **water reuse as a trend, as this could reduce sanitation service costs, making them sustainable and adding value to the economy,** as a way to help countries.

Thus, **WWTPs are beginning to introduce technological improvements to help reduce water pollution** centering on eliminating discharges and minimizing the emission of chemicals and hazardous materials. According to the United Nations University and the University of Utrecht, in an article published in the Earth System Science Data journal, wastewater treatment has increased by 50% worldwide, thanks in part to continuous improvement in technologies. However, the authors of the study point out that in developing countries, infrastructures and technologies still require upgrades and the issue of the lack of qualified staff needs to be solved.

In Europe, on May 25, 2020, the European Parliament and the Council approved Regulation (EU) 2020/741 on minimum requirements for water reuse. One of the main objectives of this regulation is **to increase sixfold the volume of treated water currently reused by 2025.**

The requirements of this new regulation set limits that divide treated water into four quality categories which establish which uses water can be put to. Classification is based on compliance with restrictions based on:

Physical parameters

Total suspended solids (TSS), nephelometric turbidity unit (NTU).

Chemical parameters

Biochemical oxygen demand (BOD5).

Microbiological parameters

E. coli, Legionella spp., intestinal nematodes, coliphages and clostridium spores.

Therefore, **water reuse is a growing trend for social, environmental, economic and political reasons,** and technology plays a key role in this process.

TECHNOLOGIES FOR REUSE

In this sense, guaranteeing public and environmental health and complying with the physical, chemical and biological parameter requirements set by the pertinent authorities requires a series of **technologies that will be increasingly implemented by water utilities in 2023 and the following years:**

Physical-chemical treatments. Mainly coagulation-flocculation.

Adsorption. A tertiary process based on the adsorption of soluble components on the surface of a solid material (adsorbent).

Ion exchange. Anionic and cationic resins with different types of radicals used to retain one or more types of ions found in the water to be treated.

Advanced filtration processes. Microfiltration, ultrafiltration, nanofiltration and reverse osmosis, ranked from largest to smallest pore size, are applied to remove compounds that exceed the pore size of the material used. Reverse osmosis achieves the highest purity water, eliminating monovalent salts, vitamins and sugars.

Electrodialysis reversal (EDR). Electrochemical ion separation is achieved by applying a direct current field. This is mainly used for desalination processes.

Disinfection processes. The aim is to eliminate pathogenic microorganisms from wastewater. For this purpose, strong oxidants such as free chlorine, chlorine dioxide, sodium hypochlorite, chloramines, ozone, potassium permanganate and silver salts are used. The water can also be irradiated with UV.

Advanced oxidation. These processes generate hydroxyl radicals (OH-) with a higher oxidation power than the previous disinfection processes. These treatments are used when the aim is to decompose contaminants, such as pesticides and pharmaceuticals.

Disinfection processes and advanced oxidation are the most effective technologies on the above list. Disinfection processes must be more reliable and efficient to comply with the more stringent quality standards imposed by the new European regulations on pathogen concentrations. **In the longer term, advanced oxidation processes will gain ground in urban wastewater treatment plants,** as more and more evidence emerges about the harmful effects of emerging pollutants (medicines, drugs, perfluorinated compounds, agrochemicals, etc.) on public health and the environment.

The choice of the most appropriate technology is one of the most sensitive issues facing water treatment plants seeking or forced to reuse their water. **The purification performance of each of these technologies must be taken into account, but special attention must also be paid to the following:**

Operating costs: energy and reagent consumption

Waste generation: related to brines and chemical sludge, as well as the environmental impact generated by these residues and the technical and economic feasibility of managing them properly.

Technical capabilities: the number of staff needed to operate the selected technology and the level of training required.

The potential for automating and monitoring the process.

THE ROLE OF DIGITAL TRANSFORMATION IN WATER REUSE

Digital transformation plays a key role in expanding and improving WWTP infrastructures that seek to reuse the water they treat.

The digital transformation of these processes starts with monitoring the main variables that regulate them. These are usually found in multiple sources, such as LIMS, SCADA and CMMS. This causes difficulties when processing information and creating indicators that combine data from different sources, hindering decision-making and causing processes to operate below peak efficiency levels.

Based on this knowledge, **the screens where the process KPIs will be displayed are calculated and designed, with all the variables sharing a common platform.** The next step is to create predictive models that anticipate decision-making and detect process deviations by comparing the value obtained with the estimated value.

Finally, **machine-learning algorithms can be trained to analyze all input variables to optimize the amount of energy and reagents used in the process,** guaranteeing target quality standards at all times. The output of these algorithms can be sent directly to the plant's SCADA to update the operating setpoints. Alternatively, the operator can be notified so that they can decide whether to carry out the recommended actions. **The latter is known as Decision Support System (DSS) and is increasingly gaining traction in the industry.**

Trend #4

AUTOMATION

The water sector is set to play a pivotal role in combating climate change, with enhanced water management benefiting a whole host of areas such as health, energy, agriculture, food security and people's livelihoods in general (UNESCO).

Process automation is one of the most important trends for 2023 and is one of the promising alternatives hailed to improve the current water scenario. Comprehensive data integration in innovative, vendor-agnostic technological solutions is the first stepping stone towards more proactive, automated water-cycle management.

Automation brings significant benefits to water utilities, such as better water cycle operability and management, cost reductions, and an increase in customer perceived value. According to Global Water Intelligence's Accelerating the digital water utility whitepaper (2019), the **ROI from automating operations can be as high as 14%.**

Integrated water cycle management encompasses the complex task of managing the systems and processes involved in urban supply, resource reuse, sanitation and irrigation. Automation optimizes the use of water in all of these phases.

EXTREME EVENTS

Droughts, storms and floods, all of which are water-related phenomena, top the list of catastrophes recorded over the past 50 years. For this reason, more and more **water utilities are turning to intelligent technological solutions to reduce the damage and operational costs** caused by these episodes. These solutions can predict and provide early warnings about these events thanks to historical knowledge and data integration.

These **solutions identify potential incidents based on exceeded thresholds** by installing sensors, analyzing historical data and using meteorological and hydrological prediction models. This internal and external data, combined with mathematical models, can be used to perform analyses aimed at simulating scenarios and supporting decision-making. **Automation is a key element of early warning systems, which bring returns on investment of up to 10 times their cost.**

DWTPs

In 2023, and in the coming years, **drinking water treatment plants will move towards automated management,** improving plant operations.

Digital transformation paves the way to centralized data management as opposed to the control of different DWTP processes in isolation. In advanced predictive control, the different algorithmic models learn and solve issues by predicting and optimizing processes in the DWTP, **and automate them without human intervention.**

Use cases include predicting the quality of the water collected, **automating coagulation dosing,** simulating the properties of stored chemicals, monitoring decanters, and optimizing filtration and pumping.

In addition, in the future we will see progress being made in the detection of potential events in supply networks, from the time water leaves the treatment plant and/or reservoir to the final point of consumption, including incidents that may pose a threat to the population. This will be achieved by a**utomating and monitoring the main water quality parameters** guaranteeing optimum cleanliness and hygiene conditions for safe consumption. Thus, water sanitation will be broadened to include other criteria over and above viruses and bacteria (SARS-CoV-2, Legionella, etc.).

The first step to achieve this is to bring together the myriad of technologies and operations that exist in DWTPs. Digital transformation based on specific needs, without being part of an overall strategic plan, has led to widespread fragmentation of sources and data in drinking water treatment plants. Accordingly, **digital platforms must be brought in to integrate and analyze dispersed data, breaking down operational silos, moving towards centralized, automatic plant control, and facilitating decision-making.**

WWTPs

Wastewater treatment plants (WWTPs) are facing new challenges that test their resilience, **requiring progress in sensors, digital transformation, and automated decision-making.** More stringent quality requirements for plant effluent and sludge quality, together with demands to reduce greenhouse gas emissions, odors and noise, are making WWTP management more complex.

In this context, **Industry 4.0 opens up new opportunities in terms of improved connectivity and operations,** boosting work centralization. Installing sensors in infrastructure and subsequently integrating internal data (LIMS, CMMS, SCADA, field devices, etc.) and external data (meteorological data, social networks) will facilitate the automation of WWTP processes.

The use of algorithms and mathematical models applied to this data will provide **operators with recommendations on what actions they need to carry out next,** anticipating potential hurdles and optimizing plant processes. Likewise, the **tendency is to implement systems that can automatically trigger any actions required in the plant,** resulting in operational improvements, robustness and cost reductions.

SMART IRRIGATION

Automating irrigation in farming is another of the trends for 2023, aiming to reduce its water footprint, promote environmental sustainability and optimize costs.

The starting point is smart irrigation, which means watering crops according to their real needs, taking into account soil types and moisture, climate conditions and weather forecasts. Technological solutions indicate when and how much water is required based on remote sensing and information from sensors installed in the fields to calculate the water balance.

However, the **digital adjustment of irrigation scheduling goes one step further,** with more and more irrigation associations automating this process. One of the main advantages is enhanced environmental sustainability, **since streamlining water consumption also reduces the amount of energy used.**

To achieve this aim, all network assets must have sensors installed so they can be monitored. **In 2023, irrigation associations are expected to digitally transform their infrastructure and introduce new technological solutions** to exploit data in the interests of greater sustainability.

Trend #5

OPTIMIZATION

Water is essential for life on Earth, but it is a finite resource. The data compiled in reports by organizations such as the UN, UNICEF, and the FAO point to **overexploitation of water as the main cause of scarcity, with between 43% and 50% of the world's population not having access to drinking water.**

Against this background, optimizing water management is a major, highly necessary strategic task. As a result, **utilities are beginning to look into ways of sustainably exploiting this resource using technology.**

2023 is set to be a year of innovation, and of technologies maturing in sectors such as agriculture and energy, areas which dovetail completely with water. It is also set to be a year in which faster connections and artificial intelligence will facilitate a new approach to optimization, driving further progress in these strategic areas.

OPTIMIZING IRRIGATION IN AGRICULTURE

Agriculture is a strategic sector which is essential for rational land management and planning, as well anchoring the population to the rural environment. These two challenges can be tackled by improving competitiveness and becoming more efficient in terms of intermediate resource use and consumption.

However, **future constraints, such as population growth, will put further pressure on this sector, as food production is set to increase by 60%**, with the consequent hike in water consumption. Given this scenario, optimizing the use of water used for irrigation is a challenge in which infrastructure and consumption monitoring will play a key role in the coming years.

In this context, **technology can provide tools for information analysis, as well as faster reaction times, thus speeding up the resolution of any network incidents**. It is therefore essential to digitally transform irrigation distribution networks, as a vehicle for significantly reducing the volume of non-revenue water, cutting production costs, and promoting environmental sustainability by decreasing water and energy consumption.

In this sense, there are high-impact technologies that can optimize irrigation in agriculture, and these will be on trend in 2023:

01 5G NR

5G NR technology can transform integrated water management thanks to greater speeds, enabling much **faster data analysis in real time**. This, in turn, will lead to optimized agricultural irrigation systems. This technology is also very useful in remote areas, where it is often difficult to obtain real-time data.

02 Smart irrigation

Smart irrigation works by **using only the amount of water that is really needed, based on a series of factors,** i.e., crops' real water needs, soil moisture status and weather forecasts. The combination of information obtained from field sensors and weather stations will increasingly be incorporated into **technological solutions that use advanced algorithms to calculate the frequency and amount of water needed.** This can then **automatically adjust irrigation scheduling** to cater for these requirements. Environmental sustainability is thus improved by optimizing water consumption and, consequently, reducing energy consumption.

03 Remote sensing

This technology brings valuable information about crop conditions without the need to deploy assets in the field. **Satellite imagery is used to build a map of vegetation and soil health** through parameters such as moisture, photosynthetically active biomass indexes and nitrification.

04 Remote reading

There is no doubt that the future of optimizing agricultural irrigation systems lies in remote reading. **This technology improves billing cycle management (reading, billing and collection), and brings progress in controlling leaks and fraud,** as well as in forecasting demand through real-time reading of customer meters and the application of advanced algorithms.

ENERGY OPTIMIZATION

Water and energy are essential elements for all the processes that shape our daily lives. In most cases, water is needed to produce energy, and energy is needed to extract, treat and distribute water, as well as to purify and reuse it.

The demand for water-related energy is roughly expected to double in the coming decades, mainly due to population growth, rising living costs and an increasingly scarce water supply around population centers brought on by climate change. This means that water will have to be transported further, pumped from greater depths, and undergo additional treatment before it can be used.

As a result, **any energy efficiency improvements, in terms of water savings, energy savings and process upgrades, translate directly into lower costs and greater economic performance,** which means that organizations are constantly seeking to improve their energy optimization plans. Therefore, over the next few years, more and more strategies will be rolled out to increase and boost efficiency, as well as to reduce costs, **by deploying initiatives aimed at controlling and optimizing the variables that influence energy consumption.**

In this sense, digital transformation has become the backbone of these initiatives, and this will be a trend throughout 2023. These initiatives include energy monitoring, digitally transforming data, the use of predictive algorithms and collating electricity billing information.

The implementation of different energy optimization plans will be increasingly common in utilities, due to their short- and long-term benefits, leading to enhanced resource use, a lower carbon footprint and process optimization.

ARTIFICIAL INTELLIGENCE AS AN OPTIMIZATION TOOL

The use of artificial intelligence techniques can mark the difference in any optimization strategy. **A clear competitive edge can be gained by taking advantage of the enormous amount of data generated by technologically mature water utilities' monitoring and control systems.** However, exploiting this data requires multidisciplinary teams and hybrid profiles with a broad knowledge of both the water sector and data science.

Artificial intelligence will assist in wastewater treatment and discharge by monitoring and, once again, predicting changes in pollutants in wastewater treatment plants.

By applying this approach, tomorrow's utilities will be able to manage the entire water cycle and exploit all the potential of data science. In this sense, **in 2023, they will be focusing on managing the cycle's changing conditions through models that consider all the available in-house and external field data** (weather monitoring networks, etc.). This will enable the optimization of treatment plant operations, such as opening and shutting down treatment lines, and adjusting reagent dosing.

In addition, there are now proven algorithms (similar day models, etc.) that reliably predict demand, helping to distribute and store water in optimum conditions. Thanks to their deployment, **the next few years will continue to see a reduction in energy costs, emissions, and the time that water remains in the networks,** with all the ensuing benefits.

The relationship with users is another aspect that will continue to go from strength to strength thanks to artificial intelligence techniques, including the **early detection of trends and the generation of work orders based on social media post analysis.** For example, if the system detects odor complaints in a certain area, utilities will receive recommendations on opening incidents to ascertain the causes, and even connect them to work orders.

Finally, **artificial intelligence will assist in wastewater treatment and discharge by monitoring and, once again, predicting changes in pollutants in wastewater treatment plants.** This is key to correctly treating wastewater and ensure its subsequent return to the environment in the best possible conditions.

Trend #6

WATER PLANNING

The current global water situation requires a major shift in strategy. In fact, **the water crisis is already regarded by the World Economic Forum as one of the main threats to the planet**. Drought, migratory movements, population growth, and inefficient water management are some of the drivers behind a major issue that directly affects the population's water security. Against this backdrop, for example, we cannot afford to lose up to 350 billion liters of freshwater per day solely through leaks in supply networks. In fact, **pressure on this resource is only increasing, with the UN indicating that water demand is expected to grow by up to 55% between now and 2050.**

In the same vein, the report focuses on the inefficient management of water resources in many countries, being one of the main drivers of "environmental degradation, including depletion of aquifers, reduction of river flows, degradation of wildlife habitats and pollution".

Therefore, **water planning, understood as the basic tool to correctly manage and allocate available water resources, is increasingly taking a central role** and should be the starting point for any action plan in this field. Water planning focuses on the rational use and sound management of resources, and technology is increasingly being used as a platform to respond to these ongoing challenges.

TECHNOLOGY, A DRIVING FORCE IN PLANNING

The availability of real-time, accessible, reliable information that provides information on the status of resources is the first step to sound water planning. In this sense, technology has become a crucial ally. For example, in the water sector, it generates scenarios which function with real-time information. Nowadays, in addition to Information and Communication Technologies (ICT), given the importance of data, water utilities are starting to use different systems and technologies. Field and infrastructure sensor networks, Geographic Information Systems (GIS), remote sensing, and SCADA systems are just some of the examples of technologies that have been successfully implemented in recent years. These will be further enhanced with the emergence of IoT on a massive scale and the use of Artificial Intelligence techniques.

In fact, the **World Bank advocates the use of technology to strengthen water security,** highlighting that it is necessary to explore "investments in innovative technologies for enhancing productivity, conserving and protecting resources". It has already identified resource monitoring information systems as a technology that is gaining traction.

Another area where technology is increasingly in demand is leak control, which is one of the main challenges of water security. The International Water Association (IWA) estimates that approximately 350 billion liters of drinking water are lost every day due to leaks. For this reason, **water utilities are increasingly implementing technological upgrades - such as the installation of sensors throughout the network, combined with leak detection systems - to gain greater control over leaks and increase supply system efficiency.**

WATER PLANNING TRENDS FOR 2023

The same causes that are driving water planning (demographics, population, climate change, etc.) are increasingly prompting the implementation of initiatives that lead to more sustainable use of water resources. They include the following:

01

Efficient aquifer monitoring and management

According to the **UNESCO,** groundwater accounts for 99% of all liquid freshwater on Earth. Of this, 25% of all water withdrawn is used for irrigation, while half of the volume of water used for domestic purposes also comes from groundwater.

Therefore, **aquifers are a key resource that is currently being tapped in many parts of the world, although growing pressure on these aquifers places them at risk of overexploitation.** Moreover, in many cases there is insufficient knowledge of the available resources and a notorious lack of networks to monitor them. Sustainable and efficient resource management requires control systems based on comprehensive sensor networks. These provide real-time information on the major levels and quality parameters of the water bodies, also enabling their integration with surface water control systems, where both types of resources are jointly managed.

02

Increasing distribution system efficiency

This aspect should be prioritized in any water planning policy. Increasing resource use efficiency can be an effective driver in achieving other objectives. **Lower consumption will lead to greater availability of the resource, enhancing water security** and making it more accessible, thus cutting distribution and treatment costs for the water supplied.

03

Reuse

In a world of diminishing water resources, **we must turn our attention to the potential of water reuse as an alternative.** The advantages of this approach are obvious: adding value to water treatment and purification processes (here, we are talking about promoting the circular economy in the entire water cycle), reducing the water and carbon footprint of many of our activities, and improving the water security of uses where recycled resources are a feasible option. Here the challenge is twofold: to ensure not only the quantity but also the quality of the effluent to be reused.

04

Use of non-conventional resources

Undoubtedly, the use of non-conventional resources (particularly desalination, given its importance) has become a necessary trend in water planning. Its major handicap, i.e., **high implementation and operating costs, can be mitigated by the use, once again, of technology.** The use of machine learning techniques and digital twins in plants (combined with automatic and operation support systems), applied to the huge flow of data provided by operating plants, has huge potential, along with the recent technical process improvements (new membrane systems, energy recovery, more efficient equipment, etc.). These include process optimization to reduce costs and the energy footprint of this kind of resources, making them more accessible and environmentally sustainable.

05

Information systems for water weather forecasts and warnings

This is another trend to be taken into account in the deployment of monitoring and warning systems for potential extreme events. It should be remembered that the **management of extreme events, such as droughts and floods, is a fundamental part of water planning processes.** In this area, the effective use of historical and real-time information and its analysis (using conventional water analysis techniques, approaches based on the use of data science tools, or a combination of both) is key to improving decision-making in challenging environments to conserve and protect resources.

06

Citizen information systems

This is an aspect that should be gradually introduced into water planning policies. Technological advances provide **access to tools that supply information to users quickly and directly.** The availability of data on consumption and savings obtained through the application of specific measures such as gamification, together with basic information on available resources (reservoir levels, etc.), is a complementary tool to more traditional planning measures.

Therefore, **the aim is to open up new technological perspectives and approaches to robust water planning, which is a core aspect of integrated water cycle management.** This is especially true when the near-future scenario of the water cycle demands sustainable solutions that can be more effective if companies have high levels of digital transformation.

CONCLUSIONS

In 2025, around 3.5 billion people will be living in water-scarce areas, while water demand will have increased by 30% in 2050. Thus, **ensuring water security requires efficient alternatives that optimize the management of this most precious resource** throughout the water cycle.

In 2023, and in the coming years, **utilities will continue to invest in deploying technologies that takes the scarcity of this resource into account, within the framework of water planning.** Anticipation of extreme events, which are becoming more frequent due to climate change, will serve to **mitigate the consequences of overflows and floods. In addition, water reuse solutions will be introduced,** transforming water from a waste product to a usable resource.

In this context, **utilities will continue to focus on both offline and online security to overcome the challenges arising from digital transformation.** Protecting infrastructures from attacks will become an increasing priority, as a way of guaranteeing quality water supply to the entire population.

In addition, **concerns about optimizing processes will lead to greater automation,** the first step of which will be to integrate data into technological solutions, regardless of vendors. This will enable utilities to improve their operations and management, reduce costs and add value. **Automation will address extreme event response, as well as process management in DWTPs, WWTPs and irrigation.**

Extracting value from data to make better decisions will continue to be a trend over the next few years, thanks to digital transformation. This is the only way to successfully tackle the current challenges posed by climate change and population growth.

IDRICA

+34 963 86 05 00
sales@idrica.com
idrica.com |