
MEASUREMENT & ANALYTICS | WHITE PAPER

Optimizing wastewater treatment through measurement

Measurement made easy for wastewater treatment





Table of contents

004 – 006	1. How digital measurement is helping to maximize wastewater treatment efficiency
007 – 009	2. Why does measurement matter for wastewater treatment?
010 – 014	3. Digital water quality technologies available from ABB
015 – 016	4. Why choose ABB for wastewater measurement?
017 – 018	5. How are ABB's technologies being used around the world?
019	Conclusion – improved water sustainability starts with measurement

1. How digital measurement is helping to maximize wastewater treatment efficiency

Introduction

Water is vital for life, yet despite 70 percent of the Earth's surface being covered in water, limited quantities are available to sustain humanity. The 97 percent of water retained in the world's oceans, is too salty to drink or use for growing crops. Only three percent of the Earth's water is fresh, and the majority of that water is held in ice caps and glaciers.

The remaining small percentage must meet all the potable drinking water and agricultural needs of a planet with a rapidly expanding population. Given this, it is not surprising that water scarcity is a growing issue across the globe, affecting every continent. Water scarcity can be caused by a physical shortage, the failure of institutions to produce and provide a regular supply, or a lack of infrastructure to distribute water.

Water scarcity in numbers

The scale of the problem is summed up by some sobering figures. Approximately four billion people — half of the world's population — experience severe water scarcity for at least one month each year, while over two billion people live in countries with an inadequate water supply.

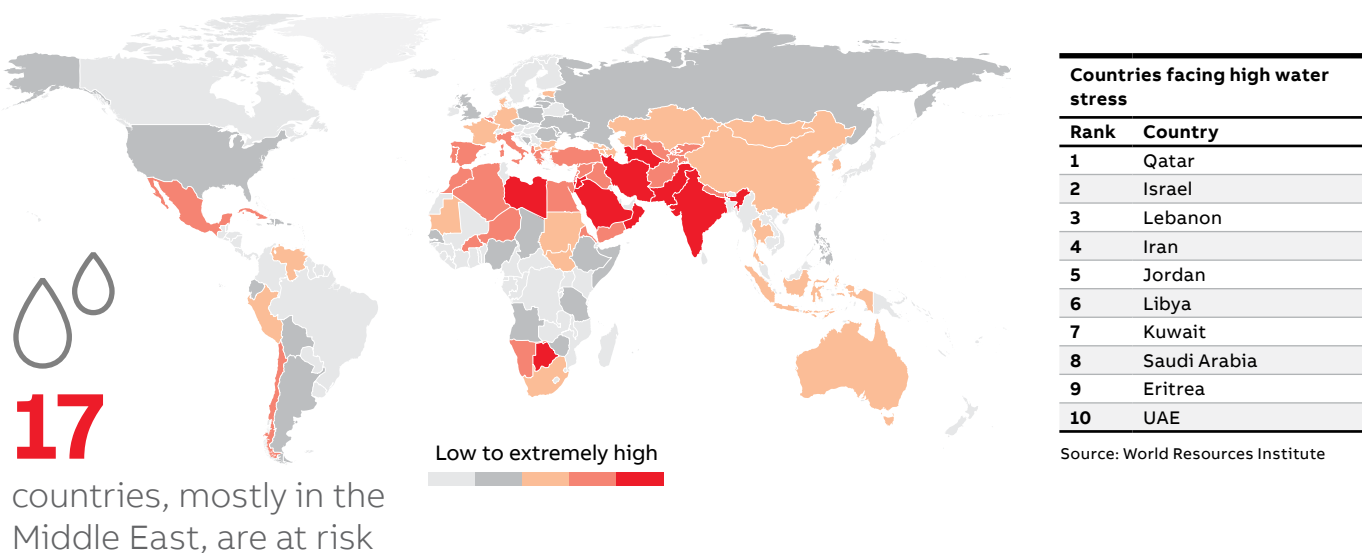
This lack of water could have profound social consequences, with 700 million people potentially being displaced by intense water scarcity by 2030. Lack of water also disproportionately affects women and children — spending time fetching water from great distances means they cannot fulfil their education or employment prospects. It has been estimated that by 2040, around 25 percent of the world's children will be living in areas suffering from extremely high water stress.¹

Preserving water supplies

One of the key aspects of water supply is preserving existing sources and safeguarding them against pollution. A key source is groundwater, which is found in aquifers, formations of rocks, sand, and gravel that hold substantial quantities of water. Accounting for approximately 99 percent of all liquid freshwater², it feeds springs, rivers, lakes, and wetlands. Once regenerated from rain and snowfall infiltrating the ground, it can be extracted to the surface for use by pumps and wells.

In arid areas without rivers and lakes, groundwater is usually the only source. Even in relatively wet areas, groundwater aquifers remain an important source of water for drinking, sanitation, agriculture, and industry.

Figure 1 Countries at most risk from water crisis





Almost all the liquid freshwater in the world is groundwater, and around 40 percent of all water used for crop irrigation comes from aquifers.

Some countries are putting their groundwater sources under growing stress, with Asia and the Pacific region having the lowest per capita water availability in the world. The use of groundwater in the region is predicted to rise by 30 percent by 2050.

It is critical to protect groundwater from pollution and over-extraction. In North America and Europe, nitrates as pesticides from agriculture are a major threat to groundwater quality, while 20 percent of EU bodies exceed European standards on water quality due to pollution from agriculture.³

Conserving and preserving supplies of groundwater is therefore vital in ensuring a sustainable water supply that meets both the demands of current and future generations. As a way of recovering and restoring supplies of used water, wastewater treatment processes have a key role to play in achieving this, making accurate and reliable measurement a key requirement.

Global trends affecting water use

Several global trends are having a major impact on how water is treated and distributed, its availability, and how it is used.

• Urbanization and development

Recent years have seen a major trend of mass migration to cities as people seek a higher quality of life. For the first



time in human history, over half of the world's population lives in towns and cities, a proportion that is set to rise to two-thirds by 2050. Less-developed regions are seeing the fastest population growth in urban areas, with the urban population estimated to grow from 3.9 billion people today to 6.3 billion in 2050.⁴

As well as increasing wastewater quantities, increased urbanization also expands the range of potential pollutants that need to be treated. This requires an increased range of measurements to detect them and make sure they are either removed or reduced to safe limits.

• Industrialization

The growth in urban populations has seen a corresponding increase in industrialization, as people demand more consumer and household goods. This brings consequences for water supplies, both in the increased use of water for manufacturing, and the toxic chemicals that can enter the water supply. Many industrial units discharge wastewater locally without treatment, or as waste into lakes, rivers, and oceans. These can include pesticides, chemicals, waste oils, and heavy metals, which can be accumulated by humans and other living organisms in their tissues. Untreated sewage discharged into rivers can cause diseases like typhoid, dysentery, and cholera, while plant supplements like nitrate and phosphates can stimulate the growth of algae.



• Agriculture

Agriculture looks set to remain the biggest user of water, with demand for new foodstuffs and products keeping water use high. These demands include the growing use of biofuels, which could require as much water as fossil fuels to produce. As populations grow, the demand for increased yields also rises. Another factor is a move away from basic staples such as starch-based foods, and growing demand for water-intensive meat and dairy.⁵

Agriculture is a major source of water pollution. Chemicals such as nitrogen and ammonia from fertilizers, frequently enter watercourses as surface run-off from fields. Once present in water, these chemicals can cause significant damage, killing aquatic life and accelerating the growth of vegetation such as algae. If the chemicals are left uncontrolled, eutrophication and other problems may occur.

- **Environment / climate change**

As the climate changes, the availability of water is becoming less predictable. One of the growing threats is flooding, which can destroy water points and sanitation facilities, and contaminate water sources. Some regions are experiencing droughts that increase water scarcity and reduce people's health and productivity. Continued access to water is one of the major strategies as we seek to mitigate the effects of climate change.

Other effects, such as increased temperatures and more extreme, less predictable weather, may alter the patterns of rainfall and snowmelt. This can disrupt or alter river flows and groundwater, further reducing the available quantities of water. Problems are most likely to affect low-income communities, which are already more vulnerable to any water supply threats. Disruption to water supplies will also impact health and food security and potentially prompt mass migrations away from water-scarce areas.⁶

This puts an onus on ensuring wastewater flows can be recovered and returned to high quality supplies of potable water with as little treatment as possible.

- **Decarbonization**

The production, distribution and treatment of water is highly energy intensive, with all contributing to a nation's carbon production. For example, in the UK, carbon emissions from domestic and non-domestic supplies by water companies are 5.03 MtCO₂e. This rises to 35 MtCO₂e when household water use is factored in.⁷

Many water companies have signed up to become carbon neutral. Turning wastewater into a suitable state for discharge into watercourses such as streams, rivers and the sea can be an energy intensive process. The required power needed for processes such as aeration and pumping is sometimes provided by fossil fuels. Accurate measurement to ensure close control of treatment processes is therefore a key requirement to help limit energy consumption.



2. Why does measurement matter for wastewater treatment?

Wastewater treatment is a multi-stage process that involves a wide range of measurements needed to make sure that both the quality and quantity of discharged water meet increasingly strict regulatory requirements.

The process of bringing wastewater flows back to an appropriate condition, fit for discharge, requires knowledge of the condition of that water as it travels from the treatment plant input to the point of final discharge, much like a journey begins with knowing your destination.

Consequently, there is a wide range of parameters that need to be accurately measured at each point in the wastewater treatment cycle. Whilst previous measurement techniques have varied in their accuracy and effectiveness in being able to provide a reliable indication of conditions outside of a specific moment in time, the latest generation of digital continuous instruments and analyzers are helping to transform measurement performance. Collecting and transmitting a range of operational and diagnostic data, these devices offer the opportunity to get a clearer indication of process conditions that can be used to optimize treatment performance and demonstrate regulatory compliance.

Environmental advantages

Continuous water quality analyzers are providing the data to make sure that environmental regulations are met.

Regulations designed to manage water quality that protect the environment, encompass everything, from tackling the spread of invasive species to minimizing chemical and nutrient pollution. Both chemical and bacteriological

pollution can tip the balance of aquatic ecosystems, affecting the full spectrum of aquatic life, from fish and amphibians through to plants. The importance of returning high-quality water to the water cycle provides maximum availability when utilities withdraw water.

The treatment and distribution of water are energy intensive. An important aspect of protecting the environment is optimising processes and cutting carbon emissions in the treatment and distribution cycle.

Digital measurement and analysis of the wealth of data provided helps to assess current performance and identify ways that it can be improved to help companies minimize their environmental impact and comply with relevant rules and regulations.

Operational advantages

Digitalization gives a better overview of processes, enabling decisions to be made on a more informed, objective basis. Systems running analytical programs provide insights into key operations such as pH measurement and control. This analysis offers the ability to anticipate changing process trends, deal with potential anomalous conditions as they occur, and help the organization achieve higher-level operational and business objectives.

Maximizing the value of the data is increasingly enabled by advances in artificial intelligence and machine learning. Multiple streams of data are collected and analyzed to establish patterns of behaviour and trends. These patterns and trends predict future outcomes, allowing utilities to operate more efficiently.



Online measurement is the most common type of measurement used by water companies today. Extractive sampling and testing on-site, which were once frequently employed to determine the quality of the water, are now mostly used to check that on-site continuous water analysis systems are producing accurate results.

One of the great advantages of online continuous water analysis is the ability to respond quickly to changing conditions. This has delivered large-scale efficiencies for water treatment works by enabling them to identify processes that may not be performing at their optimum and take necessary measures to address any problems.

Digital measurement and sensing equipment, together with advanced data processing techniques and increasingly capable computers, are creating what is effectively a 'digital brain'. As utility companies have upgraded instruments and systems over time, there has been scaled investment in the infrastructure to maximize the value of the data.

It is not only tightening environmental legislation that motivates the use of continuous water analyzers. At the most basic level, plant managers implement digitalisation to improve their snapshot view and gain an understanding of what's happening in their current operations. At the highest levels, the data is used strategically for improving customer satisfaction, balancing the allocation of capital, and supporting better decision-making in day-to-day business, financial, and operational activities. In all cases, digitalisation provides a platform for enabling more consistent operations without burdening users with the overhead or technicalities of a large data processing structure.

With digital instrumentation being used to measure an extensive range of parameters from dissolved oxygen in the aeration process to chlorine and turbidity, continuous water analyzers help to eliminate the delays and added uncertainties associated with extractive testing methods.

Digital measurement technology is making accurate water quality measurement easier, with data being used to meet and exceed regulatory requirements as well as optimize efficient process performance.

Cost

Wastewater treatment is an expensive process. Huge amounts of energy are needed to shift water between the various stages as well as treating water in processes such as aeration, which can often account for over 50 percent of a typical site's total energy burden.

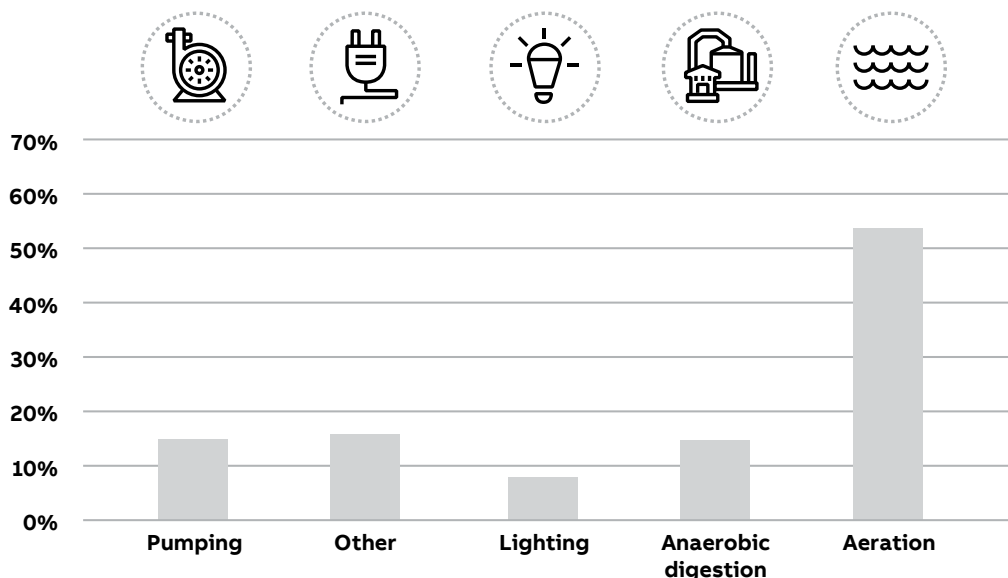
Another significant cost is that of chemical consumption. Many of the processes in wastewater treatment consume chemicals, either directly through dosing or indirectly for purposes such as producing the chemical reactions in measurement instruments needed to assess water quality. Using instruments that can measure to the highest levels of accuracy is therefore key to reducing the risk of errors that might require costly re-treatment of wastewater flows. By enabling problems to be quickly spotted, the latest generation of measurement instruments and analyzers allow timely action to be taken before any problems can escalate.

Maintenance

Water treatment works in isolated and difficult-to-reach locations are expensive to routinely maintain. The advantages of digital measurement technology for maintenance management are well documented across the process industries but are more recognized in industries that may have to send maintenance staff on long road journeys to reach their destination. As the front line in any water quality measurement scheme, continuous water quality analyzers need to be kept in good working order to provide accurate, reliable, and repeatable performance.

In these instances, predictive maintenance allows maintenance workers to schedule their work to make sure sensors are functioning properly. Combining preventive

Figure 2 Energy burden in sewage treatment



maintenance and predictive maintenance helps maximize process efficiency and guarantee that everything is operating as it should.

Digital sensors and transmitters are offering additional data above and beyond their primary measurement that indicates instrument health. If readings are not as expected, digital instruments can feedback advanced self-diagnostics conforming to NAMUR NE107.

Regular calibration will have a material impact on the measurement accuracy of analyzers. In some cases, one-button sensor calibration saves time and money on routine maintenance. ABB Ability verification for measurement devices are becoming more widely available across the range of digital instrumentation that allows for online verification of measurement accuracy for reporting and compliance.

Compliance

Increasingly stringent regulations are being introduced around the world to help limit the pollution of watercourses and make sure that those who do engage in polluting activity can be traced and penalized.

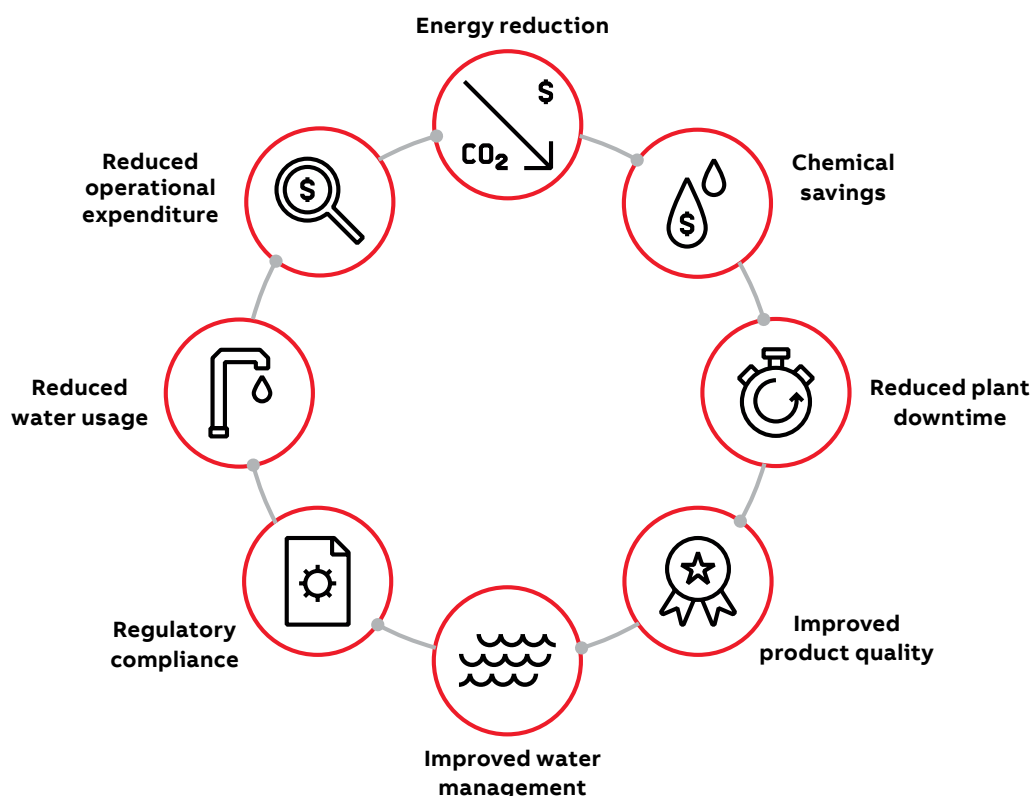
Different countries have their individual regulatory bodies, such as the Environment Agency in the UK, the Environmental Protection Agency (EPA) in the US and The Ministry of Environmental Protection (MEP) in China, that oversee the enforcement of water quality standards and set penalties for non-compliance.

In many cases, organizations that discharge water to the environment, including utilities and industrial operators, will be required to monitor the quality and quantity of their discharges and report them to the appropriate regulatory body. These requirements may also stipulate the use of specific equipment and procedures to ensure that measurement is carried out accurately and in accordance with a benchmarked standard.

In the UK, for example, both utilities and industrial operators are required to measure the quality and quantity of their effluent discharges as part of the Environmental Permitting Regulations (EPR). Under EPR, all water companies and industrial sites that discharge a volume of treated water greater than 50 cubic meters a day and carry out self-monitoring of flows must have their site certified against the MCERTS scheme. This scheme sets standards across a range of areas including the type of measurement products that should be used, the competency of personnel carrying out the measurements and the accreditation of laboratories and on-site inspection.

One of the main benefits of MCERTS is that both water utilities and industrial companies stay within their regulatory limits for discharging effluent to the environment and that effluent quality meets certain minimum standards. By obliging operators to use the best available technologies for measuring discharges, the standard puts in place a benchmark for accuracy and performance so that measurements can be considered a valid and legitimate representation of actual operating conditions.

Figure 3 Why does measurement matter?



3. Digital water quality technologies available from ABB

pH / ORP

Being able to accurately measure levels of acidity and alkalinity is vital to ensuring the highest standards of water quality, safety, and environmental performance. pH levels must be correctly balanced at the point of discharge of effluent water into water courses or damage could be caused to the aquatic environment, potentially resulting in prosecution and severe penalties. It is therefore important to have accurate data, but also to be able to react quickly if that data indicates that pH levels are within levels set by regulators.

Maintaining accuracy

Maintenance is key to enabling continued accuracy of measurement devices. A typical fault of pH measurement applications is electrode poisoning. Typically caused by the substance being measured contaminating the reference electrolyte, electrode poisoning can result in erratic and unstable readings. ABB's Digital pH sensors include perpetual impedance diagnostics, which analyze the resistance and impedance between the reference and measuring electrode; and smart reference electrode monitoring, which provides early warning of electrode poisoning, enabling problems to be quickly diagnosed.

Reducing maintenance burden

Condition monitoring optimizes maintenance schedules. By connecting the pH sensor to a digital transmitter, the unit's data output from its diagnostic functions can be used to accurately determine the root cause of a pH measurement error. Operators can make use of the increasingly rich data to identify what went wrong and derive strategies or techniques to prevent the same problems occurring in the future. This can minimize downtime and reduce the need for unnecessary inventory.

Optimization

The data available from pH sensors can be combined with data from other instruments to provide information for making decisions across the whole plant and the wider business. One of the most powerful and effective techniques is to make use of cloud-based infrastructure, which helps more people and systems get access to and act upon the data that is appropriate to their needs. This includes inputs from process-line instrumentation such as pH sensors, as well as signals sent to a range of control and supervisory equipment. These can include elements such as programmable logic controllers (PLCs), supervisory control and data acquisition (SCADA), and distributed control (DCS) systems.

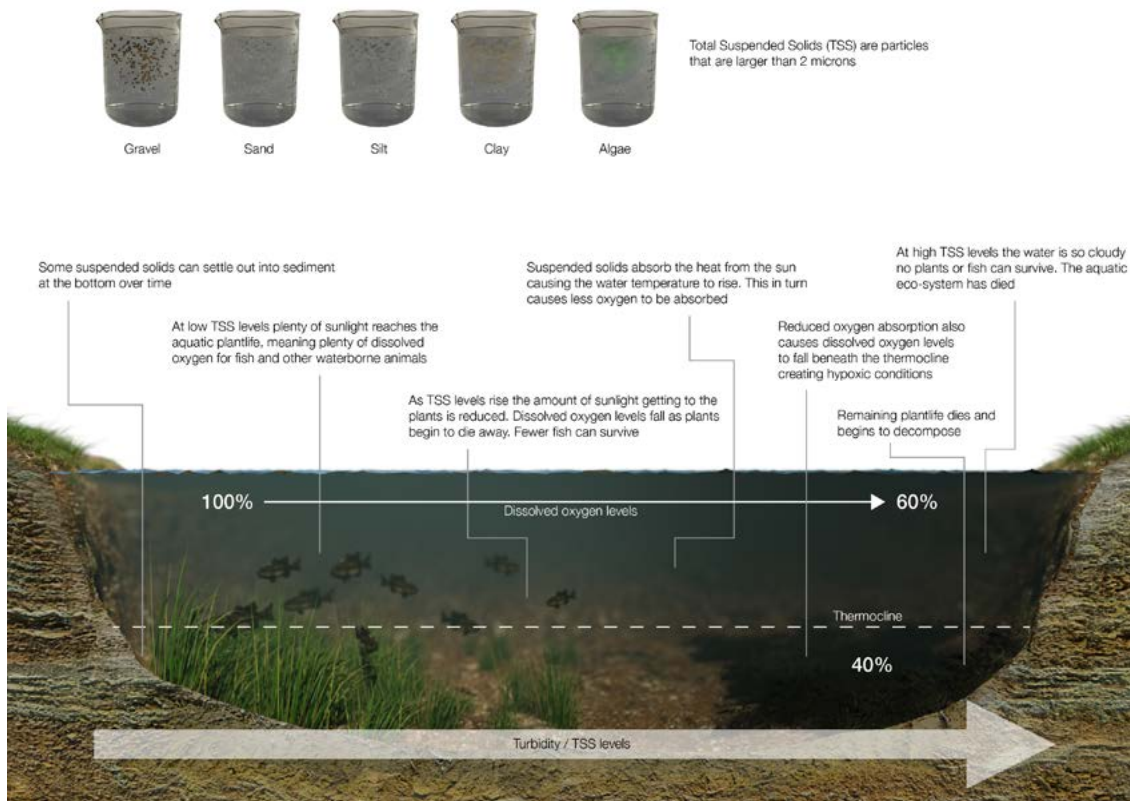
Immediacy

Continuous analysis allows for real-time or near real-time measurement. Where pH measurements were taken through extractive sampling of the source, digital performance enhances the advantages of online (i.e. real-time or near real-time) measurement compared to traditional laboratory techniques. Lab samples are only representative of a snapshot in time that may not be representative of the changing quality of water.

Digitisation makes data easier to access and more visible to plant operators and production engineers by using customizable dashboards. Displaying key performance indicators on large touch screen displays allows plant operators to be more aware of process variations and respond to them faster. The same data can be run on smartphones and tablets via appropriate apps, making it easier for plant personnel to interact with plant equipment and analytic data.



Figure 4 Impact of turbidity levels on the aquatic environment



Turbidity and Total Suspended Solids (TSS)

The clarity of the water in a stream, river or ocean is valued aesthetically, but it is also a key determinant in fostering a healthy and balanced aquatic ecosystem. The clearer the water, the greater the ability of light to penetrate to aquatic plants that generate the oxygen required for aquatic life. Controlling the level of turbidity and suspended solids in treated wastewater discharged to the environment is vital in preventing damage caused by the depletion of dissolved oxygen levels.

For this reason, turbidity and suspended solids concentrations of effluent discharges are tightly regulated and need to be carefully monitored to ensure regulatory limits are maintained. A build-up of particles or suspended solids in the water will scatter daylight passing through the water, reducing its intensity, and impeding efficient photosynthesis. ABB's ATS430 turbidity and TSS probe with adaptive TSS calibration provide operators with more reliable process data for improved process control and regulatory compliance. It is also MCERTS approved.

Maintaining accuracy

The ATS430 Turbidity and TSS sensor is supplied factory calibrated. It is equipped with EZLink automatic sensor recognition and set up for simple connection to the ABB AWT440 digital transmitter.

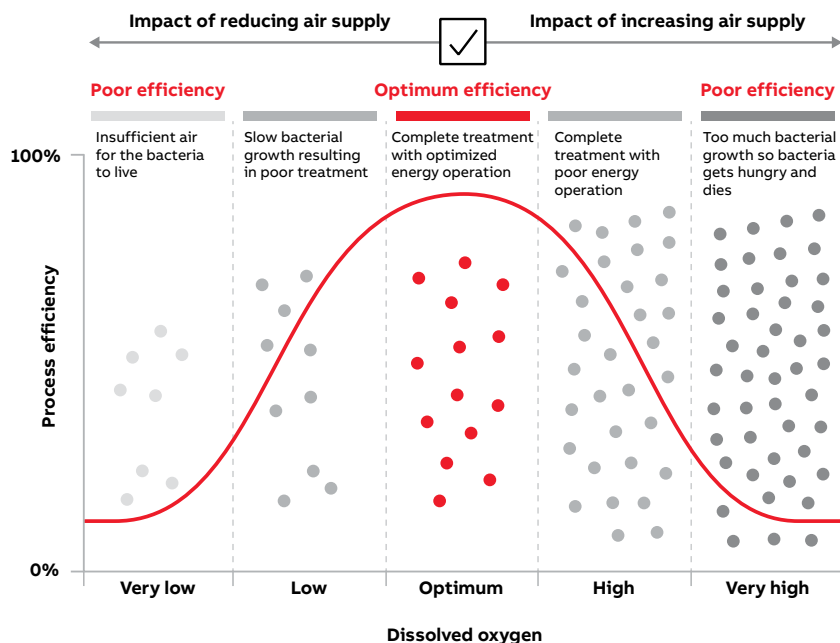
Innovations in measurement technology are overcoming the problems associated with obtaining a reliable calibration. The 'Adaptive TSS calibration' feature in ABB's ATS430 turbidity sensor, for example, provides a means to approximate the quality of the coefficient obtained by progressively building up the calibration coefficient every time an in-process calibration is performed. Every time a new TSS value is input to the ATS430 sensor, a new coefficient is calculated as a weighted average of the current coefficient plus the new coefficient.

Reducing maintenance burden.

Systems that offer continuous monitoring of turbidity and total suspended solids are helping water companies to manage coagulant dosing and filtering effectively. Previously, additional chemical dosing may have been applied to compensate for measurement errors. An effective system for measuring and controlling the correct coagulant dosing levels both reduces chemical use and the maintenance burden caused by chemical overdosing causing blockages in filtration.

Immediacy

Digital performance enhances the advantages of online (i.e. real-time / near real-time) measurement compared with traditional laboratory techniques. Previously, material output samples were taken for analysis from the source but as this method was slower, the composition of the sample could change, showing inconsistent results.

Figure 5 Impact of dissolved oxygen on aerator efficiency

Dissolved Oxygen

Dissolved oxygen is a key ingredient in the efficient treatment of waste in wastewater processes. When it comes to the control aeration processes, it is vital that levels of dissolved oxygen used to encourage the breakdown of bacteria are controlled as closely as possible. Both excessively low and excessively high levels of dissolved oxygen can be equally harmful to aquatic life, making it essential for water treatment plants that levels are as close to ideal as possible before water is discharged.

Water operators need to keep a close eye on levels throughout the water treatment process, from the treatment of waste at the aeration stage to the point of final discharge.

Aeration provides the oxygen needed for bacteria to effectively treat and stabilize wastewater. Oxygen is used by aerobic bacteria in the wastewater to break down organic matter containing carbon into carbon dioxide and water. The efficiency of the aeration process relies on dissolved oxygen levels being controlled as closely as possible. In ideal conditions, dissolved oxygen levels should be maintained at between 1.5 to 2 ppm. If there is not enough dissolved oxygen available, the aeration basins will be deprived of the oxygen required for effective bacterial growth, negatively affecting the rate of sewage breakdown and impairing treatment process efficiency.

Ensuring regulatory compliance

Waste that has not been sufficiently aerated can have a significant impact if allowed to pass into aquatic environments. Consequences can include the potential creation of filamentous growths and ammonia which can

lead to accelerated plant growth and algal blooms and reduce oxygen levels. Where the discharger and the cause of the problem can be ascertained, the resulting damage can result in potentially severe financial penalties.

The measurement of dissolved oxygen is therefore a key requirement in any industry where wastewaters are rich in organic carbon and biological wastewater management is used. Typical processes include sewage treatment, beer brewing, animal processing and paper manufacturing. The need to measure dissolved oxygen levels is also common in aquaculture settings, dam or discharge monitoring, as well as in food and beverage production processes.

Reducing energy consumption

While applying too little dissolved oxygen will reduce the efficiency of the aeration process, applying too much will also have a detrimental impact. With aeration processes accounting for over half of a plant's energy costs, their efficiency must be optimized as much as possible. Failing to establish tight control of dissolved oxygen within the 1.5 to 2ppm range greatly increases the risk of operators incurring excessive energy costs.

Maintaining accuracy

The latest generation of optical sensors offers several key features that eliminate many of the limitations associated with other forms of dissolved oxygen measurement, such as electrochemical sensors. In contrast with electrochemical sensors, optical sensors have no membrane or chemical components. The most advanced dissolved oxygen sensors work on the 'dynamic luminescence quenching' principle, a light-based measurement technique. Optical sensors are comprised of lumiphore molecules embedded in a sensing element, plus blue and red LEDs and a photodiode.

Figure 6 Optical sensors – how they work



When a reading is taken, the lumiphore molecules are excited by blue light from the blue LED. When excited, these molecules emit a red light which is detected by the photodiode. Any oxygen molecules present will quench the excited lumiphore molecules, reducing the amount of red light being emitted. The shift in the amount of red light being emitted is then measured by the red reference LED.

As DO concentration and the amount of red light being returned are proportional, a measurement can then be taken and converted into a reading based on mg/l. A key benefit of optical measurement technology is its stability and accuracy. The luminescence lifetime technique is used to measure the phase shift between the returned red light and the red reference light.

The ADS420 optical DO sensor uses Rugged Dissolved Oxygen (RDO)* optical technology for measuring dissolved oxygen in the most demanding process environments. Approved by the U.S. Environmental Protection Agency (EPA), this technology uses the dynamic luminescence quenching technique. Comprised of a sensor and multichannel transmitter, it works on the frequency domain method and provides the highest levels of stability and accuracy for dissolved oxygen measurement.

The patented signal processing within the sensor enables it to respond to changes in process conditions up to five times faster than other optical systems, allowing improved process control and maximum process savings. The use of the dynamic luminescence quenching principle also means that the sensor is not susceptible to drift, removing the need for frequent maintenance.

Reducing maintenance

Compared to electrochemical devices, optical sensors have a greatly reduced maintenance requirement. The ADS420 features a robust design that enables it to withstand the problems that can affect conventional membrane-based sensors, such as abrasion, fouling or poisoning. The sensor lumiphore is not affected by photobleaching or stray light. The sensor itself is also immune to the effects of sulfides,

sulfates, hydrogen sulfide, carbon dioxide, ammonia, pH, chloride and other interferences. This allows it to provide consistent, accurate readings over long periods without suffering from sensor drift.

The sensor head only needs to be cleaned periodically, whilst the sensor cap can operate up to two years before replacement. The cost of spares is also reduced, with no need to keep spare membranes or electrolyte filling solution.

The sensor also includes a smart sensing cap with an automatic setup. The SmartCap comes pre-loaded with factory calibration coefficients, serial number, lifetime indication, and manufacture date which are automatically uploaded to the sensor, eliminating the time normally required for set-up. By automatically prompting the user when replacement is due, the SmartCap also removes the risk of unexpected sensor failure.

Optimizing efficiency

The ADS 430 responds quickly to oxygen and temperature allowing for close control of aeration processes. The ability of the digital sensor to communicate with other instruments and equipment, such as variable speed drives in a control loop managing the speed of an air blower, can help to further optimize aeration efficiency, reducing both energy costs and waste products in wastewater treatment processes.



Digital AWT transmitters

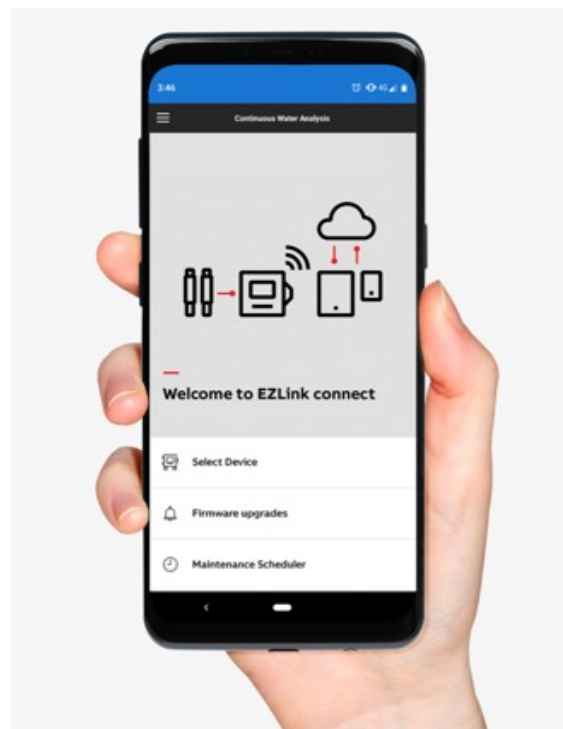
Digital transmitters provide secure access to data when and where it is needed. ABB's common HMI makes data access, calibration and troubleshooting, simple and intuitive. Software updates and sensor information can be accessed via a smartphone. Bluetooth technology provides up-to-the-minute information and technical support via ABB's EZLink connect app. The transmitters allow for a mix-and-match of analog and EZLink digital sensors to be connected.

Maintenance

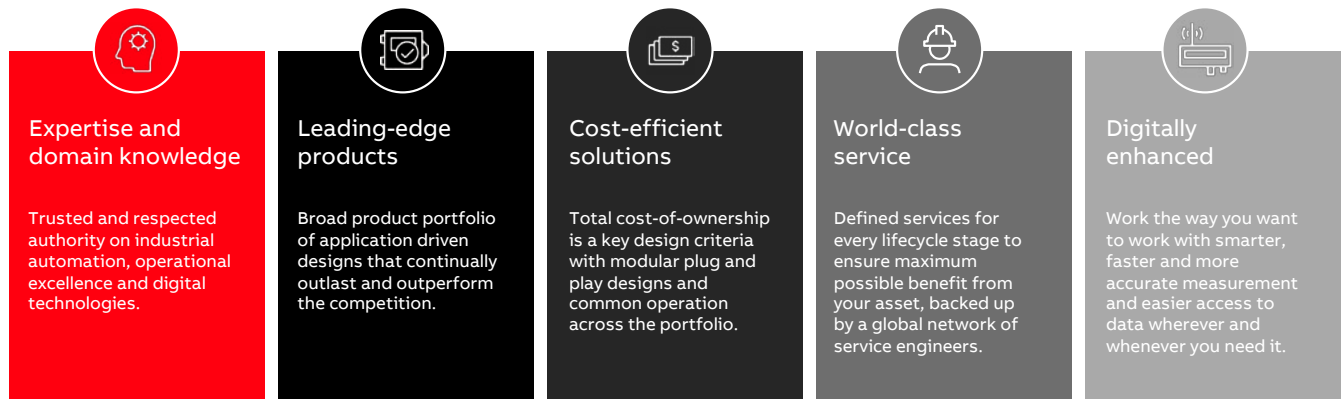
The benefit of ABB's new range of digital transmitters is that they are truly adaptable and can be quickly and easily modified to meet changing requirements. The modular design allows for the same unit to be used with any available sensor or communications modules. Modules can be removed easily and swapped enabling swift and simple upgrades in the field.

Regulatory compliance

The AWT420 transmitter records data continuously to its internal memory. This includes both event log, configuration and measurement data. Process data and historical logs can be archived securely to a removable SD card or USB stick. A key benefit of digital transmitters is that archived data can be transferred easily to a PC and analyzed using ABB's DataManager Pro data review software allowing analysis for performance improvement, or for reporting purposes.



4. Why choose ABB for wastewater measurement?



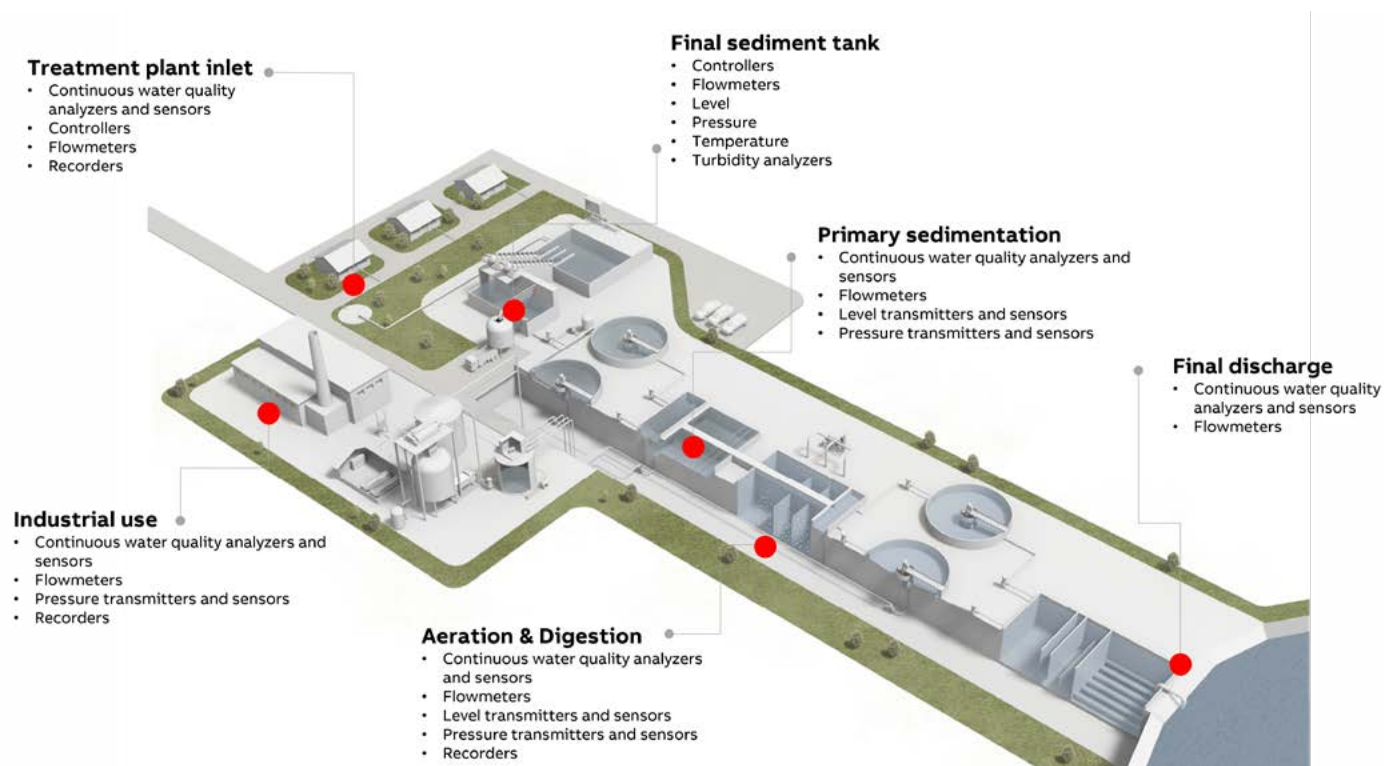
Ultimately, understanding current performance and finding ways to optimize treatment plant efficiency and safety relies on the ability to gather accurate and reliable data from as many points in the wastewater treatment process as possible.

With extensive experience gathered from hundreds of utility and industrial wastewater treatment applications around the world, ABB is well placed to help meet a wide variety of measurement challenges, from optimizing efficiency and reducing total lifetime costs to assuring regulatory compliance.

In addition to the various digital water quality measurement technologies detailed in this white paper, our portfolio also includes an extensive choice of analyzers and instruments for measuring the key parameters that are necessary for the effective and safe functioning of a wastewater treatment plant, including:

Analytical	Flow	Level	Pressure	Temperature
Aluminium	Coriolis	Laser	Differential pressure	Head mounted
Ammonia	Electromagnetic	Magnetic	Gauge pressure	Field mounted
Chlorine	Variable area	Ultrasonic	Multivariable	Non-invasive
Color				
Conductivity				
Dissolved organics				
Dissolved oxygen				
Fluoride				
Iron				
Manganese				
Nitrate				
pH/ORP				
Phosphate				
Turbidity				

Figure 7 Comprehensive measurement for optimum wastewater quality



We can also draw on ABB's complete list of products and services to offer an extended range of solutions covering a wide range of areas, including:

- Variable speed drives
- Motors
- Distributed Control Systems
- PLCs
- Smart plant control
- Electrification products
- Service and support

5. How are ABB's technologies being used around the world?

Improved aeration control with less calibration



Customer: Anglian Water, United Kingdom

Application: Aeration treatment plant

Anglian Water Services Ltd has cut calibration of an aeration control system at its Coningsby Sewage Treatment Works using ABB ADS430 Dissolved Oxygen sensors. The new solution cuts calibration intervals from three months to two years. The sensors also offer improved accuracy and are easier to use and read than the previous devices.

The senior ICA technician for the site was looking for a solution that would replace the existing ABB galvanic sensors. The plant's galvanic sensors were coming to the end of their lives and had experienced problems that affected the consistency of their measurement readings. They also needed frequent calibration, with the sensors having to be checked every three months.

With the ability to be deployed for extended periods without any need for calibration, the ABB sensors have greatly reduced the requirement for maintenance, with their ease of use also eliminating the need for dedicated instrumentation technicians to carry out checking.

“We can see easily if there is any deterioration in the sensing heads whereas previously we would need dedicated instrumentation technicians to determine sensor health. The sensors give us high reliability at low cost and also give us a lot more information on trends.”

Keeping phosphate discharges under control

Customer: Severn Trent Water, United Kingdom

Application: Monitoring for regulatory compliance

With the potential for phosphate to accelerate the growth of algae that can damage aquatic environments, many regulatory authorities have put strict limits in place on phosphate discharges. Severn Trent Water Services in the UK is using 120 Aztec 600 orthophosphate analyzers in wastewater treatment plants throughout its operating area to ensure that phosphate discharges are maintained within consent limits set by the UK Environment Agency.

Operating as part of a dosing control system alongside ammonia analyzers, iron analyzers and turbidity monitors, the orthophosphate analyzers have reduced the company's reliance on manual sampling. By providing continuous measurement of phosphate levels, the analyzers provide a level of process control that is not possible with manual testing alone, where potentially important events that occur between less frequent manual sampling can be missed. Operators can now receive an early warning of any changes to the treatment process, enabling operational decisions to be made in near real-time.

The availability of real-time data will also enable Severn Trent Water to create a more proactive maintenance schedule matched to the actual needs of its treatment plants.

"Together, the data from our orthophosphate analyzers and other instruments give us much greater visibility and knowledge of what's going on at our treatment plants," explains Paul Duckett, Senior Program Engineer for Severn Trent Water. "We are now able to spot any potential malfunctions or issues before they can escalate, enabling us to be much more effective in the way that we deploy our maintenance teams."



Providing a measured response

Customer: All Water, Australia

Application: Aeration treatment plant

The Glenelg wastewater treatment plant in southwest Adelaide provides reliable and secure wastewater service to 200,000 people in the local area. Delivering 3.8 billion liters of reused water for recreation and commercial purposes every year, the plant needs the most reliable, accurate and robust analytical instruments to ensure wastewater is safe to be discharged back into the environment.

Plant operator All Water, had previously been using a sensor product from another manufacturer to analyze dissolved oxygen levels but were unhappy with its durability and performance. In particular, problems with the installation environment meant that part of the sensors were having to be replaced every three to four months. Installing ABB's AWT440 digital transmitter and ADS430 dissolved oxygen sensor has addressed the problems affecting the previously installed sensor system. Reliability and performance has improved as a result, which has eliminated the need for parts to be replaced prematurely.

Conclusion

Improved water sustainability starts with measurement

With projections estimating that the world's population will continue to grow to 9.8 billion people by 2050, every possible effort must be made so that every drop of water can be conserved and preserved to meet growing demand.

Maximizing the efficiency of wastewater treatment processes can help to reduce the risk of pollution of the ground and surface water sources that supply raw water for potable treatment. By taking advantage of the many benefits of the latest generation of digital measurement technologies, operators can be sure that the quality of the water they discharge back to the environment meets the highest levels of quality and safety, whilst also finding ways to reduce costs and avoid the risk of regulatory infringements that could result in stiff financial penalties.



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