INTESA SANPAOLO
INNOVATION CENTER

INDUSTRY TRENDS REPORT
ENERGY, ENVIRONMENT & UTILITIES

WATERTECH

FROST & SULLIVAN

CONTENTS

EXECUTIVE SUMMARY

In 2022, the global utility water and wastewater market for infrastructure, software and services was estimated at $116.7b and is expected to reach $135.2b by 2025.

Growth is being shaped by ageing infrastructure, historic underinvestment and increasing water scarcity – due to climate change, continued industrialization, population growth and more frequent incidences of contamination – together with a sharpened focus on sustainability and circularity.

Water networks can be segmented into several verticals with pumps amongst the largest in 2022 and meters the fastest growing (30.2%, 2022-25). This is broadly reflective of the overall direction of travel with conventional technologies being replaced or at least complemented by new alternatives.

Market participants are in particular looking to develop innovative technologies to support with water production, conservation and treatment and in respect to pumps.

Water ***generation*** offers one response to **water production** with ambient air condensation and absorption the two main types of atmospheric solution. Both benefit from the fact that they are relatively simple so do not require investment in infrastructure and are therefore cost effective. Source (US) has, for example, developed solar powered hydropanels which are capable of operating in a wide range of meteorological conditions.

Water ***purification*** provides an alternative solution and can be broadly segmented into both filtration and catalysis technologies. These offer the advantage of being flexible and therefore applicable to a range of large and small applications, including for utilities. Corncob (US), for example, provides a cost-effective filtration process which is highly scalable due to its modular structure which enables the deployment of membrane discs.

Overall, the success (or otherwise) of emerging water generation and purification research will depend on financial support from national government programs.

Reverse osmosis (RO), the process of passing saline solution via a permeable membrane, is a more established process but here too innovation is occurring. Currently, energy and maintenance are key contributors to high operating costs, so market players are focusing on reducing usage and improving membranes. In the first of these areas, DuPont (US) has invented a dry seawater element for RO while, in the second, Lenntech (NL) is the company behind a new closed circuit RO technology.

Here, support from public authorities is less significant but water utilities, technology providers and research institutes are coming together to drive discovery.

In addition to water production, ***leak detection*** helps to address water scarcity with vendors leveraging digital solutions to reap the economic and environmental benefits of **water conservation** in the context of a market which is currently growing at 8.4%.

Here, online acoustic and pressure sensors and inline probes are increasingly being joined by tracer gas and aerial imagery in the fight against non-revenue water loss. More broadly, the market is moving away from standalone leak detection solutions in response to utilities' demand for one-stop-shop providers across water/waste. This is being achieved through M&A, as in the case of Ovarro's (UK) acquisition of Servelec Technologies which brings two lead detection brands, and partnerships as exemplified by Mueller Echologics (CA) team-up with VODA.ai to provide a virtual pipe condition assessment tool.

Of all the verticals, ***smart meters*** are leading the digital charge with the segment set to become the second largest in the water and wastewater market by 2025 and, alongside leak detection, play a key role in supporting water conservation efforts.

Currently, the value chain breaks down into distinct areas but "conventional" revenues from meter reading and infrastructure are increasingly being complemented by solutions to manage and leverage the vast volumes of data that they generate. Kamstrup (DK), for example, is disrupting the market with its flowIQ2200 product, a smart water meter with an integrated acoustic sensor, while ITRON (US) is helping utilities to digitize legacy mechanical solutions by leveraging connectivity protocols like Sigfox. Moving forwards, LTE-based cellular LPWAN technology is expected to accelerate smart meter roll out.

On the **water treatment** side, centralized infrastructure has failed to keep up with changing demands and decentralized packaged systems are filling the gap.

Decentralized solutions are typically modular or prefabricated with a capacity of up to 5,000m3 per day and fit within a container or other custom cover. Overall, the market was estimated at $5.9b in 2022 and is growing at 7.6% per annum with the municipal segment the largest (30%) after the industrial (49%).

For water, membrane filtration is the main technology due to its reliability, robustness and ability to recover high volumes of water while, for wastewater, moving bed biofilm reactors support end-users' efforts to become sustainable by meeting discharge regulations.

On the supply side, the decentralized water treatment market is highly fragmented with Fluence, Aqwise, Suez, Veolia and Pure Aqua the tier 1 players. They and other participants are exploring the opportunity offered by new chemical free membranes which support plug-and-play operations and, in parallel, smart and IoT-based control and monitoring solutions are becoming vital to improving the efficiency of water treatment processes. In the future, building integrated decentralized systems are expected to become more common and meet the potential for greywater reuse and nature-based solutions will also play a role, offering the prospect of reduced energy consumption and minimal maintenance requirements.

In addition to treating water, utilities are increasingly looking at the resource recovery options for sludge produced by wastewater plants.

Indeed, sludge treatment technologies represent ~20% of the total water and wastewater treatment market in Europe with generating renewable natural gas through anaerobic digestion one of many possible opportunities.

Pumps, with global revenues of $8.3b, remain the workhorses of the market, and are used for extracting, treating, distributing and discharging water and wastewater. Within this, centrifugal solutions account for ~80% of total sales and are set to benefit from manufacturers' efforts to better their efficiency.

Pump technology is mature and – with no significant changes anticipated in design or material – incremental improvement even here is based on digitization. Grundfos (DK), for example, has launched solar powered pumps to serve areas with poor infrastructure or which are remote whilst Jacobs and Xylem (both US) are third party solution providers that are working to help utilities manage their assets by monitoring pumps in real time.

This report explores the way in utilities globally are leveraging innovation across four areas – water production, water conservation, water treatment and pumps – to respond to the challenges and embrace the opportunities that they face in developing new and managing existing water and wastewater infrastructure.

INTRODUCTION

In 2022, the global utility water and wastewater market for infrastructure, software and services was estimated at $116.7b and is expected to reach $135.2b by 2025

Growth is being shaped by ageing infrastructure and historic underinvestment …

Aging infrastructure and **historic underinvestment** are key challenges for mature water networks in North America and Europe and, increasingly, in Asia-Pacific. Large, centralized projects to build new water networks have become a rare occurrence in the 21st century while the replacement and repair rate is not typically staggered in a way that suits contemporary annual budgets.

The American Society of Civil Engineers' 2021 Report Card for America's Infrastructure notes that, on average, there is a water main break every 2 minutes in the country which represents 6 billion gallons or 22.7b liters of water lost each day. Whereas legacy water and wastewater networks were often designed and deployed as part of broader infrastructure projects, new approaches to targeted rehabilitation are required to ensure timely replacement without overwhelming municipal budgets.

… together with increasing water scarcity …

Climate change is resulting in record heat waves in Europe, affecting water availability and severely increasing water stress.

The European Commission has estimated that 11% of Europe's population is currently impacted by **water scarcity** which is forecast to grow constantly and consistently unless there are significant changes.

Water scarcity is one of the most dangerous and immediate effects of global warming about which water is a kind of harbinger.

Indeed, climate change manifests itself not only in an increase in average temperatures but can also be seen in changing in atmospheric conditions. In the Mediterranean, for example, African anticyclones are increasingly extending further north, even as far as the Alps, whilst western atmospheric currents which typically bring precipitation are simultaneously decreasing. It is difficult to connect the dots when global warming causes seemingly opposing events – droughts on one hand and floods on the other – but they are two sides of the same coin and demonstrate how climate change is affecting the water cycle which is one of the most important climate mechanisms in our lives.

Water scarcity as well as extreme weather-related events such as water bombs, rising seas level, wildfires and shrinking ice fields are just some of the symptoms of the rise in temperatures and the increase in the concentration of carbon dioxide (CO2) in the atmosphere. CO2 warms the planet, causing climate change; this is a fact and human activity has raised the CO2 content in the atmosphere by 50% in less than 200 years according to NASA's "Vital Signs" climate change data.

Source: Frost & Sullivan

• Causes of water scarcity

Water scarcity is a relative rather than an absolute concept. It occurs when there is insufficient water to meet the demands of a particular region or population. Therefore, it is necessary to take into account all of the different factors that impact on water availability and to consider the problem from a systemic point of view.

In addition to ageing infrastructure, historical underinvestment, climate change and weather events, growth in the global population is spurring demand for water resource which can also result in water scarcity. Another contributory factor is overuse, when water resources are consumed faster than they can be replenished, while contamination can make them unusable or unsafe for human consumption. A final but not insignificant element is poor water management with the deployment of practices that prevent the efficient distribution of all of the available water resources.

It is important also to consider the disparity in the availability of water between developed and developing countries and how this will generate ever greater inequalities in the future. Many countries are already experiencing the effects of water scarcity with some regions in Africa, the Middle East and Asia facing severe water shortages. Water scarcity can lead to social and political conflicts as people compete for limited water resources and governments struggle to provide basic water services to their citizens.

Today, at the beginning of 2023, there is a crisis even in Europe with drought putting the agricultural sector under pressure. Rationing water has become a reality and there are difficult choices to be made about how to allocate resources. Authorities must, for example, decide whether to lower the levels of Alpine lakes to enable irrigation or to allow the creation of artificial snow for the ski season.

• Data on water scarcity

According to UNWater, the body which coordinates the United Nations' (UN) work on water and sanitation, water scarcity affects all continents. The world is increasingly "thirsty" and in 2030 about 47% of the global population will live in areas with water stress.

This is, however, a problem for now and not just the future.

World Health Organization (WHO) data from 2018 already showed that 2.3b people were living under water stress, 3.6b faced inadequate access to water for at least one month per year and 4.5b lacked access to sanitation compatible with the goals set by the UN's Sustainable Development Goal (SDG) 6. By 2050, the World Meteorological Organization (WMO) estimates the latter number is expected to exceed 5b.

Under this scenario, due to the negative impacts of climate change and other contributory factors, the scarcity of water in the driest places could cause the displacement of between 24m and 700m people by 2030, depending on the intensity of the problem.

According to the Organisation for Economic Co-operation and Development (OECD), the demand for water will simultaneously increase by 55% by 2050 and, for these reasons, it is important to look for a reliable and sustainable solutions now.

Efforts will need to be targeted at three key areas in which water is used;

- **Agriculture** accounts for about **70%** of the planet's fresh water, wasting about half of it in inefficient irrigation systems and obsolete cultivation techniques and polluting much of it due to the intensive use of pesticides
- **Municipalities** make about **16%** of all water withdrawals to serve households and provide services but population growth is putting a strain on supply
- **Industries** contribute to another **12%** with use not distributed uniformly, creating shortages in some areas and the danger of pollution due to the dispersal of toxins and pharmaceuticals which make the water unusable

Source: Frost & Sullivan

… and a sharpened policymaker focus on promoting circularity and sustainability

The European Union (EU) has implemented a **Circular Economy** Action Plan in the interest of long-term **sustainability**. The plan underlines the need for efficient reuse of treated wastewater for agricultural and industrial processes to reduce stress on freshwater resources for use across applications.

At a national level, Spain, Cyprus, Greece, the United Kingdom (UK) and Belgium have implemented treated wastewater reuse projects, mainly to cater to agricultural demand. Over the last 5 years, severe droughts have impacted countries across Europe, including in the Nordics, which has led to many adopting this approach as a measure with which to boost supply and tackle climate change.

The EU Water Reuse Regulation will take things one step further by defining a minimum quality requirement for the safe reuse of urban wastewaters in agriculture irrigation and will apply from to Member States from June 2023. The Regulation is expected to drive utilities and authorities to find new avenues to reuse treated wastewater and enhance the circular economy. Currently, only 2.4% (or 1 billion m3) of the treated wastewater is reused in EU countries whereases there is potential for the reuse of around 6 billion m3 annually. This is expected to be achieved through the recent reuse legislation.

France, for example, currently recycles just 1% of its treated wastewater. It aims to increase reuse by 3x over the next 5 years. The country is currently piloting the deployment of treated wastewater for indirect potable use by blending it with river water with a project being implemented by Veolia and Vendée Eau at the "Sables-d'Olonne" wastewater treatment plant in mid-western France.

More broadly, the UN SDGs are having a strong influence on global investment trends. With a target of universal water and wastewater service provision by 2030, national and nongovernmental organizations are striving to meet this challenge. Funding has been boosted and efforts are being made to drive greater participation from the private sector. Brazil, for example, has adopted strategies to increase competition and reduce costs whilst India is pursuing its National Monetisation Pipeline (NMP) which aims to unlock value in brownfield projects by engaging the private sector, transferring revenue rights for (but not the ownership of) water/wastewater networks to improve operations.

Indeed, collaboration and cooperation between countries and stakeholders are essential to addressing water scarcity and ensuring the sustainable management of resources.

Policy instruments such as the setting of water standards, effluent limits and pollution load reduction targets as well as the issuing of water permits and the pricing of water and water-related services are important for managing demand and promoting the efficient use of water. An integrated water management plan is needed to allocate water among competing uses and to generate finance to invest in water-related infrastructure and services.

There is also growing awareness of the vital contribution of water-related investments to climate resilience and to delivering on the challenging targets of the Paris Agreement. The benefits could exceed hundreds of billions of dollars annually while, on the contrary, the scale of global economic losses related to water insecurity are estimated at almost $500b per year (Sadoff et al., 2015) and could cause a reduction in Gross Domestic Product (GDP) of at least 6% by 2050 according to the World Bank.

For this reason, future investment needs are expected to be significantly higher than current financial flows. This is also why companies operating in water treatment are particularly attractive for Impact Investors who target companies, organizations and funds that operate with the aim of generating a positive, measurable social and environmental impact but at the same time delivering strong economic performance.

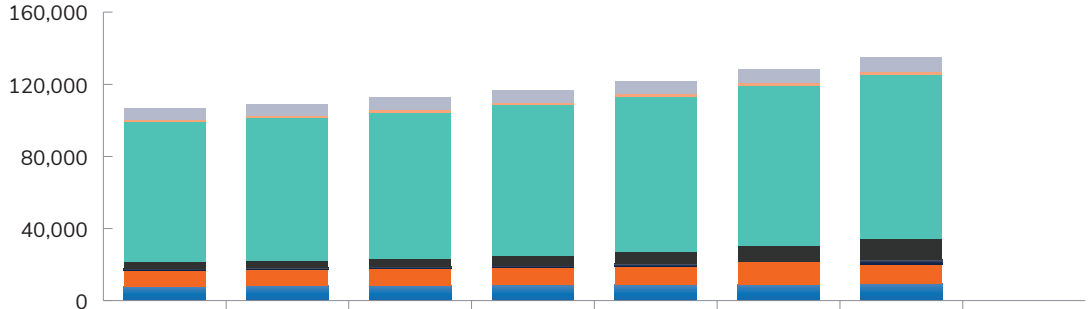
S&P Global Water Index tracks 50 of the largest publicly listed companies involved in water-related business activities. Its analysis shows that they have increasingly provided higher risk-adjusted returns than broader global equity markets over the last 10 years.

Source: Frost & Sullivan

Water networks can be segmented into several verticals with pumps amongst the largest in 2022 and meters the fastest growing (30.2%, 2022-25)

WATER AND WASTEWATER NETWORKS, REVENUES BY VERTICAL, GLOBAL, 2019-2025

REVENUE CAGR, 2022-2025 = 5.0%



	2019	2020	2021	2022	2023	2024	2025	CAGR (2020-2025)
Design and Engineering	6,200	6,424	6,669	6,938	7,230	7,550	7,900	4.2%
Leak Management Services	1,270	1,234	1,295	1,387	1,501	1,636	1,798	7.8%
Pipes and Allied	78,000	79,611	81,462	83,519	85,797	88,310	91,074	2.7%
Meters	3,632	3,700	4,275	5,370	6,936	9,334	11,851	26.2%
Meter Data Management	728	846	1,037	1,253	1,550	2,001	2,515	24.4%
Automation and Control	8,974	9,193	9,437	9,705	10,001	10,326	10,682	3.0%
Pumps	7,977	8,133	8,315	8,518	8,743	8,991	9,311	2.7%

Other significant verticals include Pipes and Allied materials, Automation and Control equipment and Design and Engineering services whilst the Meter Data Management and, to a lesser extent, Leak Management Services segments are also emerging rapidly.

This is broadly reflective of the overall direction of travel with conventional technologies being replaced or at least complemented by emerging alternatives

Water utilities across the globe are under growing pressure to improve the resilience of their assets to events that are occurring due to climate change while policy makers are ensuring long-term sustainability through extensive replacement and rehabilitation plans to modernise water infrastructure and short-to-medium term measures to ensure the continuity of essential services by focussing on efficiency improvements of the existing infrastructure.

Digital transformation has become the core solution for utilities to meet short-, medium-, and long-term sustainability goals with emerging technologies having the potential to jump-start efficiency improvements, both now and in the future.

Over the last 5 years, there has been significant growth in the adoption of smart IoT based sensors and meters across the globe. The COVID-19 pandemic has given fresh impetus to the roll-out of software, Artificial Intelligence (AI) and Machine Learning (ML) based data analytics solutions while Digital Twins (DT) are more recent major disruptors that have heralded a significant leap in the overall digital transformation of water utilities.

This report explores the way in utilities are leveraging innovation across three key areas and to respond to the challenges and embrace the opportunities that they face in developing and managing water and wastewater infrastructure

Source: Frost & Sullivan

PRINCIPAL ABBREVIATIONS

AI	*Artificial Intelligence*
AMI	*Automated Metering Infrastructure*
AMR	*Automated Meter Reading*
APAC	*Asia Pacific*
AVF	*Automatic Variable Filtration*
AWG	*Atmospheric Water Generation*
B	*Billion*
CA	*Canada*
CapEx	*Capital Expenditure*
CCRO	*Closed Circuit Reverse Osmosis*
CCTV	*Closed-Circuit Television*
DK	*Denmark*
DT	*Digital Twin*
EU	*European Union*
FELL	*Focused Electrode Leak Location*
IIoT	*Industrial Internet of Things*
IL	*Israel*
IoT	*Internet of Things*
LIDAR	*Light Detection and Ranging*
LMaaS	*Leak Management as a Service*
LPRO	*Low Pressure Reverse Osmosis*
LPWAN	*Low Power Wide Area Network*
M	*Million*
M3	*Square meter*
MABR	*Membrane Aerated Bioreactor*
MBBR	*Moving Bed Bioreactor*
MBR	*Membrane Bioreactor*
MDM	*Meter Data Management*
ML	*Machine Learning*
NL	*Netherlands*
NRW	*Non Revenue Water*
O&M	*Operation & Maintenance*
OEM	*Original Equipment Manufacturer*
OpEx	*Operating Expenditure*
PFOA	*Perfluorooctanoic Acid*
PFOS	*Perfluorooctane Sulfonate*
PV	*Photovoltaic*
R&D	*Research & Development*
RBC	*Rotating Biological Contactor*
RLB	*Rural Local Body*
RNG	*Renewable Natural Gas*
RO	*Reverse Osmosis*
SAF	*Submerged Aerated Filter*

SBR	*Sequential Batch Reactor*
SCADA	*Supervisory Control and Data Acquisition*
SDG	*Sustainable Development Goal*
TaaS	*Technology as a Service*
THP	*Thermal Hydrolysis Process*
TN	*Nitrogen*
TP	*Phosphorous*
TSS	*Total Suspended Solid*
UAV	*Unmanned Aerial Vehicle*
UK	*United Kingdom*
ULB	*Urban Local Body*
US	*United States*
UV	*Ultraviolet*

Source: Frost & Sullivan

ABOUT INTESA SANPAOLO INNOVATION CENTER:

Intesa Sanpaolo Innovation Center is the company of Intesa Sanpaolo Group dedicated to innovation: it explores and learns new business and research models and acts as a stimulus and engine for the new economy in Italy. The company invests in applied research projects and high potential start-ups, to foster the competitiveness of the Group and its customers and accelerate the development of the circular economy in Italy.

Based in the Turin skyscraper designed by Renzo Piano, with its national and international network of hubs and laboratories, the Innovation Center is an enabler of relations with other stakeholders of the innovation ecosystem - such as tech companies, start-ups, incubators, research centres and universities - and a promoter of new forms of entrepreneurship in accessing venture capital. Intesa Sanpaolo Innovation Center focuses mainly on circular economy, development of the most promising start-ups, venture capital investments of the management company Neva SGR and applied research

For further detail on Intesa Sanpaolo Innovation Center products and services, please contact

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