SAND TECHNOLOGIES

Water AI

8 Ways AI in Water Management Creates a Better Future

Introduction

Climate change and population growth place increasing burdens on water supplies and infrastructure all over the world. Although millions of people are mindful of water-related challenges, the water cycle remains a mystery, even to the people charged with understanding how water moves on, above and below the surface.

Governments and NGOs have immense amounts of data about water. By using artificial intelligence (AI) in water management practices, that data can be used to help preserve water supplies, reduce contaminants, ensure wiser and more-equitable distribution, improve water quality and better protect people from floods and droughts.

> AI is revolutionizing water management by optimizing water utilization and creating a more-resilient water infrastructure.

Here are eight ways governments and NGOs are using AI to shape the future of water management and drive sustainability.

1 Detecting Potential Water Supply Failures Before they Happen

Utilities typically assume that specific components in their water-management equipment and infrastructure must be replaced or repaired within set periods of time. Following this maintenance approach can cause a component to be upgraded or replaced before required or push it past its service life and cause a catastrophic failure.

Digital twins of water infrastructure combine AI, Internet of Things (IoT), edge computing, cloud computing and other technologies to enable predictive maintenance. These virtual models of actual water systems let leaders compare data gathered in real time to historical data from thousands of similar systems. With this information at hand, utilities can predict when and how specific systems will behave.

Utilities that use predictive approaches can maximize system uptimes and leverage the entire service life of each component. Applying AI algorithms to data enables them to repair or replace components before they fail, but not so early as to waste time or resources unnecessarily. Leaders can also plan for and schedule work for times when demand is low, reducing outages and the impact on daily users.

2 Enhancing Water Distribution Networks

Because AI can detect trends hidden within vast amounts of data, it can help utility leaders understand and predict water demand to optimize water supply throughout the course of a day. This helps utilities reduce wasted water and meet water demand effectively.

To maintain a constant, consistent supply of water even when repairs are underway, machine learning (ML) algorithms can analyze data in real time, then adjust water flow and pressure to minimize losses and enhance network performance.

When AI models are trained to also consider weather, seasonality and other broad factors, they can help utility and other government leaders identify and respond to larger and more critical patterns in water use. This then guides their decision-making processes about infrastructure, investments and workforces to support future needs.

AI-enabled platforms and solutions can also help optimize water distribution networks by identifying pressure-related problems like leaks and then coordinating a response. When leaks are detected, they can pinpoint the location and dispatch repair crews. Artificial intelligence water monitoring systems can then view progress and advise management about when work will be complete so they can inform the public.

3 Elevating Water Quality Monitoring

AI lets water managers leverage data to monitor quality, track usage, and identify potential infrastructure problems in water systems. Ideally, managers can leverage the insight they gain to detect and remediate issues before they become crises.

Utilities typically use IoT and similar technologies to gather the data required for this type of analysis. This requires teams of data scientists and others who can use technology to extract the value that lies within their data. That level of tech talent can be hard to find, so many utilities prefer to upskill existing workers. Depending on the training program, this also equips employees to support initiatives to improve the utility's capacities in edge computing, cloud computing and other technologies.

Once the tech stack and team have been assembled, AI-enabled platforms let utilities monitor pH levels, turbidity, contaminants and other quality parameters in real time. Utilities AI can also analyze sensor data to detect anomalies, trigger alerts and guide corrective actions to maintain safe and clean water supplies.

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4 More Accurate Mitigation and Prediction of Flooding

Floods are a normal part of the water cycle. In some places, like the deltas of the Nile and Mekong rivers, floods famously occur on a predictable schedule. In less accommodating areas, water managers must juggle data on weather, river levels, climate change and historical flood patterns to predict and mitigate the effects of floods.

This work was once done on paper. Now officials can leverage digital twins, IoT, generative AI and other combinations of AI-enabled water management technologies to predict and mitigate the risks associated with floods. Over the long term, insights from these technologies can guide government leaders as they invest in critical infrastructure to protect their populations from floods, plan for disaster recovery, test preventive measures and better understand the risks associated with floods.

During a flood event, these technologies can give utility leaders critical information and help responders prevent loss of life. After the water recedes, they can also help governments restore water quality and repair damage to more quickly improve the quality of life for citizens.

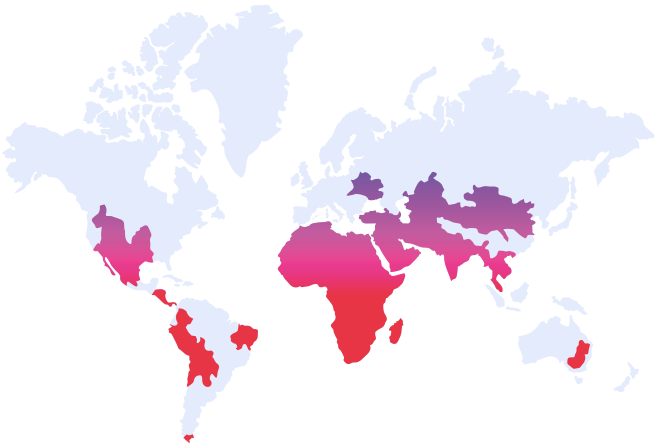
5 Energy Efficiency in Treatment of Wastewater

For many governments, plants that process drinking water and wastewater are among the largest consumers of energy, accounting for 30 to 40 percent of total energy used. Making these plants more energy efficient can reduce these costs by 15 to 30 percent, with payback periods of only a few months to a few years.

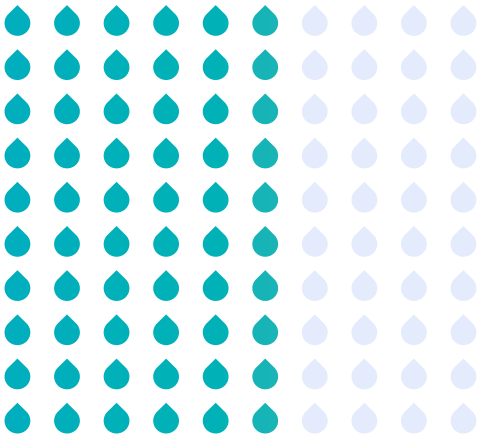
AI-driven optimization algorithms can help leaders optimize treatment processes, adjust aeration rates and minimize energy-intensive operations to reduce energy consumption. One tool for leveraging these algorithms is the digital twin, which lets utility leaders develop hypotheses about where to save energy and run near-instant tests of their hypotheses using different variables. There are several digital twins misconceptions, but when coupled with Gen AI, more-advanced digital twins can develop and test their own hypotheses, then offer suggestions as to how managers can optimize the systems they represent.

The true value of a digital twin lies in how users can access vast amounts of information and insights. In manufacturing lines, treatment plants and other process systems, they merge operational data to accurately depict the system's current state and operation, allowing detailed analysis and insights into system performance and potential enhancements.

6 Stronger Climate Resilience and Adaptation



Approximately **40%** of the global population currently experience water shortages



By 2030, global freshwater demand is projected to outpace supply by **40%**

The world's growing population increases the need for access to clean water, but the Earth's changing climate increases the difficulty of providing it.

AI water management models leveraging data gathered through IoT data monetization can analyze data once considered too disparate to compare, allowing government leaders to assess climate risks better and develop adaptive strategies for managing water supplies.

IoT applications and digital twins combine and analyze data from sensors embedded across the landscape, while AI helps to create virtual replicas that mirror the response to various stimuli in real time. Users can see how the twin performs normally, then test different scenarios to understand how the system might respond. Digital twins can reveal how systems interoperate, suggest courses of action and offer suggestions about how to improve the original.

These platforms and solutions let government planners anticipate and prepare to mitigate the effects of increasingly severe weather events. They can also identify potential vulnerabilities so decision makers can engage in more proactive planning, preparation and resilience-building measures.

7 More Accurate Drought Prediction and Water Allocation

Across history, drought has killed entire civilizations and forced humans to abandon cities, fight wars and migrate to new lands. It's an entirely normal part of the water cycle, but it can be devastating to those living in it.

Like many aspects of water management, predicting drought can be difficult, and water managers must juggle vastly disparate forms of data on weather, water tables, soil moisture, vegetation health, drought patterns and other historical climate information.

This extensive data analysis is tailor-made for AI in general and Gen AI in particular. Now governments can leverage digital twins, IoT and other combinations of AI-enabled technologies to predict and mitigate drought risk.

We may never be able to fully avoid drought, but AI-enabled platforms can help government leaders adapt to drought in their regions, then find and promote new ways of using water more efficiently so dwindling supplies can serve more people.

> Misunderstanding and misusing water can have profound effects on human life. Fortunately, with the rise of utilities AI solutions for water, we can transform how we preserve and manage our most precious resource.

8 Smart Irrigation Systems

All crops need water, but not every part of a field needs to be watered in the same way, at the same time or with the same amount of water.

For thousands of years, farmers watered their fields intuitively, but the scale of modern agriculture makes that impossible. Fortunately, the field of AI water management uses IoT irrigation systems to combine information about crop species, weather forecasts, soil moisture, water tables, surrounding vegetation health, sunlight patterns and more to optimize water usage on industrial-scale farms. These systems then deliver the precise amount of water when and where the plants need it, reducing waste and maximizing crop yields.

Achieving this level of precision requires people who know how to combine the right tech stack with the right sensors, applications, platforms and data. That talent can be hard to find, so it makes sense to upskill employees who already understand your business to meet these challenges. They'll have the chance to assemble the tools you need while working on projects that add directly to the bottom line. Our Sand Academy offers the training necessary to make this happen and directly influence your artificial intelligence water management.

Harness the Power of AI in Water Management

Misunderstanding and misusing water can have profound effects on human life. Fortunately, with the rise of utilities AI solutions for water, we can transform how we preserve and manage our most precious resource.

The key to using these technologies lies not in focusing on any single platform or tool, but in understanding each building block and then choosing the tools that best meet the task at hand.

Sand Technologies' teams of experts have particular expertise in the water sector and serve clients around the world through training as well as direct support.

Contact us today to see how your utility can capitalize on an AI-powered water management system.

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