

Droughts, Pandemics, Recessions, And More: How Machine Learning Can Help Water Utilities Prepare

As populations grow, [forecasting helps water utilities](#) prepare for changes in demand and usage patterns. For example, the addition of a new housing development in a district could mean a sharp increase in water usage during mornings and evenings as people prepare for work and come home to make dinner. Growth in a commercial sector may mean an uptick in usage during work hours, reflecting process and domestic water usage.

Most types of forecasts are based on assumptions and habits that are easy to understand and that simply need to be estimated for the sake of near-term and long-term planning. However, there are occurrences that can be difficult to both predict and prepare for, even as they are happening. Extreme situations, such as the COVID-19 pandemic and multi-year droughts experienced in many

parts of the U.S., present unprecedented challenges to water utilities.

While no one can predict if or when another pandemic will strike, water utilities can help themselves prepare by investing in machine learning analytics software. Machine learning incorporates data from a variety of resources, including weather, economic data, and more, to build models that help utilities make the necessary adjustments to their processes, budgets, and potential capital expenditure (CAPEX) spending.

Here are some examples of situations that can cause extreme changes in water usage patterns, and how [machine learning can help water utilities](#) adapt.

Droughts. In many parts of the U.S., drought has become a fact of life. Water scarcity is one of the greatest challenges

water utilities are facing today. The severity of droughts waxes and wanes from year to year depending on a variety of environmental factors, so having a reliable multi-year forecast can be critical for long-term decision-making. For example, such forecasts can help make the case for investing in water reclamation or desalination technology. They can also be critical in determining whether to tighten or loosen usage restrictions, if an increase in rates is necessary to maintain the current operating budget, and more. This may require working with climatologists, local universities, or environmental organizations to identify data sources that can help machine learning software make the best possible forecasts.

Pandemics and Outbreaks. In many parts of the U.S., COVID changed water consumption patterns in dramatic ways.

For example, as people lost jobs or began working remotely, they woke up later, which shifted peak morning usage times later than utilities were used to. Likewise, commercial centers saw steep declines in demand as office space and retail outlets went vacant during lockdowns.

It's unclear if machine learning could predict a future pandemic. However, with COVID seemingly becoming a normal part of daily life, it may be possible to forecast potential outbreaks that can lead to increased home isolation and remote work, and therefore more residential usage. Likewise, a rise in COVID infections can also mean a rise in activity in hospitals and medical centers and/or declines in commercial and retail sectors of the distribution system. COVID case numbers from the CDC and state health departments, along with data from wastewater analysis, can help machine learning software determine trends and make forecasts.

Recessions. In May 2022, as inflation ramped up in the U.S., many economists began questioning whether a recession was on the horizon. Economic slowdowns of any kind can result in businesses closing and people losing jobs. Data from the 2008-2009 recession showed that as homes and retail space went vacant, [water usage declined](#) in many regions. In many cases, utilities had to raise rates to compensate for lost revenue. Economic data can be incorporated into machine learning software to help water utilities understand if, and when, a recession might hit and brace themselves for potential lost revenue. If a recession is in the forecast, water utilities may need to budget for a decrease in revenue, which in turn could delay or scale down future CAPEX investment plans.

Economic Booms. In contrast to recessions, long periods of strong economic growth can lead to a number of changes in water usage that utilities may need to prepare for. This includes

increases in demand as population and housing growth hits a region. New businesses moving into an area can also change demand patterns. Businesses such as food processing or automotive manufacturing consume a tremendous amount of water. Regardless, a forecast of economic growth may require long-term plans to expand the distribution system and prepare treatment systems for an increase in millions of gallons per day (MGD). In addition, a forecast of increased revenue may allow for additional hiring and/or CAPEX investments.

The future cannot be fully known. However, water utilities that incorporate the right data sources into machine learning analytics can help produce the most accurate forecasts and prepare for the most probable changes and trends in water usage. Armed with this knowledge, water utilities can prepare budgets and allocate both financial and labor resources toward projects that account for whatever challenges the future might bring. ■