

Stadtwerke Trier

Climate-neutral drinking-water supply: AI-aided energy optimization for daily energy balancing

Generating electricity to produce drinking water is an intensive resource-consuming process. However, demand for electricity can be covered by increased in-house renewable power generation in conjunction with a smart, advanced control system based on artificial intelligence.

The challenge

Stadtwerke Trier (SWT) operates a drinking water network in Germany's oldest city with a capacity of around 10-11 million m³ of water per year.

After the successful deployment of artificial intelligence in its main sewage treatment plant, the Trier utility decided to harness this new technology to optimize the energy efficiency of its drinking water network to obtain additional savings.

The water supply facilities, consisting of a waterworks, pumping stations, elevated tanks and pressure reduction systems, consume an average of 1.5 million kWh per year.

SWT has added a pump turbine and several photovoltaic systems to generate the annual electricity required for its own water supply.

Although the utility generated more electricity than required, it was often not possible to use the self-generated energy directly. As a result, SWT fed around 500,000 kWh into the grid every year and later withdrew the same amount from the grid again.

SWT has continued its cooperation with Xylem and has set up a digital assistance system for an optimized water network operation in order to use as much of the self-generated energy as possible.

The solution

The goal of any drinking water supply system is to deliver the right amount of high-quality drinking water at the right time and at the right pressure. This requires energy. To make the most of renewable energy sources, water utilities need to shift the energy balance and consumption to times when these energies are available. However, this depends on having accurate forecasts of consumer demand for the following 24 hours.



Program highlights:

- 95% direct use of self-generated green electricity and savings of up to 100,000 euros/year
- An "energy pool" enables local renewable energy sources to directly power individual pumping stations.
- AI-powered system forecasts water demand every 15 minutes, enabling real-time adjustments to be made to pumping operations and water tank filling.

This is where the [Xylem Vue](#) water network optimization system comes in. It leverages artificial intelligence, specifically artificial neural networks, to forecast water demand in the different areas over the next 24 hours at 15-minute intervals. The system then uses these neural network predictions to adjust pump operations and water tanks filling schedules, aligning them as much as possible with times when on-site power generation is available.

A number of constraints are maintained in the process, such as reducing hydraulic shocks and minimizing pump wear. This approach not only maximizes energy efficiency and reduces costs but also synchronizes consumption with energy generation throughout the day.

The Xylem Vue optimization solution is the hub of this system, organizing the entire data flow between the physical process, the optimizer, the neural networks, and the human-machine interface.

The results

An “energy pool” made up of local generation facilities now supplies power directly to individual pumping stations in the drinking water system. This setup enables every kilowatt-hour of renewable electricity to be used as efficiently as possible on-site. While ensuring a reliable drinking water supply remains the top priority, and occasional reliance on the power grid can't be entirely eliminated, artificial intelligence and battery storage help maximize renewable energy use. At Stadtwerke Trier (SWT), these technologies enable the utility to use 90% of the green electricity it generates directly within its operations.

At Stadtwerke Trier (SWT), these technologies enable the utility to use 90% of the green electricity it generates directly in its operations. Expanding its battery storage capacity will increase self-consumption to 95%. This corresponds to an improvement of over 500,000 kWh of directly self-used energy. This makes Stadtwerke Trier less dependent on grid and market energy costs and has fixed the cost share for the energy used directly. In 2023, Stadtwerke Trier was able to save around €100,000 in energy costs via this system.

