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Let's Solve Water

Saves energy, saves chemicals, saves costs

OPTIMIZATION OF THE WASTEWATER TREATMENT PLANT PROCESS WITH THE HELP OF ARTIFICIAL INTELLIGENCE

With climate change increasing the frequency of severe weather events and energy prices continuing to rise, it is more important than ever for cities and municipalities to leverage wastewater treatment plant data to optimise operational efficiency and sustainability.

CLIENT:
Stadtwerke Trier, main sewage treatment plant, wastewater treatment plant

SYSTEM:
Xylem Vue powered by Go Aigua's Plant Real-Time Decision Support application

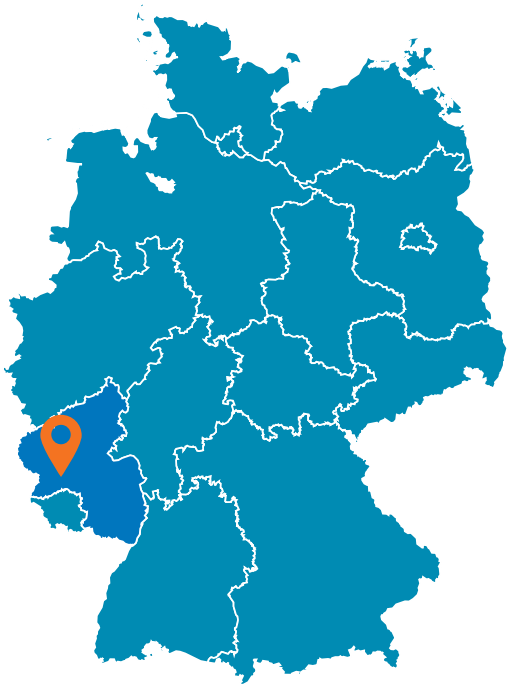
RESULT:
Energy consumption for pressurized ventilation reduced by >20 %. This corresponds to the consumption of approx. 50 private four-person households.

1 The challenge: Sustainability through intelligent control

With the main wastewater treatment plant in Trier, Stadtwerke Trier operates a wastewater treatment plant with a capacity of 170,000 population equivalents (p.e.).

For a long time, the main wastewater treatment plant in Trier was one of the largest energy consumers in the Group. Due to non-optimized control, hundreds of thousands of kilowatt hours of valuable energy were drawn from the public grid. Although investments in energy-efficient technology significantly reduced this share, intelligent control was still needed to achieve the greatest possible efficiency from the existing technology and even make the plant operation self-sufficient in terms of energy.

Germany's oldest city was therefore looking for an innovative system that would simultaneously optimize the energy requirements in the biology, increase operational safety and improve the control of chemical use. The optimization measure should significantly reduce operating costs and close the energy cycle within the main wastewater treatment plant. In this way, energy consumption and energy production are to be coordinated so that no further energy must be purchased externally. With this ambitious goal, the control system also had to ensure that the monitoring values of the wastewater treatment plant effluent are always reliably maintained.



xylem vue
powered by go-aigua

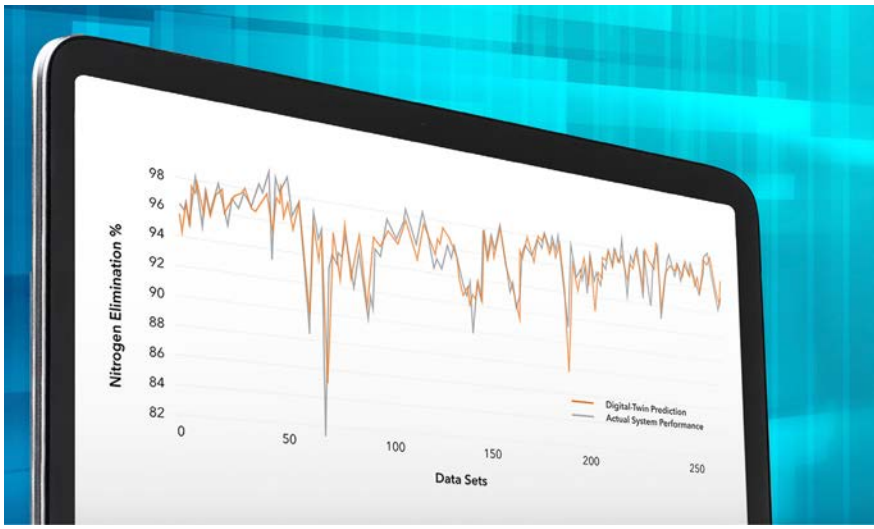
2 The Solution: Digital twin optimizes wastewater treatment plant processes

Aquatune GmbH - which has since been aquired by Xylem - was entrusted with this project. As a first step, a real-time assistance system for wastewater treatment was implemented at the main wastewater treatment plant in Trier. The aim was to support the operator in complying with the monitoring values and to reduce the energy required for pressuized aeration of the biological treatment stage. On the basis of model-based forecasts, the optimization system makes suggestions for the selection of control variables for the wastewater path that allow reliable compliance with the effluent values while consuming a minimum of energy. Previously, only conventional controllers were used for automatic control of the processes under consideration.

Together with Xylem, Stadtwerke Trier used the Plant Real-Time Decision Support application. The technology is based on artificial neural networks, which are used to create data-driven models for the degradation of carbon, nitrogen and phosphorus compounds. The system receives all the parameters and data required for this in real time from the existing SCADA system at the wastewater treatment plant. The resulting digital twin allows hundreds of scenarios to be simulated within seconds, so that the required aeration intensity for the biological degradation of carbon and nitrogen compounds, as well as the chemical requirement for phosphorus precipitation, are optimally controlled depending on the current and expected load of the wastewater treatment plant.

After completion of the model training and trial operation, the system was finally put into operation in November 2017 and from then on determines the optimal setpoints for the operation of the pressure aeration of the six biological treatment basins connected in parallel.

In the second step, a prediction model was created using Plant Real-Time Decision Support to predict boththe energy consumption and its production at the treatment plant. Depending on this prediction, the gas production can be intelligently controlled.



3 Results: Optimized operation prevents peak consumption

At the beginning of 2018, the optimization results of the first phase were compared with the data from the previous operation of the main wastewater treatment plant. From this, an important parameter for measuring success was derived: the specific energy used to eliminate one kilogram of freight. This parameter highlights fluctuations in plant operation that are avoidable.

Thanks to the optimized operation of the plant, a significant reduction in these fluctuations and thus in the situational peak energy consumption has been achieved. Since the implementation of the Plant Real-Time Decision Support application, the Trier Main Sewage Treatment Plant has been able to reduce the energy consumption of the aeration system by >20 %. This corresponds to a saving of 4000 kWh/year. Of course, all monitoring values of the wastewater treatment plant effluent are also safely and continuously complied with.

Xylem services

- Creation of optimization models for the wastewater treatment plant using Xylem Vue powered by Go Aigua's Plant Real-Time Decision Support application to reduce required energy and chemical consumption while maintaining the required effluent values.
- Creation of forecasts for energy consumption and production
- Integration of Plant Real-Time Decision Support into the existing process control system.
- Ongoing maintenance contract for continuous improvement of the system and its forecast

Success

- >20 % less energy consumption for ventilation
- Optimized plant operation led to a drastic reduction in peak energy consumption
- Savings of approx. 4000 kWh per year, equivalent to about 50 private four-person households
- Forecasting models help to control gas production depending on consumption

Conclusion: A calculation that works

The implementation of the Plant Real-Time Decision Support application pays off. The wastewater treatment plant has achieved a >20 % reduction in energy consumption for pressurized aeration. This corresponds to the consumption of approx. 50 private four-person households.

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