Case study
Cuxhaven, Germany

EWE WASSER GmbH

Reducing aeration energy usage by 30%, minimizing operational expenses, and reducing compliance risk by applying a decision intelligence approach

EWE WASSER GmbH (EWE) is one of northwest Germany's largest wastewater disposal companies and is responsible for the transportation and purification of wastewater through 23 modern wastewater purification plants. In Cuxhaven, the company operates a large municipal wastewater treatment plant with the capacity to purify wastewater for the nearly 400,000 residents of this seaside town.

The challenge

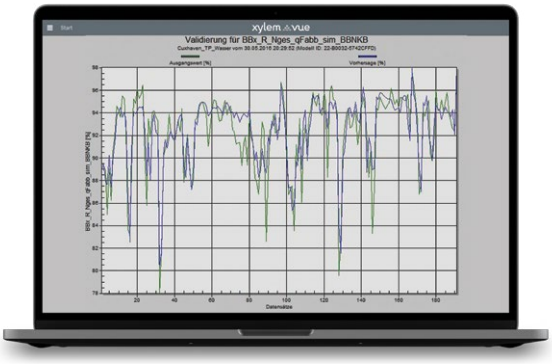
In Cuxhaven, as in most cities, the pumping and treatment processes are the largest consumers of energy in the water cycle. And typically, aeration accounts for more than 50 percent of wastewater treatment energy consumption. This is due to energy intensive technologies such as mechanical aerators, blowers and diffusers.

As a proactive wastewater treatment operator, EWE wanted a system to optimize the energy consumption associated with aeration and improve safety with better system control of chemical usage. While EWE was hoping to reduce operating costs through optimization, the control system implemented also needed to ensure effluent concentrations were within legal limits.

The solution

In early 2017, EWE partnered with Xylem to apply its decision intelligence approach to the Cuxhaven Wastewater Treatment Plant. The objective was to better understand, control and increase the efficiency of Cuxhaven's aeration processes by modeling performance in a computer environment to optimize plant operation, reducing energy and chemical consumption while increasing effluent water quality. Previously Cuxhaven operated plant system sensors with manual controls and lacked an optimization strategy.

EWE partnered with Xylem to develop and deploy what would become Xylem Vue's Plant Real-Time Decision Support application which uses neural network powered models of the carbon, nitrogen and phosphorous elimination processes based on data from the plant's existing SCADA system. The application provided a real-time digital twin of the entire plant so that each process receives optimal aeration and chemical inputs to match the needed chemical and biological oxygen demand.



Xylem's modelling maps target conditions vs. actual conditions within treatment processes.

Program highlights:

- 30% reduction in aeration energy usage, corresponding to 1.2 million kWh annually
- Optimized plant operation resulted in a drastic reduction of situational peak energy consumption
- Virtual sensors helped the plant operator accurately estimate influent concentration to efficiently operate the aeration process

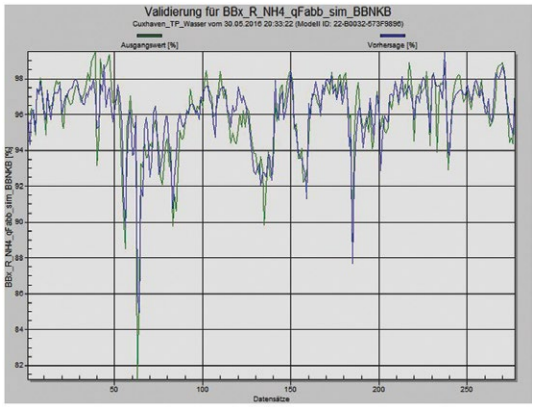
Since EWE had no online sensors available to take real-time measurements of influent concentrations, several “virtual sensors” were developed to calculate an estimate of the incoming carbon, nitrogen and phosphorous loads of the influent. In the absence of traditional sensor data, these virtual sensors helped EWE accurately estimate influent concentration and operate the aeration process in the most efficient way while meeting regulatory requirements.

In August of 2017, after several months of manual plant operation, Plant Real-Time Decision Support was activated to predict and calculate the best set points to operate the aerators of five parallel biological treatment tanks.

The results

At the end of 2017, optimization results from this first phase were compared against the previous data from the manual operation of the Cuxhaven plant, which provided data for the model. A critical parameter for measuring success was the specific energy required to eliminate one kilogram of load, which is not usually calculated or controlled, and which can cause unnecessary plant fluctuations. **The optimized operation of the plant resulted in a drastic reduction in these fluctuation and prevented situational peak energy consumption**.

Since implementing Plant Real-Time Decision Support, the Cuxhaven treatment plant has shown a **30% reduction in aeration energy usage, corresponding to 1.2 million kWh annually** — enough energy to power 321 homes using 3,500 kWh per year. In addition, all plant effluent concentrations continue to maintain regulatory compliance.



After implementing an optimization strategy, actual conditions closely correlate with the optimal set-points for wastewater treatment.

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