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GOTHA WATER TREATMENT PLANT (82,000 PE)

Job Report: Energy savings through more efficient operation of the biological treatment

General Information

The wastewater treatment plant in the city of Gotha, located in the county of the same name, has been built in 1993 and treats the wastewater of the city of Gotha as well as of surrounding villages. At the time of its construction it was one of the most modern of its kind. The treatment plant is designed for 150,000 PE and currently loaded with a COD equivalent of approx. 82,000 PE. The biological treatment had been realised via two looped aeration tanks with a total volume of 23,000 m³, a downstream circular tank for phosphate elimination as well as four secondary sedimentation tanks.



Main Features

Customer:

Wasser- und Abwasserzweckverband Gotha und Landkreisgemeinden

Construction size / Current load:

150,000 PE / 82,000 PE

Construction time:

2013 / 2014

Scope:

Installation of 8 submerged stirrers and 8 guide baffles for the surface aerators, installation of an Aqualogic® control system and according sensors

Initial Situation

Before the optimization works, nitrification and denitrification took place simultaneously in the aeration tanks, process-controlled by NH_4 und NO_3 . A maximum total of 16 Mammoth Rotors with each 45 KW power load had been operated for the aeration. After 20 years, the operation mode had become outdated and the energy consumption was comparable high. In addition, the oxygen distribution inside the aeration tanks has been less than ideal.

Improvements

Together with the operator, a concept has been prepared in 2013 to reduce the energy consumption of the plant and to improve the treatment performance. Therefore, 8 submerged stirrers as well as 8 guide baffles for the surface aerators had been installed as a first measure. Both, stirrers and guide baffles, had been installed at the beginning of the straight channels in the looped tanks, right downstream after the first surface aerator. The guide baffles guide the oxygen contained in the activated sludge deeper into the tanks and at the same time improve the efficiency of the new stirrers. The stirrers are only operated during the denitrification phase, to achieve an optimal mixing of the activated sludge. This allows switching off the surface aerators during the denitrification phase.

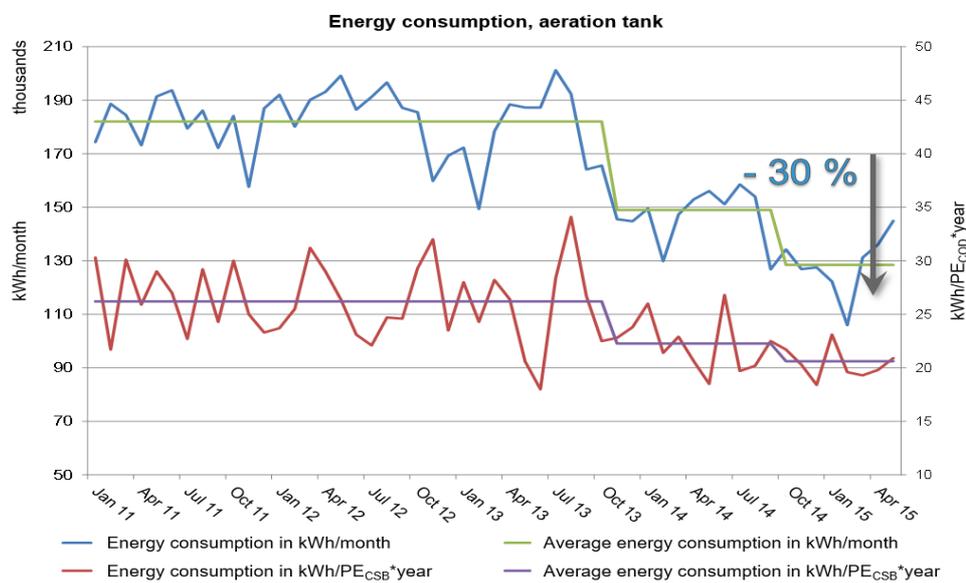
The improvements for the first aeration tank took place in November 2013. The measures for the second aeration tank had been completed in April 2014. The complete process control by Aqualogic® had been commissioned in September 2014.

To achieve an optimal intermittent operation between nitrification and denitrification, the Fuzzy Logic based control system Aqualogic® has been installed. The control of oxygen injection is based on measurements of Oxygen, Ammonium, Nitrate and temperature. In addition, Aqualogic® controls return sludge, surplus sludge based on temperature (sludge age regulation), process water dosing based on Ammonium and precipitant dosing based on Orthophosphate. The existing measurement technology had been extended with the required sensors.

Results

During the concept stage for the optimization of the biological treatment, the projected energy savings were approx. 72,000 €/year. Considering a capital investment of 420,000 €, the amortization time would have been approx. 6 years.

A recent analysis revealed an actual energy conservation of 30% (see diagram), which exceeded the expectations. Based on the actual energy costs of 19.8 ct/kWh and a monthly energy conservation of average 53,500 kWh, the actual savings amount to 127,300 € per year, reducing the amortization time to approx. 3.3 years. The total energy consumption of the biological stage in relation to the load has improved from 26.2 to 20.6 kWh/(PECOD*year). The following diagram demonstrates the savings during the individual optimization stages. The average outlet parameters in terms of overall nitrogen concentration are far below 5 mg/l.



Energy savings by optimization with the Aqualogic® controller system on the sewage treatment plant Gotha

Aqseptence Group
Water Treatment Systems

Kettelerstraße 5-11
97222 Rimpar | Germany
Phone +49 9365 808260
info.aqualogic@aqseptence.com

www.aqualogic.de