Sewage treatment plants hold a special position among municipal facilities. On the one hand, they are large consumers of power and will typically rank even above schools and hospitals. On the other hand, most sewage plants can also generate power and heat. Anaerobic sludge decomposition produces biogas, which — after purification — can be used for power or heat generation with gas motors or cogeneration units. Treating wastewater, however, also requires a great deal of energy, and a different type of energy as well, especially large quantities of compressed air that is produced by rotary compressors or turbocompressors, a process that is a major consumer of electrical power. The process also requires heat energy, for example, to control the temperature in the decomposition and fermentation processes. So energy optimization of a sewage plant includes both aspects: reducing energy consumption and increasing energy efficiency.

Basic and detail analyses are the keys to success

This was also the aim at the sewage treatment plant in Geldersheim, where more than four million cubic meters of wastewater are purified annually. As manager Jürgen Seufert explains, in addition to upgrading the Simatic controllers, the replacement of the existing process control system was planned. In order to successfully implement these projects, Seufert consulted specialists — both the Nuremberg branch of the H2Office engineering firm, which specializes in wastewater treatment plant optimization, and the experts at the Siemens office in Würzburg — to help boost the facility’s efficiency.

The optimization of energy use in wastewater treatment usually starts with an energy audit. During the basic analysis, a basic classification of the plant is performed and potential savings are identified. The de-
Replacement of instrumentation and controls

In Geldersheim, it quickly became clear that in addition to process engineering expertise, the use of modern technology was also required in order to achieve the desired increase in efficiency. The Simatic WinCC Supervisory Control and Data Acquisition (SCADA) system, initially installed to monitor the exterior buildings, and the Acron logging tool established the basis for the detailed analysis. Upgrading the drives with variable-speed Sinamics frequency converters also played a role in ensuring energy-efficient plant operation. The integration into the SCADA system and the visualization of energy data were easily accomplished. The automatic motor speed control allows for the immediate adjustment of power consumption in partial-load operation. Virtually no energy is wasted, unlike with mechanical systems.

Multifunctional measuring devices from the Sentron PAC series round out the technical equipment of the wastewater treatment plant. With these devices, measured variables such as voltage, current, and power supply values can be recorded precisely. These data are then also made available to the higher-level control system. Visualization of the newly captured operating data in Simatic WinCC required an extension of the operating protocols. The experts from H2Office and Siemens worked together to achieve this. The engineering firm specified which energy data were to be incorporated into the calculation of ratios and how the values recorded were to be evaluated and displayed. The Siemens specialists then took on the appropriate programming and visualization in the control system.

As part of the detailed analysis, the experts from H2Office set up dynamic energy models for individual areas of the Geldersheim sewage treatment plant. Secure remote access to the protocols then allowed the simulation of pumping stations with all the actual operating parameters. This enabled other operating modes and control behaviors, as well as their effects on power consumption, to be examined without affecting actual operation.

Energy generation was also to be increased in addition to energy savings. According to the general analysis, it made sense to treat other organic waste as well. In the detailed analysis, the result was confirmed by measurements indicating that gas production could be increased by about 30 percent through the co-fermentation of the grease separator contents, enabling savings of more than 20,000 euros per year.

Positive balance

“We are proud of the optimization measures we have implemented,” says plant manager Seufert, “and the next steps have already been identified.” Among other things, the team plans to introduce an energy management system for the reduction of peak loads. “Both the theoretical and technical bases are finally available,” says Seufert. With Simatic WinCC and the know-how of the two teams of experts, the operators are perfectly prepared to implement further energy optimization measures in Geldersheim.

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We are proud of the optimization measures we have implemented, and the next steps have already been identified. Among other things, we plan to introduce an energy management system for the reduction of peak loads.”

Jürgen Seufert, Plant Manager, Geldersheim Sewage Treatment Plant