



Your belt in good hands:

TEAtherm combines biomass CHP with pioneering sewage sludge drying

In Dinkelsbühl, Bavaria, five entrepreneurs developed a concept that combines local added value and sustainability in an exemplary way. Nature, citizens, and each of the founders' operations benefit equally from the jointly founded company, TEAtherm GmbH. It all started with an insolvent combined heat and power station (CHP) run on biomass with a thermal sewage sludge recycling plant: The five shareholders with synergistic skills in the areas of waste management, recycling, and electricity generation purchased it in equal shares. The newly founded TEAtherm GmbH began operations in April 2013 and now produces 64,000 megawatt hours of green energy, which supplies around one third of households in the district. The economic highlight of the concept, however, is the use of the heat generated as a by-product of electricity generation: The largest consumer is one of the shareholders, a state-of-the-art plant nursery, which uses it to heat its ten-hectare greenhouse adjacent to the power station. In addition, some of the heat is fed into the district heating network of Dinkelsbühl municipal services to supply firms in the Waldeck industrial zone, houses, and a hotel complex. A further portion of the heat is used in the company's own belt dryer for drying municipal sewage sludge from around 40 different sewage plants. A major contributor to the great efficiency of the sewage sludge drying plant is the 5099 PPC process belt from the GKD Group (GKD – Gebr. Kufferath AG) used in the dryer. It was replaced for the first time after a service life of seven years and the TEAtherm team was trained in fitting the belt.



With an output power of eight megawatts, the power station generates electricity for 8,200 hours per year – which corresponds to an availability of 93 percent. The only fuel used is wood from rural conservation – i.e. wood which is not intended for use in the construction trade or for furniture. This material, which is generated during clearing in the maintenance of highways, electrical power lines, or railroad lines, for example, is subject to strict quality management with certified proof of origin at TEAtherm. Quality control of every single truckload of prepared fuel takes place upon delivery: The fuel shipments are sorted into quality classes and stored in separate fractions based on visual criteria such as grain size distribution and the amount of needles, leaves, and bark. This incoming control also ensures that no contaminants or old wood have been delivered. In addition, a sample is taken from every load delivered in order to determine the water content as the basis for the calculation. Several photos are also taken to document the quality classification. This strict quality management is the result of extensive process optimizations. They ensure not only that the requirements are met for upholding remuneration under the Renewable Energies Act, but also that fuel use, plant failure, and ash disposal are minimized.

90,000 tons of renewable fuel

The power station receives 90,000 tons of wood from rural conservation per year from around 80 regional fuel suppliers – 70 to 100 truckloads per week. TEAtherm uses only fresh, undried wood from rural conservation: To ensure that the system is able to reach full capacity, the water content and fuel quality need to be just right. The fuel proceeds to the infeed grate via the vibration chute, trough chain conveyor, and hydraulic pusher. The combined heat and power station with steam turbine has a maximum electrical output of 9.6 megawatts and is fed with 36 tons of steam per hour. The turbine exhaust steam is condensed at a temperature of 45 degrees Celsius and is used to heat the neighboring greenhouse. In comparison with conventional



district heating networks with a temperature of 90 °C, this use of exhaust steam not only avoids the loss of power caused by steam withdrawal from the turbine, it also increases the electrical efficiency of the system. With 40,000 megawatt hours per year, the greenhouse is already the largest heat consumer by far. By the end of 2021, however, the greenhouse area is set to be expanded by a further five hectares and will then consume another 15,000 megawatt hours of heat.

Drying 20,000 tons of wet sludge

TEAtherm uses around 13,000 megawatt hours of heat to operate the sewage sludge dryer. The belt dryer made by Andritz has a drying capacity of 22,000 tons of wet sludge per year. The volume of dry material produced annually is 4,800 tons. At 20 meters in length with a width of ten meters, the dryer has a throughput of 2.7 tons of wet sludge per hour. For the drying process, the sludges delivered with a water content of 78 percent are evenly spread onto a slowly moving process belt made from PPC in an 80 millimeter-thick layer. The air in the dryer is circulated via two circulation fans, heated in heat exchangers, and channeled through the product for drying. The dryer is fed with hot steam at a temperature of 200 degrees Celsius at a pressure of eight bars. The sludge then moves through different temperature zones on the process belt for 30 to 50 minutes – from 140 degrees Celsius at the start of the dryer to 100 degrees Celsius at the end. This causes the water in the sludge to evaporate and the water content drops from 78 to less than ten percent at the dryer outlet. Some of the dry material generated is mixed with the wet sewage sludge in the mixer at the dryer infeed in order to achieve a granulate with better drying properties. The exhaust air is channeled via another fan through a washer and biofilter for cleaning. Cleaning the exhaust air produces an ammonium sulfate solution of fertilizer quality.



Seven-year belt life in continuous operation

When the system was put into operation by TEAtherm, there was still a GKD 5099 PPC process belt on the dryer – around 36 meters long, 3.80 meters wide, with L-seam and edge coating. Unlike with polyester belts, the material of this belt type means that no hydrolysis occurs, so that the mesh design comprised of robust monofilaments permanently withstands the large surface weights. Woven in 3/2 twilled weave, the belt is particularly resistant to wear on the underside due to its flatness. With air permeability of 4,300 l/m²/s optimally tailored to the drying process and a CFM value of 660, it ensures an efficient drying process despite the very closed surface. At the same time, the smaller number of direct apertures resulting from the weave type reduces dust ingress. The belt also stands out with dimensional stability up to 200 degrees Celsius and resistance to chemical influences up to a pH-value of 14. "It is simply a reliable belt that served us well for seven years," says Jakob Friedrich, CEO of TEAtherm, in praise of the firm's first experience with the GKD belt. He adds: "We know from other system operators that some of them have to replace their belt every year."

All-in service with perfect training

When a tear appeared in the belt in its seventh year of use, TEAtherm wanted to fit a spare GKD belt they had found at the power station. However, mechanical engineer Friedrich and his team lacked the necessary experience and so asked GKD for help, which was promptly delivered. The fitter sent by GKD was on site for two days to fit the replacement belt and train the TEAtherm team in how to fit the belts. He didn't know that Jakob Friedrich had joined the team so that he could see the process for himself. "If you want to form a valid opinion as an engineer, you look at things yourself and join in with the work so you know what works and what doesn't when you're in contact with your co-workers," explains Friedrich. GKD supplies these process belts with a specific unrolling function in the transport crates.



This makes it possible for the heavy belt to be pulled into the machine directly from the crate with a special belt feeder and straps. This not only enables energy-saving fitting without the need for a crane, but is also gentle on the material, as the belt is not pulled across the floor into the dryer. "The GKD employee performed the replacement brilliantly with our staff and generally provided us with very good support," says Jakob Friedrich. He was so impressed with this dedication and service that he ordered a new belt right away. This support proved its value after just a year: The spare belt found by TEAtherm turned out to be a used belt, which itself had to be replaced. "We fitted the new belt ourselves without any problems," says Friedrich, who attributes this success to the high-quality training service from GKD. The 5099 PPC also meets TEAtherm's specific requirements for a dryer belt in every respect: Thanks to its low wearability with process-specific air permeability, tear resistance to contaminants, and long service life, it guarantees an efficient drying process in the long term. That's why the company immediately ordered a new spare belt, as Jakob Friedrich's opinion of the process belt and GKD is thoroughly positive: "Fast delivery, reliable belt, and a service we can rely on." Perfect conditions for the planned capacity expansion in sewage sludge drying.

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