Torsten Fischer of Krieg + Fischer Ingenieure discusses a legal investigation related to the deficiencies of a digestate dryer at a German biogas plant

First-person sleuthing: investigating a digestate dryer

Torsten Fischer, founder and managing director at Krieg + Fischer Ingenieure, has been an expert legal witness for more than 10 years covering 120 cases and wrote his first report about a biogas plant accident more than 15 years ago. In this personal account, Fischer discusses a legal dispute between a construction firm and the owner and operator of a farm-based biogas plant, exclusively for *Bioenergy Insight*.

Background information

The typical input substrates for a biogas plant are manure, energy crops, and organic waste, resulting in biogas and raw digestate. The digestate has to be stored for several months, depending on the country. In Europe, this differs between four and nine months. For large biogas plants, this may require huge storage capacities. Biogas plants with 10,000 or more cubic metres of raw digestate storage capacity

Figure 2. Typical raw digestate

are not uncommon. To reduce investment and trucking costs, a digestate dryer may provide a convenient solution for operators — especially if excess heat from the CHP can be used for the drying process. Such excess heat may originate from two sources: CHP exhaust gas and cooling water.

In most dryers, common sludge-type (raw) digestate is dewatered and the solid digestate is dried. Some dryers use the raw digestate as it is, mixing it with dried digestate and drying the mix. Other systems take the liquid digestate behind the dewatering and evaporate as much water as possible while keeping the digestate in a pumpable condition. This report covers all such systems in general with the focus on drying the solid phase behind the dewatering. The result of all such processes is a big stream of strong-smelling air that needs to be treated in most locations before being emitted into the environment.

Setting

The court asked me to take evidence and write a report about the potential deficiencies of a digestate dryer at a biogas plant. The facility was a typical German standardised biogas plant system, with mostly corn silage and pig manure used as the input substrate.

My reaction

Dryers are always difficult; this is no easy job.

The job

Court reports must follow certain rules - the judge outlines the questions and the technical expert must answer them. The short version of the questions, in this case, was: “Does the dryer work or not?” and: “What are the reasons for the deficiencies?”

Site visit and report

The site visit revealed that the dryer system was a belt dryer based on a container-type machine with an upfront dewatering system for the digestate and a close connection to the neighbouring CHP that delivered hot water to the dryer (Figure 1).

On top of the container was a small buffer tank for raw digestate (Figure 2). From here, the screw press separator takes it. The liquid phase is pumped back into the biogas plant and

Figure 1. The containerised dryer. The front metal box contains the fore- and back-run pipes of the CHP. Behind the stack on top of the container: the buffer tank for raw digestate

Figure 3. Solid digestate from behind the dewatering with a screw press separator. This falls onto the conveyor belt of the disputable dryer

Figure 4. Dried solid digestate

the solid phase falls onto a conveyor belt. The conveyor belt is heated with hot water from the CHP at 90°C. Fresh air is heated in a heat exchanger and blown across the conveyor belt. In this case, saturated air is emitted directly via the stack into the environment.

My main investigation was into the efficiency of the dryer. Due to missing data on the diagram, Figure 5 can just be taken as an orientation; however, this orientation is strong enough to show that the disputable dryer worked on a very low level of efficiency.

Conclusion

The contact between the biogas plant operator and the dryer supplier came via an advertisement in a magazine. The operator called the supplier and from that moment on all written documents were produced by the supplier only. Later during the court case, this created a bad position for the operator. Besides the court file, I read through about 150 documents before writing my report, and nowhere was any specific technical requirement from the operator's point of view fixed. Everything depended on the texts from the supplier. Technical parameters such as dry matter content (input/output), the target dry matter content for the output, or any information about test runs were not fixed — it was all about 'wet' and 'dry' only. Calculations within the quotation were not related to the digestate specifically, but were in general about the amount of water evaporated from any digestate. If nothing was fixed — how could I establish whether the dryer was deficient?

A dryer is a machine, according to the machinery guideline. There are required standards for the documentation. In not one case for all the dryers I investigated had the suppliers fulfilled documentation requirements completely. In most cases, even the piping and instrumentation diagram is missing.

This scenario is also typical: the supplier delivers the dryer, assembles it on site, and is ready "Friday at noon". There is a cold start-up and about an hour of training before the (unprofessional) operator signs the final protocol for commissioning, the workers from the supplier quickly leave in order to be back home for the weekend, leaving the operator very much alone with fairly complicated machinery that he has no clue how to deal with and that has not shown any performance.

The fine print

There may be, roughly, 200 dryers of all kinds installed at biogas plants in Germany. Meanwhile, they have a certain reputation of having poor efficiency and catching fire easily. It is beyond my imagination why so many operators believe that they can buy such an expensive and complicated machine over the phone. According to the German Renewable Energy Law, an extra payment per thermal kWh is valid if the CHP heat is used in a dryer. This results in a situation where the less efficient the dryer is, the more money the operator receives. Finally, in 2011 the German Biogas Association published a target value for the efficiency of dryers. The dryer investigated here was not even close to that target value.

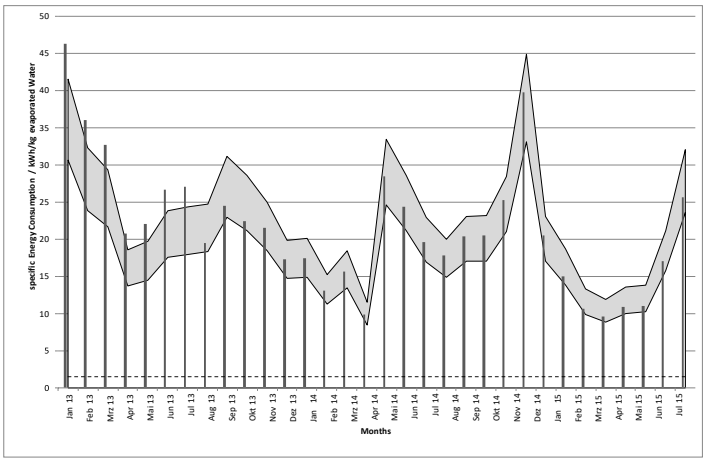

Figure 5. Diagram showing the specific energy consumption of the disputable dryer. The grey area shows the range of the potential energy consumption if the solid digestate is dried to 60-90% dry matter content. The beams are related to the measured energy consumption in real life. The dotted line shows, for comparison, the required target value from the German Biogas Association

Lessons learned

This example shows a poor but not exceptionally poor case. The operator lost the court case. After reading my report, he withdrew the lawsuit. All he could present was the advertisement in a magazine. The supplier had written his quotation in a — for the supplier — very favourable style. At the end of the day, it became clear that the operator got what he had ordered.

Note: not all details have been presented in full and some elements have been simplified.

For more information:
This article was written by Torsten Fischer, founder and managing director at Krieg + Fischer Ingenieure. Visit:

kriegfischer.de/en/biogas-plants/services/expert-opinions-and-studies/. Fischer is happy to receive questions at fischer@kriegfischer.de.