

New Mixer in Digester to Enhance Work Environment and Increase Efficiency

A broken mixer in one of BIOFOS' digesters at the Damhusaaen Treatment Plant required action. The choice fell on a new type of mixer, a so-called GasMix, which is mounted externally. This means the end of having to use large cranes to lift a 9-meter-long mixer up and down, as well as avoiding biogas emissions. It's a significant advancement for both the environment and the work environment, according to BIOFOS.

The Greater Copenhagen utility company has four digesters at Damhusaaen, which are due for renovation from 2024 to 2027. This is part of a general upgrade of the treatment plant. The digesters, built back during World War II, require concrete inspection, emptying, and thorough cleaning. At the same time, the mixers need to be replaced, so the installation of the new mixing system in one of the digesters is both a necessity and a test.

"If it works as well as we expect, we will install the same type in the other three digesters. It's

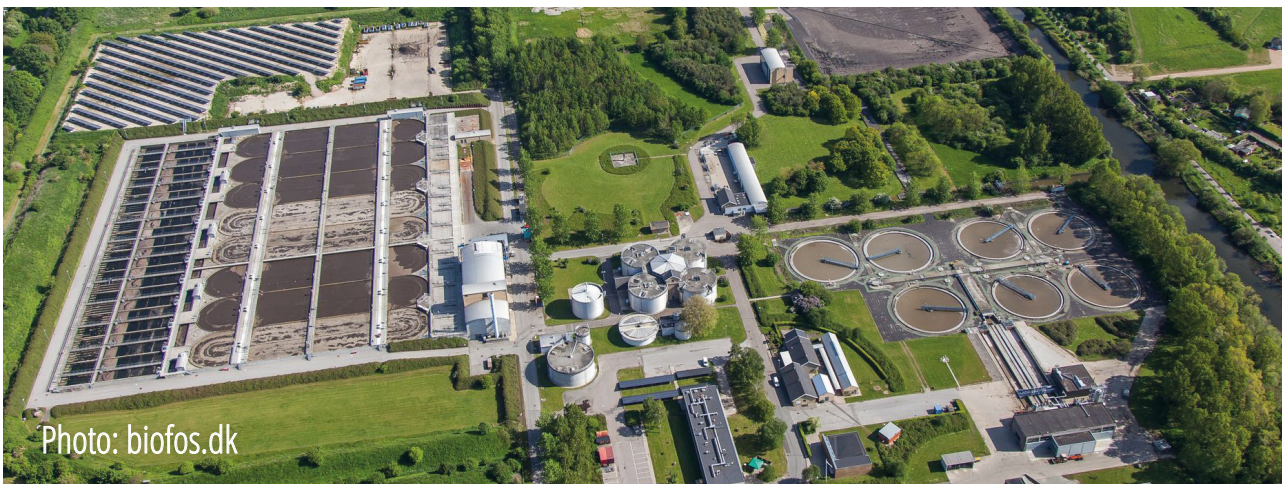
an improvement for our work environment. At the same time, we expect higher biogas production, but the next couple of years will show," says Lars Erik Hansen, Production Manager at the Damhusaaen Treatment Plant.

The GasMix mixing system, developed and produced by Danish company Landia, utilizes recycling of biogas and sludge to stir the contents of the digester. Gas from the gas zone of the digester is sent to the bottom of the digester. As the gas rises, it helps to "stir" the digester. This new mixing system is externally mounted, a significant departure from the top-mounted mixers previously used in the digesters.

Going forward, mechanical parts inside the tank are avoided, so all service can be done from the outside. "This significantly increases safety, as there's always a risk involved when we service and repair a mixer. It also requires emptying the whole tank and stopping biogas production, leading to economic loss and CO₂ emissions. We'd rather use the gas for something sensible," says Lars Erik Hansen.

Mounted on a full tank

Repairing the pump, located at ground level on the digester, also becomes much easier. A technician from Landia drilled holes into the full tank, then mounted the GasMix system. "We've installed a pump, two flushing nozzles, and a GasMix nozzle on the full tank, so the operating staff didn't have to do anything.



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There's a flushing nozzle at the bottom, one at the top, and a GasMix nozzle in the middle. The system then switches between these three nozzles," says Andreas Aksglæde, Key Account Manager at Landia.

A pipe is led from the nozzle at the top of the tank down to the GasMix nozzle. The gas is then pulled from the top down to the GasMix, where it is injected back into the tank. Landia has experience with this from other biogas plants. References from plants in the USA show that it increases biogas production by up to 20%, without extra costs. However, Andreas Aksglæde cannot promise how much the production at Damhusaaen will increase, as it depends on the fiber content in the sludge.

Work Environment in Focus

Although BIOFOS appreciates increased biogas production, the primary investment in the new mixing system is to strengthen the work environment. An increased gas production would be a welcome additional benefit, contributing to pushing natural gas out of the network by selling it to HOFOR City Gas. This would improve the CO₂ balance for BIOFOS, HOFOR, and Copenhagen as a city.

If BIOFOS had chosen to install a classic top-mounted mixer inside the tank, it would have required emptying the tank and using a crane to pull out the old mixer and similarly install a new one. "It's clearly cheaper to install the new GasMix compared to a top-mounted mixer. Whether it will be more expensive in operation,

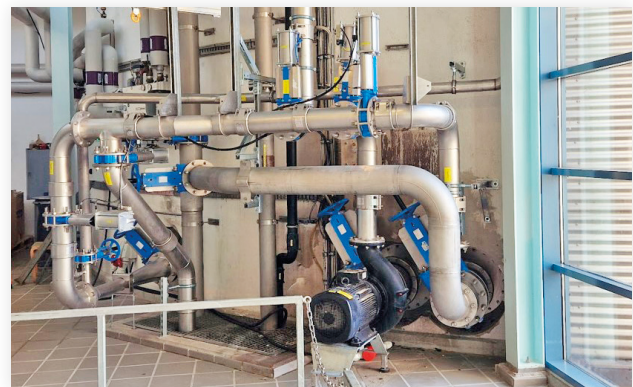
future operational experience will show, but we don't think so. Energy-wise, it's on the same level as a top-mounted mixer. The pump doesn't need to run more than necessary, but of course, rising electricity prices affect the business case. However, we generate 4 million kWh of electricity a year at Damhusaaen, so we essentially supply it with power ourselves," says Lars Erik Hansen.

He explains that with the current mixer, grid material wraps around the propellers, forming a round ball in the digester that has no effect. The new type of mixer, however, keeps the sludge in suspension, preventing a water phase where water just lies at the bottom. It's designed with a cutting system that chops the grid material into small pieces, avoiding clogging.

"The crucial point is safety around maintenance. We mix the digester at multiple levels and run in several sequences. It's really good for the work environment, as the operational staff never have to enter a so-called ATEX zone - meaning no longer is there gas work on the tank, which is crucial for safety," says Andreas Aksglæde.

BIOFOS still aims to become CO₂-neutral by 2025. The new GasMix mixer contributes to this goal to the extent it increases biogas production.

In collaboration with Aarhus University, Landia has demonstrated a higher biogas production compared to traditional mixing technology. In biomass with high fiber content, the fibers are "split" by the repeated recirculation through the GasMix system - a function not achieved by traditional stirring of the digester.



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