Retrofit of digester mixers helps Biosciences Institute boost gas yields by 15-25%

At Hillsborough, one of seven AFBI sites that provide scientific research and services to government, non-governmental and commercial organisations, the retrofit of the AD plant's main digester has improved biogas yields by 15-25%.

At what was the first biogas plant of its type in Northern Ireland, the cow slurry from the site's 300-strong dairy herd is co-digested with grass silage produced on the research farm, to produce biogas which is combusted in a CHP engine providing heat and electricity for the site.

The new mixing system ensured that fresh feedstock was being better mixed in the main digestion tank and was not discharged too early, as witnessed by higher discharge temperature than that observed from the old mixing system.

Dr Gary Lyons from the Agri-Environment Branch at AFBI, said: "The original mixing system, installed when the plant was built, worked well for a number of years, but eventually a build-up of sludge in the bottom of the primary and secondary digestion tanks meant that we were getting poor digestate mixing. This impacted biogas production and the level of methane in the biogas. We decided that we needed to shut the system down, clear the sludge from the tanks, and retrofit a new mixing system on to the main digestion tank, which would not give us issues with sludge build-up in the future."

A robust mixing system is critical

He added: "At AFBI, we understand that busy farmers have more than enough to do, without having to constantly repair and maintain their biogas plant, so we've been able to see first-hand that a robust mixing system is critical. One that doesn't have any wear parts on the inside of the tank will prevent the big headache of downtime."

Written by: Chris French

The new mixing system in question is a simple, but highly effective one. Externally-mounted, a Chopper Pump (invented by Landia in 1950) with venturi nozzles. No working at height. No working in the gas zone. And no costly downtime for servicing.

"There's more to it than that of course," continued Gary. The Landia GasMix provides the dual benefit of both hydraulic and biogas mixing in one system, which was appealing to the AFBI team. We're not a commercial plant, but our role is to explore all of the possible benefits for farmers. This means not only maximising the amount of clean energy that can be produced, but how to achieve that with the minimum amount of energy that goes in.

More gas and also better quality gas

"When we were just using slurry as a feedstock, the Landia mixers increased our output from 300 m^3 of biogas per day of dry solids to typically 360, and as high as 400. I'm a sceptic by nature, but the results were there right in front of us with our readings; more gas and also better quality gas, with the Landia GasMix system working away without any problems, continuously reducing the particle size of the feedstock.

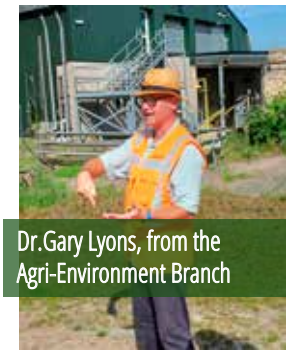
"Over time, only two of the 18 lines on the old mixing system hadn't blocked. We knew we had to look for a lower maintenance alternative."

Gary and his team's search saw them consult with the first biogas plant of its type in the Republic of Ireland, where in County Limerick, impressive performance numbers were being reported at the site owned and operated by Greengas.

I spoke with David McDonnell at Greengas," said Gary. "He told me that his plant was benefiting from having Landia mixers. I also looked hard at the Danish Biogas Association's advice on the use of venturi nozzles for digester mixing at AD plants. This led to us working with DPS (part of the EPS Group) of Bangor (who supply Landia equipment in Northern Ireland and the Republic of Ireland) to help with their knowledge and experience

"In this situation, throwing more power at the process isn't the answer. We've also understood that dwell times are very important, which takes convincing for some, but through careful fine-tuning, we don't have to run the Landia mixers flat out to optimise biogas yields; just in 10-minute cycles, so only 30 minutes each hour. We need to experiment more with dwell times to hit the sweet spot of minimal mixing for maximum plant performance.

"We have had no problems with digestate mixing whatsoever since installing the Landia digester mixing system. By increasing the surface area of the feed with truly comprehensive mixing of the tank, the bacteria get to work much quicker. I do like the fact that the system incorporates biogas re-circulation, and we do not appear to have solids settlement issues."



Dr.Gary Lyons, from the Agri-Environment Branch

"As a scientific research centre, we've experienced the good, the bad and the ugly of AD, which should help farmers avoid the downside of those mixing systems that can only be retrieved by having to laboriously drain down the tank and then have to start the whole process from scratch.
We won't be doing that again.

"Following the increase in biogas production and methane content that we saw with mono-digestion of slurry as the feedstock, it will be very interesting in time to collate the data from the co-digestion of slurry and grass silage."

Read more about the Landia GasMix here