

BioReact AD boosts biogas generation 32% and lowers natural gas use 10% at 200 000-m³/day WWTP

Results Summary

- Biogas generation: +32 percent (212 MWH/month)
- Natural gas consumption: -10 percent (221 MWH/month)
- Volatiles Solids (VS) reduction: +10 percent
- Total Solids (TS) reduction: +9 percent (2.55 dry tonnes/day)
- Gross savings: \$22 000 per month

THE SITE

The 200 000-m³/day wastewater treatment plant has been a leader in the use of renewable energy for wastewater treatment. It currently generates 95-percent of the energy it uses from onsite biogas, purchased natural gas, and solar energy generation. Only 5 percent of its energy requirement is imported from the local power utility.

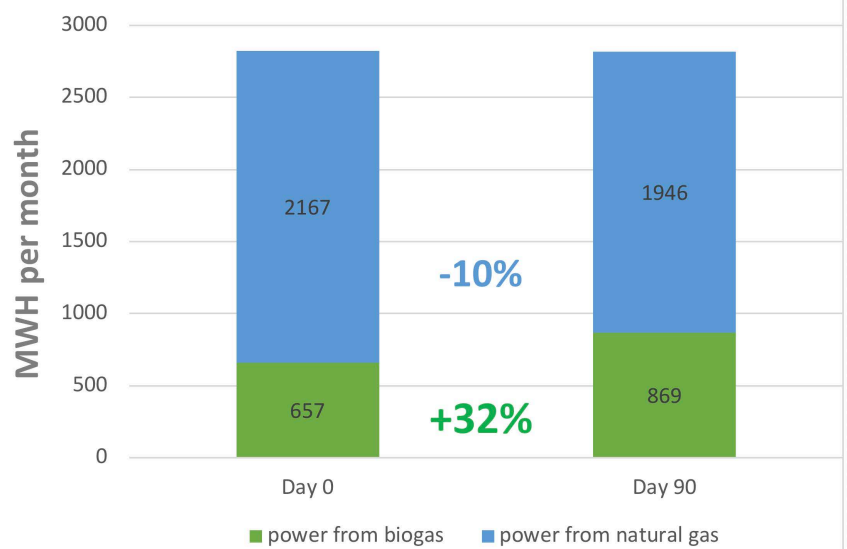
THE TECHNOLOGY

Drylet's innovative technology draws from material science and microbiology. Its BioReact AD product is comprised of carefully selected beneficial microbes embedded inside non-toxic particles made of an engineered porous media substrate. The particles are approximately 200-600 µm in size. They protect the microbes, allowing them to thrive and replicate fast so they can be effectively integrated into microbial ecosystems.

THE PROCESS

BioReact AD was added to the digesters starting in November 2018 with a daily dosing of 22.6 kg. The goal was to boost biogas and enhance solids reduction. The demonstration took place over 90 days. Training was provided to facility personnel on the best points of product application.

GAS-POWERED ENERGY BREAKDOWN





32%
biogas boost



10%
natural gas reduction



9%
Total Solids reduction

How it works

Anaerobic digestion is a three-step process:

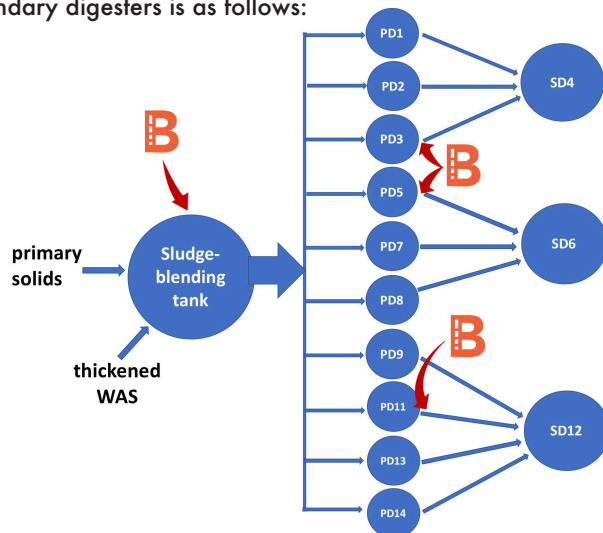
1. **Hydrolysis:** Secondary and primary solids are broken down into smaller molecules.
2. **Acidogenesis and acetogenesis:** The products of hydrolysis are converted into short chain fatty acids (e.g. acetate), CO₂ and H₂.
3. **Methanogenesis:** Archaea (methanogens) convert SCFA, H₂ and CO₂ into methane.

WAS (Waste Activated Sludge) is the portion of the solids that is most difficult to degrade because it is made up of excess bacterial cells from the activated-sludge process. The breakdown of WAS requires the lysis or breakdown of the bacterial cell wall before the interior cellular contents – which are made up of long chain molecules like carbohydrates, proteins and lipids – can be broken down. Drylet's innovative technology enables the enhanced degradation of undigested solid waste (hydrolysis), promoting a reduction in biosolids and an increase in the generation of biogas.

Demonstration protocol

Drylet proposed the addition of BioReact AD to the primary and secondary digesters to enable up to a 20-30% boost in solids destruction and biogas generation. Its engineers worked with the plant's personnel to develop a comprehensive demonstration protocol to guide the demonstration. **Data was collected on a broad range of operational parameters such as biogas generation, biogas composition, alkalinity, sludge-haulage volumes, solids flows to and from the digesters, energy generation from various sources and natural gas costs.**

BioReact AD was fed to both the 10 primary and 3 secondary digesters in varying amounts, totalling 22.6 kg per day (one of the secondary digesters was offline and under maintenance during the demonstration period.) The sludge-feeding arrangement into the secondary digesters is as follows:



Primary solids and thickened WAS are mixed in a sludge-blending tank prior to being fed into the primary digesters. During the feeding of solids into the 10 primary digesters, the overflow of the corresponding quantity of fed raw digester solids (primary digestate) flows into the connected secondary digester.

A single feed point was used for all the primary digesters. The overflow from three selected primary digesters (PD3, PD5, PD11), was used for applying product dosage into the secondary digesters.

PLANT OVERVIEW

14 primary and secondary anaerobic digesters make up the anaerobic digester complex. The primary digester contents are heated and maintained at about 95°F.

27 810 Standard Cubic Metres (SCM) of biogas are generated per day, with methane making up 60 percent of its content.

90 percent of the power used by the facility is generated onsite from biogas and natural gas.

26.7 tonnes of solids are destroyed each day on average in the process, for a biogas yield of approximately **0.7 SCM per kilogram of Total Solids**. Average TS and VS destruction in the digesters prior to the addition of the Drylet was 43% and 55% respectively.



Product dosing into the thickened sludge feed to the primary digesters.

OUTCOME

Within 90 days, results showed: **32% boost to biogas generation led to a 10% decrease in natural gas use + \$10 825 monthly cost savings in solids handling.**

Total gross monthly savings: \$22 000