LysoThane®

37 55 HT H2

Biomethanization and methanation of municipal and industrial sludge

John Cockerill

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Green energy source

Multiple benefits

Biomethanization of municipal and industrial sludge represents a defossilized energy source whose potential has yet to be developed in many countries. The biogas produced is either injected into the grid or used locally in cogeneration plants. In addition to its energy contribution, anaerobic digestion significantly reduces (35% to 45%) the quantities of sewage sludge and, where applicable, the land required for land application. It produces a stabilized digestate, largely free of pathogenic germs (bacteria, viruses and parasites), volatile organic compounds and odour nuisances. Biomethanization is also the only sewage sludge treatment process that enables the energy potential of organic matter to be recovered, while preserving a large part of its fertilizing potential.

Why LysoThane®

John Cockerill offers **mesophilic, thermophilic and two-stage anaerobic digestion solutions** for urban and industrial processes, complete with **pre- and post-treatment** stages for the digested sludge. They are designed on the basis of tried-and-tested, modular process bricks, drawn from the Group's broad technological and environmental portfolio (water, air and waste), **which aim to considerably increase methane production, make industrial or municipal water treatment plants less polluting (by releasing greenhouse gases (GHGs) such as N_2O), less energy-intensive and therefore more efficient**.

John Cockerill offers a complete service:

- Audit and sizing of biogas plants according to needs
- A comprehensive, modular offering for all types of industrial and municipal plants
- Advanced technologies to maximize biomethane production (thermal lysis of sludge, two-stage digestion, coupling with methanation, etc.).
- Technologies to recover nutrients (nitrogen stripping, phosphorus recovery) and minimize final residues (drying, digestate pyrolysis)
- Biogas purification technologies
- Automation, supervision and data processing systems (**Acva**Smart™)
- Industrial expertise in plant safety (hazard studies, ATEX zoning, etc.).
- A high-performance solution, from design to commissioning

Biomethanization & methanation

Your customized solution

Feasibility study and design

John Cockerill offers a wide range of high-performance technologies and solutions for energy recovery from sludge. During the design phase, the optimum combination and integration of the various modules and components is studied by our engineers according to the site's parameters.

Sludge pre-treatment

Static and dynamic thickeninge

Thickening concentrates the fermentable matter in sludge from primary and secondary clarifiers, reducing the volume to be digested.

Sludge hygiene

Hygienization (pasteurization) of sludge upstream of anaerobic digestion is necessary when the sludge contains animal by-products from a slaughterhouse. This involves heating the sludge before it is fed into the digesters.

Screening, sieving and grinding

In order to avoid clogging equipment with filtrates, eliminate undesirable matter and reduce maintenance requirements and downtime, the sludge to be digested can undergo various mechanical pre-treatments: screening, sieving, grinding, etc.

Methane production

Mesophilic, thermophilic or two-stage digestion

Mesophilic anaerobic digestion at temperatures of around 37°C is compact and simple, and accounts for over 90% of biodigesters worldwide.

Thermophilic digestion takes place at temperatures of around 55°C. It offers better sludge hygienization, shorter residence times in the digester and higher biogas yields than mesophilic digestion.

For inputs that are difficult to degrade, two-stage digestion uses an initial thermophilic phase, followed by a second mesophilic phase.

Thermal lysis

Thermal lysis involves recirculating, pressurizing and heating a fraction of the sludge to improve digestibility. It increases the rate of volatile matter removal and maximizes biogas production. It also reduces digester volume and digestate quantity.

Biological methanation

Biological methanation increases methane production by up to 50%. Hydrogen injected into the aqueous phase interacts with dissolved CO2 in the presence of specific microorganisms. A large proportion of the carbon dioxide present is thus converted into methane instead of being released into the atmosphere.

LysoThane H_2: Combining Tomorrow Water's thermal hydrolysis and John Cockerill's anaerobic digestion or co-digestion technologies with Enosis' biological methanation enables the partners to offer the biogas industry an integrated waste-to-energy solution that contributes to security of energy supply.

Réduire l'impact environnemental : en valorisant l'azote nos unité de stripping AyraVal™ Ammonia évitent l'émission de protoxyde d'azote (N_2O), gaz à très fort pouvoir à effet de serre.

Digestate post-treatment

Dehydration and drying

Dewatering the digestate using screw presses or centrifuges reduces its volume by a factor of 5, and is an essential step prior to drying.

Evaporative drying reduces the volume of digestate after dewatering by a further factor of 5.

NesaCore™ : **Pyrolysis of digestate**

High-temperature pyrolysis takes place at temperatures of around 900°C in a low-oxygen atmosphere. It completely eliminates the organic fraction of the digestate and enables post-combustion of the synthesis gas produced. The result is a 100% mineral, inert and stable residue.

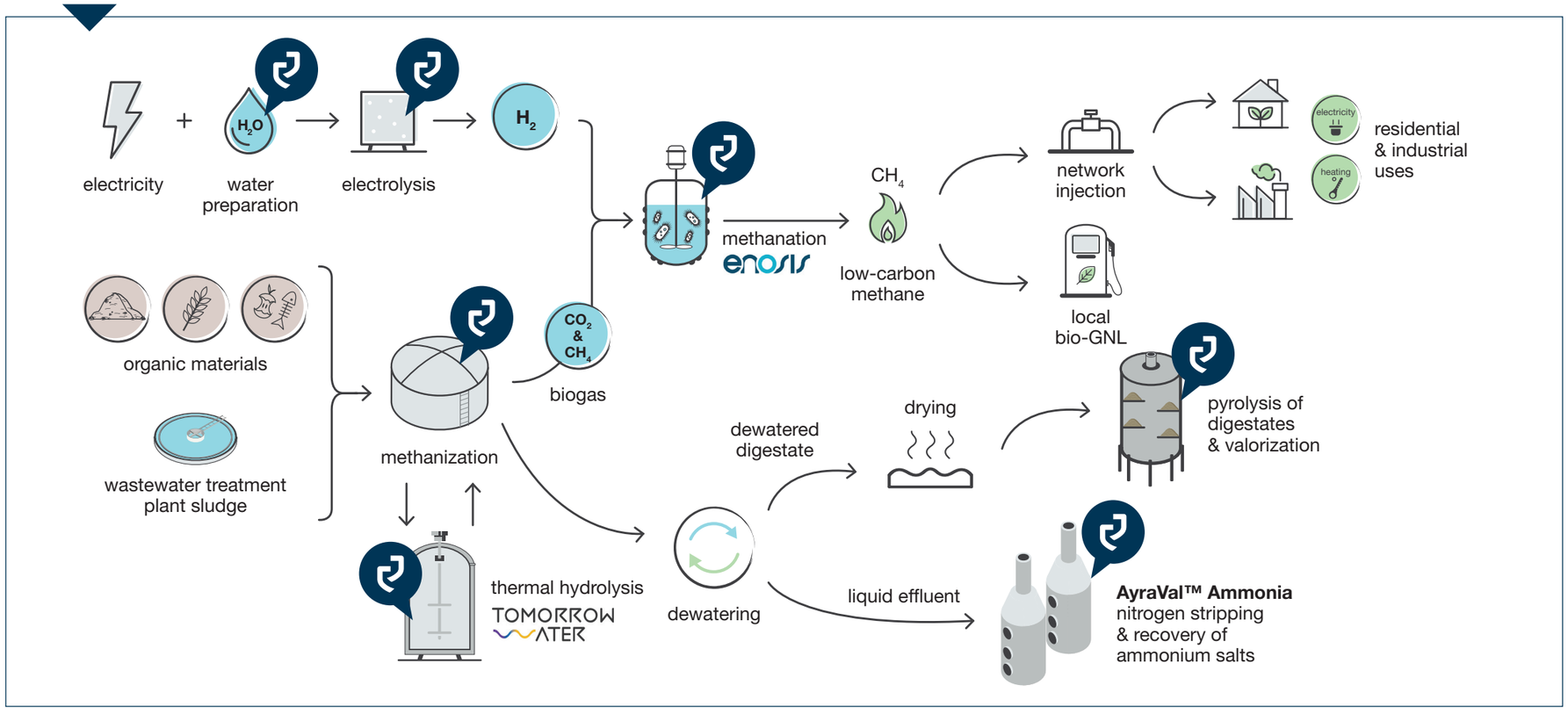
AyraVal™ Ammonia : **Nitrogen stripping**

Nitrogen stripping extracts this nutrient from liquid digestate. In addition to preventing the release of GHGs (N_2O), and cutting plant OPEX by up to a factor of 5, it reduces the nitrogen load of returns to the plant head, thus relieving the water treatment system. The final product, rich in ammonium sulfate, is used as a mineral fertilizer.

Phosphorus recovery

Phosphorus is precipitated and crystallized in a reactor by injection of magnesium salts. Phosphorus accumulates as struvite at the bottom of the reactor, from where it is extracted. In some cases, phosphorus can also be extracted from pyrolysis ash.

Biomethane production from WWTP sludge



Construction principles

Steel or concrete tanks

Digester tanks are made of either concrete or steel. Concrete is a durable solution, suitable for large-volume digesters. An internal coating protects the concrete from corrosive environments.

Steel tanks are well suited to volumes of up to 7,000 m³. Made from stainless steel or coated steel sheets and assembled on site, they offer significant time savings during installation.

Biogas storage

The biogas generated can be stored directly in the digester or in a separate gasometer.

- Storage integrated into the digester is the most economical solution, with a reduced footprint. It reduces the area affected by ATEX regulations.
- The separate gasometer is a flexible solution, generally reserved for larger installations. It is compatible with all types of mixing and offers easy maintenance.

Sludge mixing

The sludge is mixed either by biogas injection or mechanical agitation. Biogas injection mixing is an economical and robust solution, with no moving parts inside the tanks. It is perfectly suited to large volumes and concrete digesters.

Pendulum stirring is suitable for small and medium volumes. It offers better control of stirring intensity and reduces the size of the ATEX zone.

Horizontal stirring requires the tank walls to be penetrated. It is suitable for small-volume digesters. The agitator is located outside the ATEX zone.

Energy management

The energy yield of an anaerobic digestion plant depends on the solutions chosen to maintain reactor temperatures:

- Gas-fired boilers represent the simplest solution, with minimal investment. However, they consume part of the biogas produced.
- Sludge heating using a heat pump improves plant efficiency and conserves all the biogas produced.
- Sludge/sludge heat exchangers recover heat from sludge leaving the digester to heat incoming sludge.
- Thermal insulation of the reactor and use of the waste heat produced by various equipment (compressors, co-generators, etc.) further improves the plant's energy balance while reducing operating costs.

Upgrading of biogas

Network injection

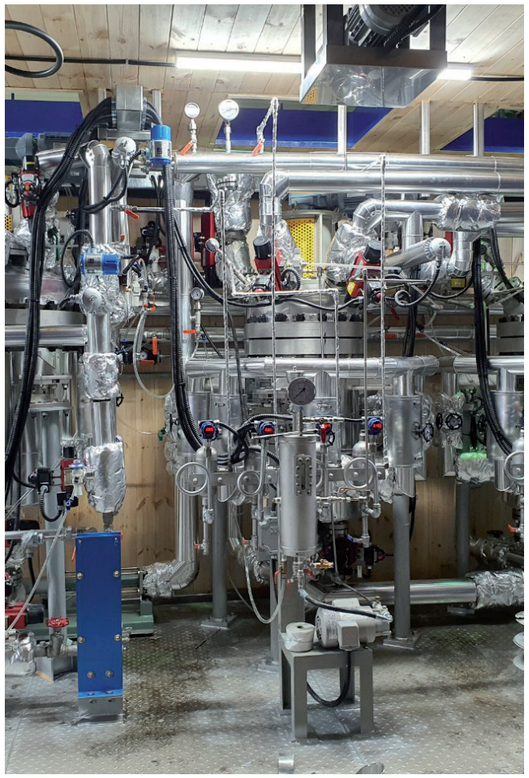
Network injection requires a biogas purification step to eliminate CO2 and other impurities that may be present. One of the most widely used technologies today is membrane purification.

On-site boiler

Using gas on site to heat processes or even buildings is often seen as a simple and inexpensive solution in an industrial context. Desulfurization by scrubbing or activated carbon adsorption is often necessary.

Cogeneration

Cogeneration converts purified biogas into electricity and heat. The use of on-site waste heat guarantees an advantageous energy balance. The electricity produced can be sold at subsidized rates or consumed on-site.



At your service

Start-up and training

Operating and maintenance teams are given autonomy through rigorous training and assistance during plant start-up. The aim is to optimize process biology, manage risks and prevent undesirable effects (foaming, clogging, inhibition, stoppages, etc.).

Pilot assistance

On-line measurements (pH, biogas flow, temperature, pressure, suspended solids) generate large quantities of data, which can be analyzed according to a predefined plan, enabling predictive optimization of biological processes and energy yields. Remote control systems enable rapid intervention when required.

Risk prevention

Methane plants are subject to specific safety risks:

- formation of an explosive atmosphere (ATEX);
- leakage of methane, a highly greenhouse gas;
- hydrogen sulfide (H_2S) poisoning.

John Cockerill brings all its expertise to bear on the analysis of these risks and the implementation of measures to prevent them.

Our solutions

Solution	Technology
LysoThane 37	Mesophilic methanizers at 37°C
LysoThane 55	Thermophilic methanizers at 55°C
LysoThane BI	Bioreactors at 37 + 55°C
LysoThane HT	Thermal lysis
LysoThane H2	Biological methanation
LysoDens	Sewage sludge thickeners
Pyrolyse HT	High-temperature pyrolysis of digestates

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John Cockerill's solutions cater to the ecological transition and circular economy

Firmly anchored in our experience, our solid technological know-how and our bold innovation in the treatment of water, air and waste, our **Water Business Line** offers highly performant and modular solutions for the efficient treatment of industrial and municipal wastewater, the production of process water and REUSE, as well as optimized renewable methane production.

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