

RIKA Biofuels (Fridays, UK)

A short introduction to RIKA Biofuels

Rika Biofuels (UK) develops large scale anaerobic digestion (AD) projects in Europe and is specialized in manure treatment from intensive livestock production.

Rika Biofuels, partnered with DVO (supplier of the digester), has initiated the construction of the AD plant of Fridays in the United Kingdom. Fridays will be operated with 100% poultry manure and a treatment capacity of 50 kton per year.

Table 1. Technical information of the biogas plant.

Characteristics	
Date of construction	2019
Size (MWe)	1.8
Volume (m ³)	14 000
Digester type	Mesophilic digestion

Drivers for Nutrient Recycling

To date, poultry manure is often incinerated because of the high organic matter content and low water content. The energy production during incineration is high, however, it causes valuable nitrogen and carbon loss as N₂ and CO₂ in addition to greenhouse gas (GHG) emissions.

Rika Biofuels wants to generate value from manure via AD and provide solutions to farmers whose manure is a liability to their business rather than an asset. The company realized that nutrient recovery (nitrogen separation) could improve the efficiency of the AD by reducing the requirement for water to dilute high nitrogen containing feedstocks (e.g. poultry manure). As a consequence, higher biomass yield and a more stable digestion process is achieved.

Fridays will demonstrate that chicken manure can be treated in a sustainable way while recycling nitrogen (N) and phosphorous (P), reducing GHG emissions and reducing manure disposal costs.

Feedstocks

Every year the digestion plant will treat 50 kt of poultry manure (Table 2) diluted with 134 kt of recycled water coming from the nutrient recovery plant.

Table 2. Origin of Fridays feedstock.

Type	Origin	Mass
Manure	Poultry manure	50 kt

Biogas production

The installation will produce around 8 Mm³/y of biogas (Table 3), of which 450 m³ of biomethane will be injected to the grid. Furthermore, the installation will produce 550 kW of heat and 500 kW of electricity. The expected biogas composition is reported in Table 2.

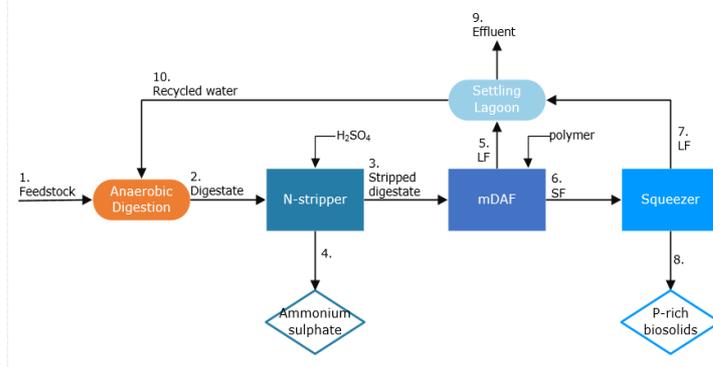
Table 3. Yearly biogas production and average composition before purification.

Component	
CH ₄ (%)	55
CO ₂ (%)	43.8
H ₂ S (ppm)	500
O ₂ (%)	0,7
Total biogas production (Mm ³)	8
Biogas per tonne of feedstock (m ³ /t)	125

Nutrient Recovery and Reuse (NRR) Technologies

The anaerobic digester is a two-step, mesophilic mixed plug-flow system with a retention time around 20 days. The first step takes place in an acidification chamber, while the second occurs in a methanogenic chamber, allowing separation of bacteria for acid and methane formation. The waste flows through a channel as follows: as fresh manure enters one end, digestate is pushed out of the other end, continuously mixed with biogas circulation. The gradual increase of pH in the methanogenic chamber to 8.5 provides optimal conditions for subsequent ammonia stripping.

N is recovered as a valuable ammonium sulphate (AmS) since during the process ammonia is stripped by adding acid (H_2SO_4). Up to 90% of P is recovered from digestate through a modified Dissolved Air Flotation step (mDAF) and subsequent squeezing. The investment for the AD plant and the N stripping system amounts to 12.8 M€.



Status of construction

The reason for the delay in the construction of Oaklands biogas plant is that planning permission was retarded due to the Environmental Agency demands of a detailed design at a very late stage in the planning application. Rika Biofuels completed the design work and successfully attained planning permission for the project. However, in September 2016, government renewable energy policy was changed and any Feed In Tariff (Rika's renewable subsidy) for projects with an output over 500 kW electricity (kWe) has been effectively removed.

Fortunately, Rika Biofuels has another site under development with Fridays Eggs in Kent which will substitute Oaklands demonstration installation. This project is identical to Oaklands since both rely on DVO technology to process at least 50,000 tonnes per annum of poultry manure. This is a gas to grid project and therefore does not rely on the Feed in Tariff over 500 kWe as Oaklands. The project has planning permission, a grid connection and funding. After a delay of more than a year, the UK Government finally introduced new renewable heat tariffs in May 2018 for which Rika have applied. Subsequently, construction of the Fridays project is due to start in September 2018 with the commissioning targeted to take place in October 2019.

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Products and market

Pathogen reduction by 90-99% of faecal coliforms and streptococcus is ensured by the mixed plug-flow digester. The solids obtained with 20% of dry matter (DM) will be exported to Germany and neighbouring countries. By mixing biosolids with AmS 40% solution, Rika is planning to produce marketable NPK-fertilizers.

Rika Biofuels is also exploring the option of crystallising AmS solution. This can be achieved at a cost of about 60 € per tonne of crystal for which the market is thought to be in excess of 120 € per tonne.

Table 4. Expected composition of the recovered products.

	Ingoing manure	RIKA Recovered products	
		AmS	P-rich biosolids
Dry matter (DM %)	73		27
Organic matter (%)	68% of DM		32% of DM
N-total (%)	4	7.2	0.7
P ₂ O ₅ -total (%)	2.6	0.08	3.3
K ₂ O-total (%)	2	0.08	1.3

Economic benefits

The economic advantages of reusing recovered products are:

- Cost efficient production of biosolids and mineral organic fertilizers and
- Direct recycling of the final liquid fraction (e.g. feedstock dilution for AD) due to its low nutrient concentration.

Sustainability goals

Rika Biofuels is committed to reach the following targets:

- Improving the sustainability of livestock farming through the production of renewable energy from the mono/digestion of manures and wastes from the agriculture sector and
- Achieving a GHG saving of at least 70% compared to fossil fuel alternative in Rika's facilities for the production of renewable energy.