Factsheet
SYSTEMIC Demonstration Plant

# AM Power (Pittem, BE)

## A short introduction to AM Power

AM Power is located in the western part of Flanders (Belgium), a region characterized by an excess of animal manure and yet a high market demand for formulated synthetic fertilizer. The demonstration plant is the largest biogas installation in Belgium: it has a treatment capacity of 180 kt/y spread over five digesters, for the production of 7.5 MW of electricity (Table 1).

*Table 1. Technical information of the biogas plant.*

| Characteristics | |
|---|---|
| Date of construction | 2011 |
| Size (MWe) | 7.5 |
| Volume ($m^3$) | 20 000 |
| Digester type | Thermophilic digestion |

## Drivers for Nutrient Recycling

AM Power has always been experimenting and investing in innovation towards the recovery of nutrients. A long time ago they already envisaged the importance and benefits of moving towards a circular economy. Getting rid of the digestate represents an important cost for biowaste treatment plants. On top of this, the agro food industry in Flanders realizes that their waste streams are valuable and thus demand a gate fee to biogas plants for intake of their waste.

Competition between biogas plants makes it difficult to get the turnover break even. AM Power believes that nutrient recovery can be a way to balance this again.
AM Power generates every year 160 kt of digestate and strives to treat it in a cost effective, efficient and relatively simple way, without losing the nutrients. The plant has developed a technological solution for the recovery of nutrients into valuable fertilizers, which will be further implemented.

## Feedstocks

The co-digestion plant treats about 180 kt of feedstock every year out of which almost 90% is organic biological waste (i.e. food waste). Co-substrates include animal manure and energy maize (Table 2).

*Table 2. Origin of AM Power feedstock (2017).*

| Type | Mass |
|---|---|
| **Organic biological waste** | 160 kt |
| **Manure** | 15 kt |
| **Maize** | 5 kt |
| **Total** | **180 kt** |

Horizon 2020

# AM Power (Pittem, BE)

## Biogas production

The biogas produced every year (including digesters and post-digester) is around 30 $Mm^3$ (Table 3). The biogas is converted by a CHP engine into electrical and thermal energy. The amount of heat and electricity produced is respectively 7360 and 7435 kW.

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

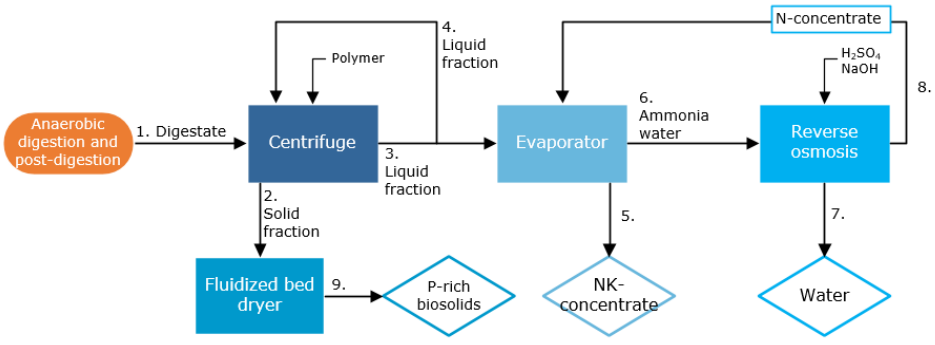
| Component | |
|---|---|
| $CH_4$ (%) | 56 |
| $CO_2$(%) | 43 |
| $H_2S$ (ppm) | 50 |
| $O_2$ (%) | 0.1 |
| Total biogas production ($Mm^3$) | 30 |
| Biogas per tonne of feedstock ($m^3/t$) | 170 |

## Nutrient Recovery and Reuse (NRR) Technology

Currently the process works as follows:

- Organic wastes are collected and homogenized in a mixing unit to a substance with a dry matter (DM) content of approximately 20%.
- Homogenized feedstock is hydrolysed in a separate unit (with a retention time of 3 days) and fed to a thermophilic digester.
- Digestate (9% DM) is sent to a centrifuge for solid/liquid separation. Coagulation and flocculation are favoured by the addition of polymer and iron sulphate.
- The solid fraction that contains 90-95% of the initially separated total phosphorous (P) is dried, while the liquid fraction is sent to a flotation and reverse osmosis (RO) unit. Drying of solid fraction is accomplished by recycling waste heat from CHP engines and it requires around 2600 kWh. The resulting product is exported to France.
- Before the RO, a flotation step (DAF) reduces the DM content of the liquid fraction to 1.6 - 1.7% DM. The RO step requires the addition of acid ($H_2SO_4$) to the influent to ensure a good membrane separation. The resulting concentrate is rich in nitrogen and potassium (N and K) and is used as a fertilizer on local agricultural land.

The envisaged process includes a continuous multiple effect vacuum evaporator prior the RO, thus increasing the recovery of nutrients from digestate. The vapour contains ammonia, which is condensed as ammonia water and is subsequently pumped to the RO unit. Moreover, the flotation step will not be necessary anymore. The investment of the evaporator and adaptation of the process amounted to 2 M€.



# AM Power (Pittem, BE)

## Status of construction

Am Power has defined all the technical specification for the installation of the new evaporator, however, not all the financial aspects have been addressed yet.
Am Power initially planned to have the first part of the evaporator ready by July 2018, but September/October seems to be a more feasible date.
The start-up of the process equipped with the evaporator is foreseen around November 2018 and based on the first results it will be decided how to proceed with the necessary improvements.

## Products and market

Currently, the digestate treated with the membrane system is transformed in biosolids, NK-concentrate and water. The NK-concentrate is used as fertilizer in greenhouses owned by AM Power or spread on grasslands. Biosolids are exported to France where P demand is high. Product characteristics are listed in Table 4.

*Table 4. Composition of the recovered products (target values).*

| | Ammonium sulphate | Biosolids |
|---|---|---|
| Dry matter (%) | 3.19 | 90 |
| Organic matter (%) | 1.67 | 43 |
| N-total (g/kg) | 3 | 27 |
| $P_2O_5$-total (g/kg) | 0.5 | 77 |
| $K_2O$-total (g/kg) | 2.8 | 12 |

## Economic benefits

The economic advantages of reusing recovered products are:

- By improving RO efficiency, AM Power estimated that approximately 160 m³ of water per day will become available as dischargeable water (after polishing) or used on site. This amount of water does not have to be transported and treated, and
- By replacing DAF, the costs for additives will be drastically reduced.

## Sustainability goals

AM Power is committed to reach the following targets:

- Reduce $CO_2$ emissions related to digestate transport,
- Reduce the use of additives and chemicals,
- Promote water recycling and
- Reduce the distance for fertilizers transport by producing locally bio-based mineral fertilizer.