

## 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 <sup>3</sup> )	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 profits of going to 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
<b>Organic biological waste</b>	160 kt
<b>Manure</b>	15 kt
<b>Maize</b>	5 kt
<b>Total</b>	<b>180 kt</b>

## AM Power (Pittem, BE)

### Biogas production

The biogas produced every year (including digesters and post-digester) is around 30 Mm<sup>3</sup> (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.

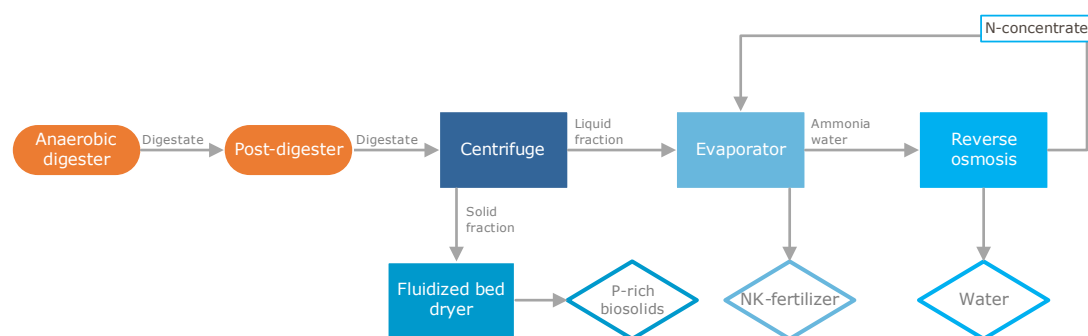
Component	
CH <sub>4</sub> (%)	56
CO <sub>2</sub> (%)	43
H <sub>2</sub> S (ppm)	50
O <sub>2</sub> (%)	0.1
Total biogas production (Mm <sup>3</sup> )	30
Biogas per tonne of feedstock (m <sup>3</sup> /t)	170

### 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 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% dry matter, 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<sub>2</sub>SO<sub>4</sub>) 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)

### Products and market

Every year, the digestate treated with the novel process will be transformed in 12 kt of biosolids, 18 kt of NK-concentrate and 81 kt of water. The NK-concentrate can be mixed with the solid fraction to make a NPK-fertilizer. Biosolids characteristics are listed in table 4; NK-concentrate composition will be determined once the new system will be operating, as it is influenced by the different separation step (no DAF and different polymer dosing).

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

	Biosolids
Dry matter (%)	90
Organic Matter (%)	45
N-total (g/kg)	25
P <sub>2</sub> O <sub>5</sub> -total (g/kg)	50
K <sub>2</sub> O-total (g/kg)	13

### Economic benefits

The economic advantages of reusing recovered products are listed below:

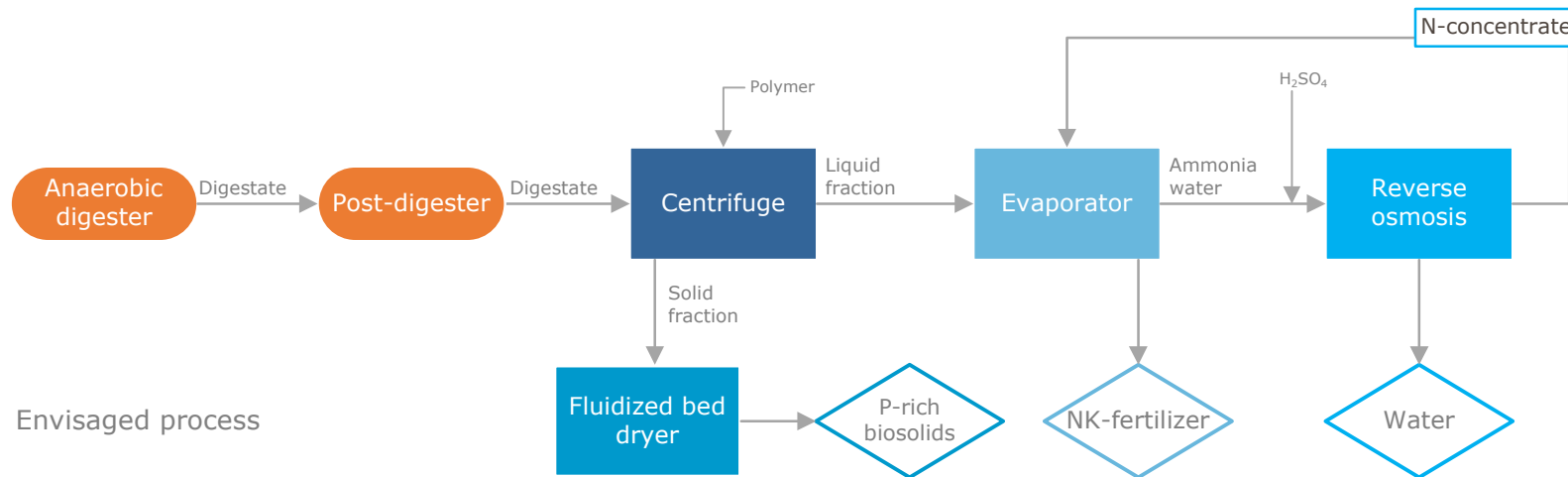
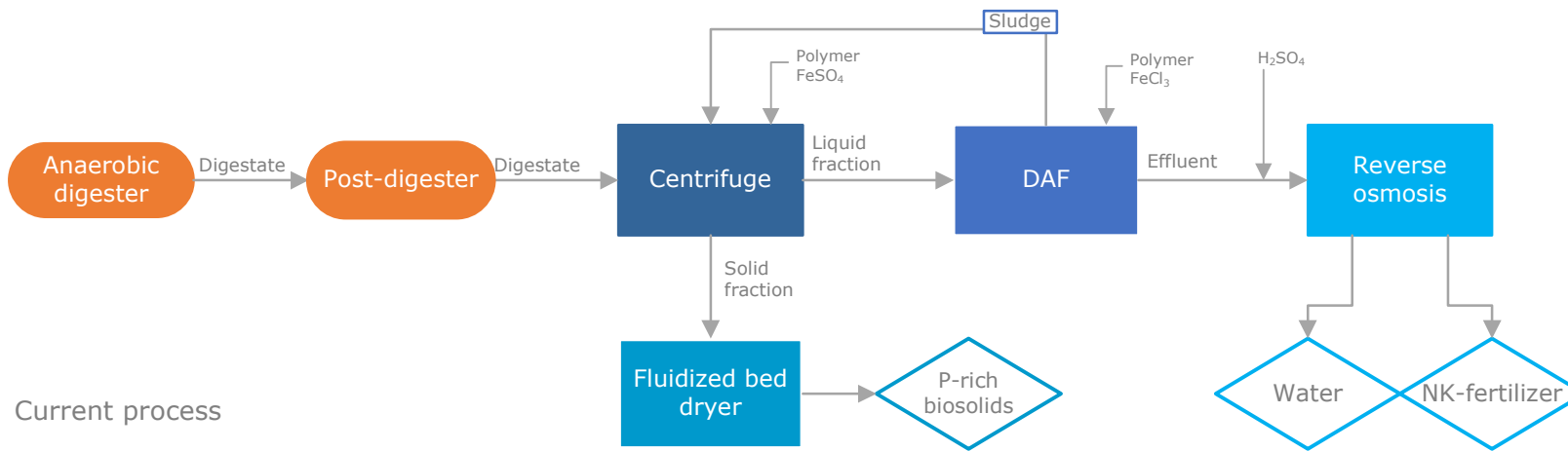
- By improving RO efficiency, AM Power estimated that approximately 160 m<sup>3</sup> of water per day will become available as dischargeable water (after polishing) or used on site. This amount of water doesn't have to be transported and treated.
- By replacing DAF, the costs for additives will be drastically reduced.

### Sustainability goals

AM Power is committed to reach the following targets:

- Reduce CO<sub>2</sub> emissions related to digestate transport.
- Reduce the use of additives and chemicals.
- Promote water recycling.
- Reduce the distance for fertilizers transport by producing locally bio-based mineral fertilizer.

## Annex 2: AM Power Demonstration installation – Pittem (BE)



Technical specifications:

Current process

Name	Type	Treatment capacity (m <sup>3</sup> /h)	Power consumption (kW)	Heat requirement (kW)
Centrifuge	Mechanical separation	25	40	-
Fluidized bed dryer	Drying	2800 lH <sub>2</sub> O/h	250	2500
DAF	Mechanical separation	20	7	2500
Reverse Osmosis	Membrane filtration	20	130	-

Envisaged process\*

Name	Type	Treatment capacity (m <sup>3</sup> /h)	Power consumption (kW)	Heat requirement (kW)
Centrifuge	Mechanical separation	25	40	-
Fluidized bed dryer	Drying	2800 lH <sub>2</sub> O/h	250	2500
Evaporator	Evaporation	15	60	3000
Reverse Osmosis	Membrane filtration	20	30	-

\*estimated data