

# BIOGAS

## Purification Station

# BRECHT

## (Belgium)

*Biogas is a gas resulting from the anaerobic decomposition of organic materials (woody waste, farming residues). For several years, there has been an economically viable alternative to traditional energy sources which is also one of the less expensive renewable energies available. In Brecht, in the Antwerp region, the conclusive results of a pilot biomethanation unit have led to the installation of a larger biogas production plant, marking a new milestone in municipal waste treatment policy.*

## THE CITY

Located 25 km north-east of Antwerp in the Antwerp region, Brecht has a population of almost 25,300. From the end of the XIX century, until the 1970's, several brick-yards grew along the Turnhout-Schoten canal, which runs to the edge of the city. With so much pasture, forest and moorland in the Campine region, farming has been spearheading the local economy for years. In Brecht, there is a Campinois museum, which traces the history of coal mining in the region.

### Climatic information:

Average yearly temperature: 9,4 °C



## CONTEXT

IGEAN, the intercommunity union which was founded in 1969, covers the towns and villages in the northern Antwerp region. This multidisciplinary union supports its' members in their various municipal tasks and takes a lateral approach to the management of regional planning, safety, the environment, and municipal, industrial, and agricultural waste management. A board of directors runs the union, with each community represented and allowed to vote, no matter what size it is.

To eliminate uncontrolled dumping in the Brecht area, and at the initiative of Brecht's town hall, a procedure to provide the region with the necessary infrastructure to treat municipal waste has been instigated. The programme also includes the elimination and depollution of illegal landfills and, within the context of the "IGEAN Plan 2000", aims to reduce the accumulation and production of waste by implementing incentive measures. The first step in implementing this plan was to organize separate collection of municipal organic waste.

At the end of the 1980s, after examining the different technological solutions available on the market, IGEAN opted for biomethanation using the DRANCO (Dry Anaerobic Composting) system. This biotechnology was developed at Gand University and fine-tuned by OWS (Organic Waste Systems). The process involves thermophilic, single-phase anaerobic fermentation of solid or semi-solid organic waste. The anaerobic process was chosen over the aerobic process for the following reasons:

- This solution makes it possible to treat substrates with a relatively high degree of humidity;
- Because the degradation process is confined to airtight reactors, odour emissions are extremely reduced. Ammonia given off during aerobic post-composting of the digestate can easily be controlled;

- The limited ground space requirement;
- The high quality of compost recovered, devoid of pathogens and with a low saline content;
- Lastly, the production of biogas.

IGEAN's choice in 1991 was inspired by the European Directive promoting renewable energies, in particular biogas, and offering to back relevant projects.

## EXPERIENCE OF BRECHT

In 1991, IGEAN ordered a pilot installation from OWS, capable of treating 10 to 15 tons of municipal waste per year (DRANCO 1). The low tonnage compared with estimated potential can be explained by a fear of over-investment. Indeed there was a great deal of uncertainty as to the actual quantity of organic waste available, because selective sorting had been introduced only a short time before and this required a change of mentality in the local population.



The installation was commissioned in June 1992, meeting the needs of 26,000 households. The town pays for each ton of waste treated and has agreed to supply the plant with 8,000 tons per year for 8 years. Certain improvements, made during operations, have optimized the production of biogas which reached an average annual production of  $10 \text{ m}^3/\text{m}^3_{\text{reactor}}$  in 1999 (i.e. a daily intake capacity of  $21.2 \text{ kg of COD}^1/\text{m}^3_{\text{reactor}}$ ). With 55%  $\text{CH}_4$ , Biogas is used to heat the digester and powers a 290 kW generator. The plant uses 40% of the electricity produced and the rest is sold to the national electricity company.

This pilot installation has increased experience with both the new DRANCO anaerobic process as well as selective collection. Following the success of this operation, IGEAN decided in 1999 to build a second installation with a capacity of 45,000 tons of organic waste (DRANCO 2) as well as a wastewater treatment plant for process water and run-off from the treatment centre.

### Production process

Organic waste from selective sorting is stored in a warehouse with a supply capacity of 5 days. Reduced in a rotary drum, the waste is graded to 40mm to obtain the right dimensions for later conversion and treatment. Just before the sifted fraction is transferred to the digester, it is inoculated from the converted residue in the digester and reheated to  $55^\circ\text{C}$  by steam injection.

The substrate is sent to the reactor at a rate of  $100 \text{ m}^3/\text{h}$ . The average retention time is 20 days. Biogas from methane fermentation is accumulated in a gas-holder. It is used as fuel for two 657 kW generators, heat from which is passed through a heat exchanger and used to produce steam (substrate heating). The electricity produced is partly used to run the installation and the surplus sold to the national electricity company.

The digested residue is removed from the reactor, flaked and dehydrated to 50% dry material. It is then sieved and subjected to aerobic post-composting for two weeks. The final product is sold as a high-quality soil improver.

The installation was commissioned in June 2000. The results for the first eleven months are presented in the following table:

<sup>1</sup> COD: Chemical oxygen demand

<b>DRANCO 2 plant</b>	Digester capacity: 3,160 m <sup>3</sup>
<b>Waste used</b>	Kitchen (10-40%), garden (40-75%), paper (14-20%) waste
<b>Production of biogas</b>	118 m <sup>3</sup> /tons of equivalent waste
<b>Production of electricity</b>	8,500 MWh per year
<b>IGEAN investment</b>	16 million Euros
<b>Collection cost</b>	Each community pays 82 Euros per ton of organic waste collected

## EVALUATION AND OUTLOOK

A few years after setting up the "IGEAN Plan 2000" programme, IGEAN, the inter-community union, can boast that it has achieved all its objectives:

- Illegal dumping sites in the region have been eliminated;
- The quantity of waste sent to the landfills has decreased;
- The acquisition of a degassing station for one landfill, biomethanation and wastewater treatment plants have provided a solution for treating the organic fraction of municipal waste.

On this last point, note that the resources used to organize waste sorting strongly influence the quantity and composition of organic waste obtained and consequently the production and quality of biogas.

Also, the waste to energy value of biogas has raised awareness of the various ways in which energy can be produced from renewable sources. These are now systematically envisaged and represent an increasingly important factor in the decision making process.

As long as they are economically justified and do not threaten future development, investment in avant-garde technology will form the basis of IGEAN's policy. IGEAN has therefore entered into a partnership including the region and city of Antwerp, a second inter-community union, and a private company, to discuss the treatment of non-organic municipal waste (restwaste). This project aims to build a "separating-yeasting installation" with a capacity of 150,000 tons. This solution was chosen after examining and evaluating various processes:

- Incinerator combustion with heat recovery,
- Biological drying, separation and a high level of waste to energy recovery in a fluidized bed incinerator.

Waste to energy treatment of biogas is expected to produce an extra 20,000 MWh per year.

### FOR FURTHER INFORMATION

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