Urban waste for biomethane grid injection and transport in urban areas

URBAN BIOGAS
www.urbanbiogas.eu

UrbanBiogas study tour in Munich

Technical description

WP 2 – Task 2.4, D2.3

May 2011

ZAGREBAČKI HOLDING
Podružnica ČISTOĆA

Authors: Bojan Ribić, Zagrebački Holding- Podružnica Čistoća

Contact: Zagrebački Holding - Podružnica Čistoća
Bojan Ribić
Email: Bojan.Ribic@cistoca.hr, Tel: +385 1 6321 325
Radnička cesta 82
10 000 Zagreb, Croatia
www.zgh.hr, www.cistoca.hr

The UrbanBiogas project (Urban waste for biomethane grid injection and transport in urban areas) is supported by the European Commission in the Intelligent Energy for Europe Programme). The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EACI nor the European Commission are responsible for any use that may be made of the information contained therein. The UrbanBiogas project duration is May 2011 to April 2014 (Contract Number: IEE/10/251).

UrbanBiogas website: www.urbanbiogas.eu

Contents

1. Biogas plant of Ganser Entsorgung and BTA technology

Location: Kirchstockach, near Munich
Owner: M. Ganser GmbH & Co
Feedstock: Biowaste from households (>30% green waste)
Technology: BTA Process with two-stage digestion
Capacity: 30,000 t/a
Start: 1997.

Description:
The Ganser Company[1], among others, is using source separated biowaste for energy production at its own biogas plant with an adjacent composting plant. The plant is designed for 20,000 t/y and was extended in 2006 to 30,000 t/y. The enlargement has only increased the volume of the tank for hydrolysis. The production is organized in one-shift (Monday to Friday) and two-shift working is only at the pre-treatment. Total number of employees is 4: plant manager, assistant, waste reception and one at composting site. Gate fee is 70 €/t and about 6,000 t/y are impurities (20%).

Technology:
Pre-treatment stage
Separately collected biowaste is being weighted and unloaded (no separation of wooden materials, only bulky waste is being removed). After magnetic separator, using a conveyor belt, biowaste is transported to the pulper. Biowaste is mixed in pulper with water to obtain a suspension (pulp). Impurities are separated and removed, heavy fraction (stones, sand, metals) and light fraction (plastics, textiles). Smaller impurities are removed using the patented BTA® Grit Removal System before the pulp suspension is pumped into the suspension tank. Volume of the pulper is 30 m^3.

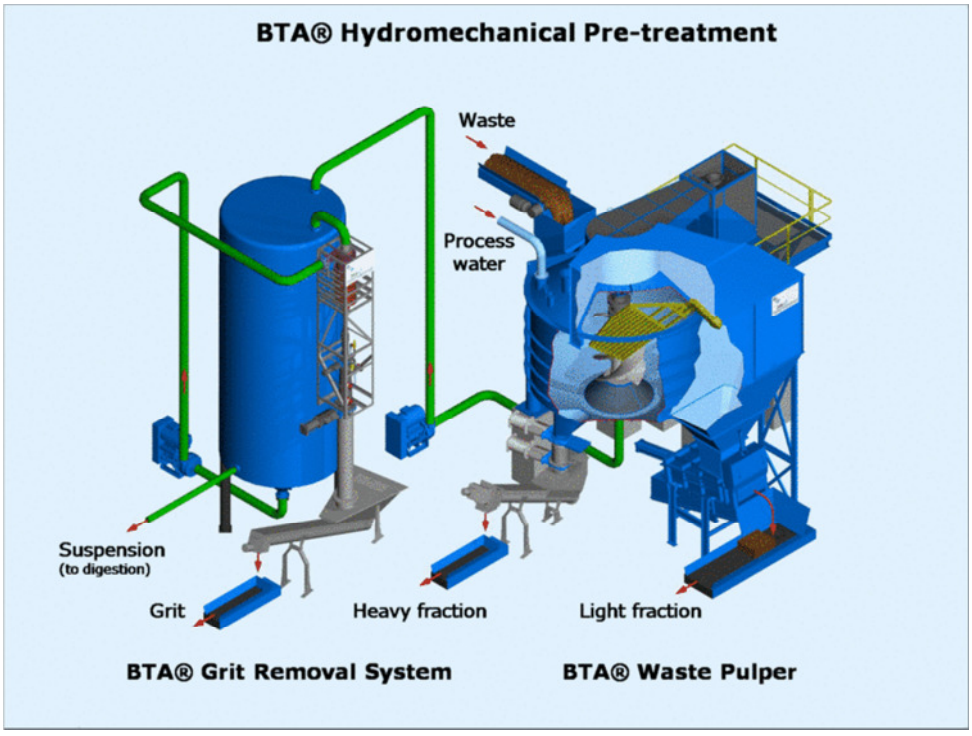

Figure 1: BTA Hydromechanical Pre-treatment

[1] *http://www.ganser-gruppe.de/index.php/entsorgung-bioabfallvergaerungsanlage-muenchen.html*

Figure 2: Reception gate

Figure 3: Unloading biowaste

Figure 4: Biowaste transport

Figure 5: Pulper

Anaerobic stage

The plant is designed in two-stage digestion: hydrolysis and methanization. Before the biological process, pulp is separated in liquid and solid phase. Liquid phase, with higher dissolved organic material (TS: 1.5%) is pumped directly into the fermentation reactor while solid phase (TS: 20-30%) goes into the process of hydrolysis to dissolve the remains of organics. After 2-4 days the liquid suspension goes into digester.

The process is under mesophilic conditions (about 35°C). Dry matter content of input is between 8-12% and the output is 4-6%. Capacity of the hydrolysis tank is 1,200m^3 and digester is 3,000m^3. Tanks are made of steel. Digester has no dynamic mixer therefore recirculation is used for mixing with specially designed system. Retention time in the digester is about 14 days.

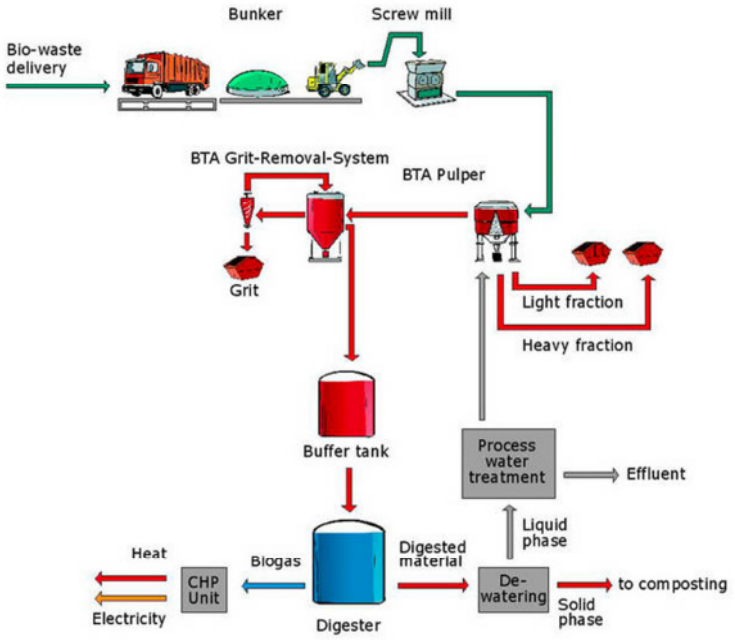

Figure 6: Schematic layout of BTA process

Figure 7: Digester and waste water treatment

Digestate treatment and biogas utilization

Digestate is free of impurities with very low salt content and as such is being mixed with a structural material on a composting site and to be used as organic fertilizer.

Most of the wastewater is re-used back into the pulper and only a part of the effluent goes to waste water treatment system which is consisted of a floatation and nitrification/denitrification stage. After this step, the wastewater with satisfactory quality is released into the public sewage system.

Produced biogas is used in a cogeneration unit (CHP) for production of electrical and thermal energy. The energy is used for the plant while the surplus is fed into the grid (same is with produced thermal energy).

Gas engine in CHP unit is 2x350 kW and allowed concentration of H_2S in biogas is 200 ppm (catering waste could have higher siloxane concentration). Laboratory within the plant is only for basic analysis (dry matter, concentration of volatile organic acids, COD and ammonia).

Figure 8: Composting site

Figure 9: Biogas flare

Figure 10: Solar panels on the roof of the composting site

2. Agricultural biogas plant in Eitting

Location: Eitting, near Munich
Feedstock: Corn silage, manure
Technology: Schmack Biogas[2]
Capacity: approx. 20,000 t/a
Start: 2000

Description:

The plant is designed for biogas production from energy crops (corn silage) and farm waste (manure, slurry). Plant is standard “energy crops” type (around 6,000 agricultural biogas plants are installed in Germany), feedstock reception is without removal of any impurities and it has been fed directly to the digester. Capacity of feedstock storage is 12 months.

Figure 11: Side entrance to the plant

Figure 12: Digesters

[2] *http://www.schmack-biogas.com*

Process is under mesophilic conditions and produced biogas is used in a cogeneration unit (engine: 2xDEUTZ, each 380 kW), for production of electricity and heat. Electrical energy is fed into the grid while the thermal energy is used only for internal purpose for heating the digesters (20-30% of the totally produced heat) where surplus is released into the atmosphere.

Figure 13: Corn silage in the feeding unit

Figure 14: Digester and open lagoon for digestate

3. Biogas plant of Wurzer Umwelt

Location: Eitting, near Munich
Owner: Wurzer Umwelt

Company Wurzer Umwelt[3] is engaged in waste management as well as in maintenance and cleaning of public areas. Within its complex they have: *biogas plant, composting site and sorting facility*. Also they collect wooden bulky waste.

During this year a pilot plant for the pyrolytic waste treatment has been installed (Pyromax).

Figure 15: Vehicle fleet

Biogas plant

The plant produces biogas from source separated organic waste in the area of several counties surrounding Munich (e.g. Erding, Freising). The capacity of the plant is 30,000 t/y and the produced biogas is used in cogeneration unit. After removing impurities or larger parts, biowaste is fed into digesters for process of dry-fermentation (no usage of water). Digesters are horizontal and installed in a hall. The of the digesters is 2x100 m^3 (one of the advantages of such technology is smaller size of digesters) and filled up to 75% of total volume.

Plant is producing 1 MWh_{el} and process is thermophilic (52-56°C). Retention time is 21 days Digestate, after process, is mixed with structural material and used as a fertilizer. The produced thermal energy is used completely in winter to heat the facilities, whereas thein summer there is surplus of heat which is not used.

[3] *http://www.wurzer-umwelt.de*

Figure 16: Cogeneration unit

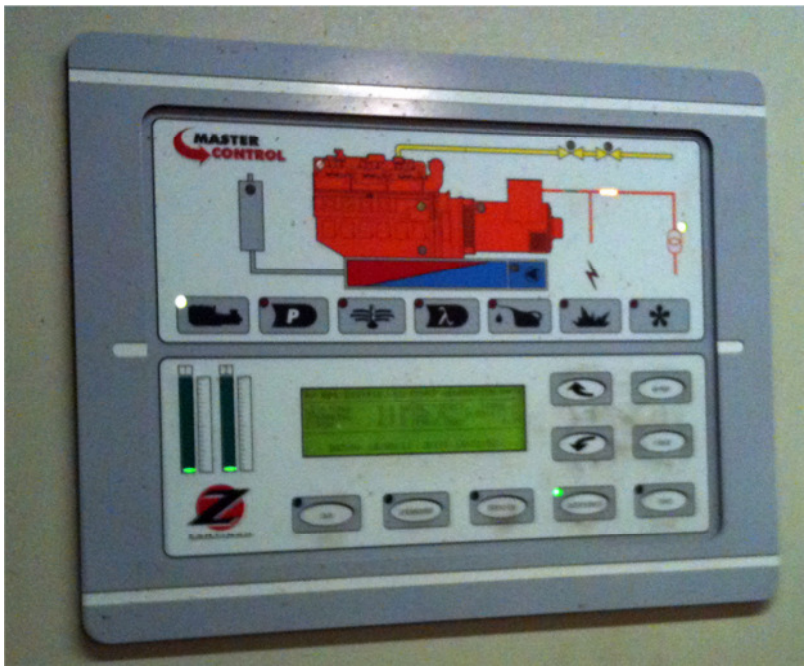

Figure 17: Gas engine control panel

Figure 18: Digesters

Composting site

Separately collected biomass (green waste e.g. from landscape maintenance), which is not suitable for biogas production, together with digestate from anaerobic digestion, is used for composting. Also, biodegradable waste collected during maintenance of public areas, waste wood and organic waste from cleaners are being used at composting site.

Composting process is open type (aerobic fermentation, 2-3 months) where biodegradable waste is sorted in piles by its quality and size. Aeration of compost has been done by transferring the material from one pile to another.

Size of a location is 12,000 m^2 and annually around 100,000 m^3 of biowaste has been composted. Private households are allowed to dispose up to 1 m^3 of biowaste per month, over that is charged.

Figure 19: Grinding and separation of biomass

Figure 20: Unload of biodegradable material for composting

Figure 21: Different types of compost

Sorting facility

Waste, which has been brought in yellow bags, goes into the process of sorting. Yellow bags are for disposal of packaging waste i.e. plastics, tetra-pack, alu/fe. Sorting capacity is 50,000t/y of waste (200-250 t/d), size is approx. 200x30 m and total investment was 10-12 mill €.

Yellow bags are transported using excavators to the separation system where the bags are being removed. After that, depending on a size of a sieve, bigger parts are removed which are manually separated. In the next step, heavy and light fraction is separated (gravity, vibration). Along the entire plant Titech[4] systems for separation are being installed (near IR technology, 11 systems in total). At the end of line different types of plastics, paper/carboard and alu/fe have been sorted.

From the total mass of waste approx. 36% is being recycled, 46% used for energy recovery (heat value : >30 MJ/kg, not considered as incineration) and 18% for incineration (heat value 18 MJ/kg.)

Figure 22: Sorting facility

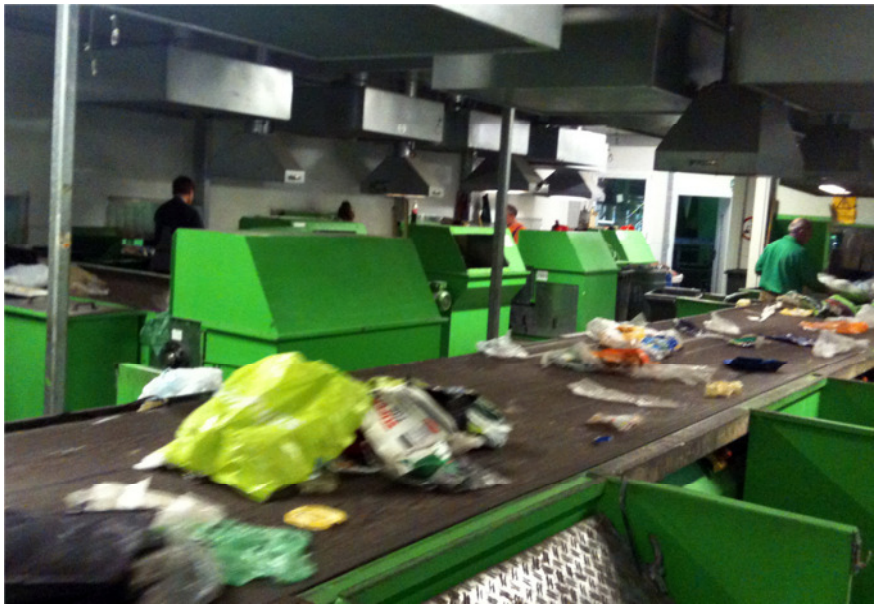

Figure 23: Manual separation

[4] *http://www.titech.com/*

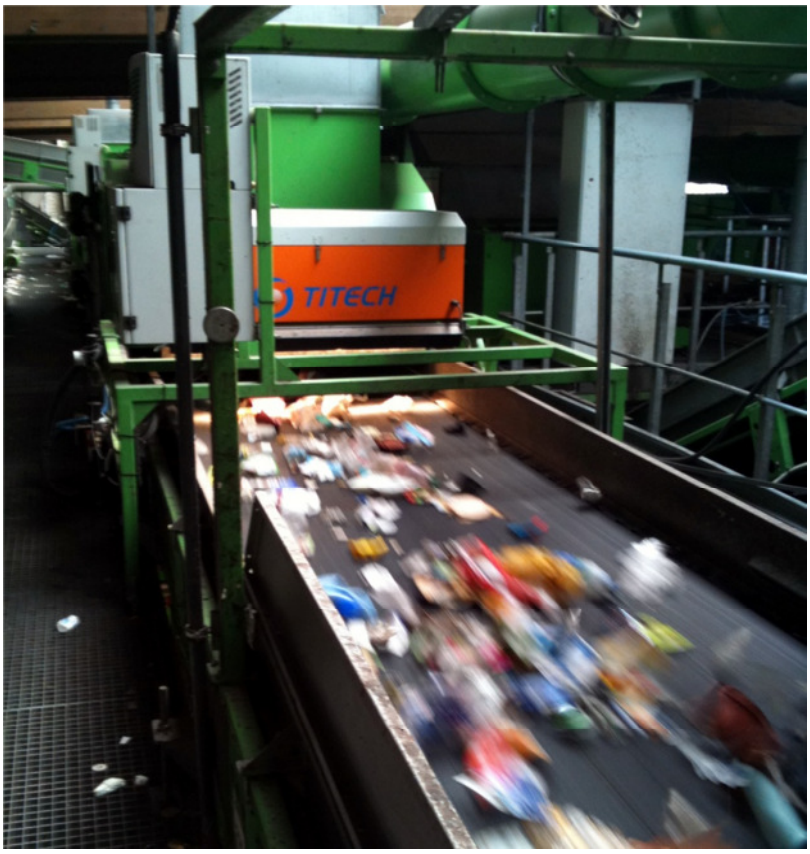

Figure 24: Automatic Separation of light fraction

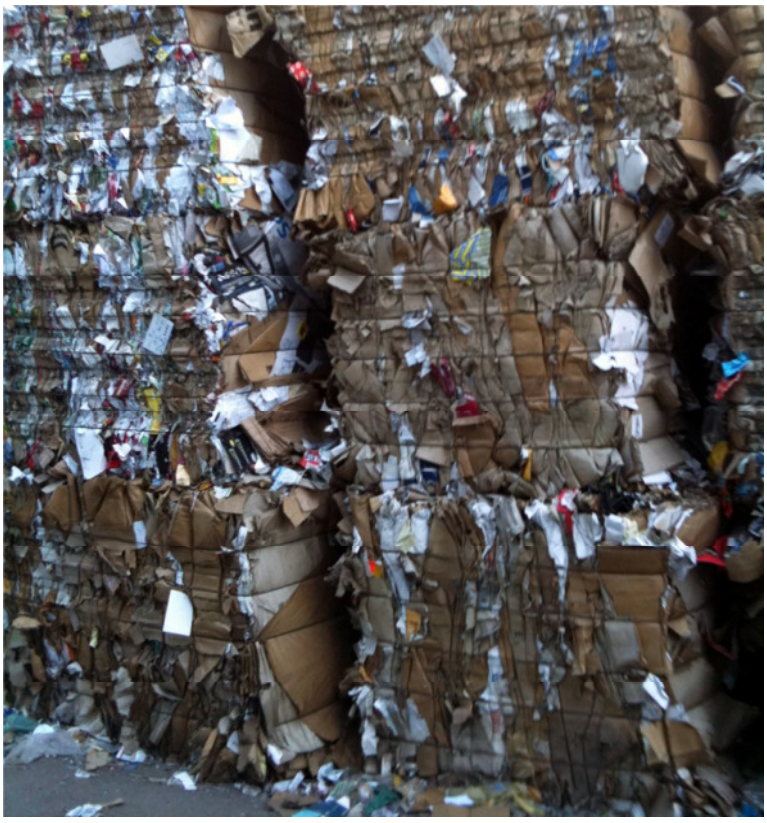

Figure 25: Sorted paper/cardboard

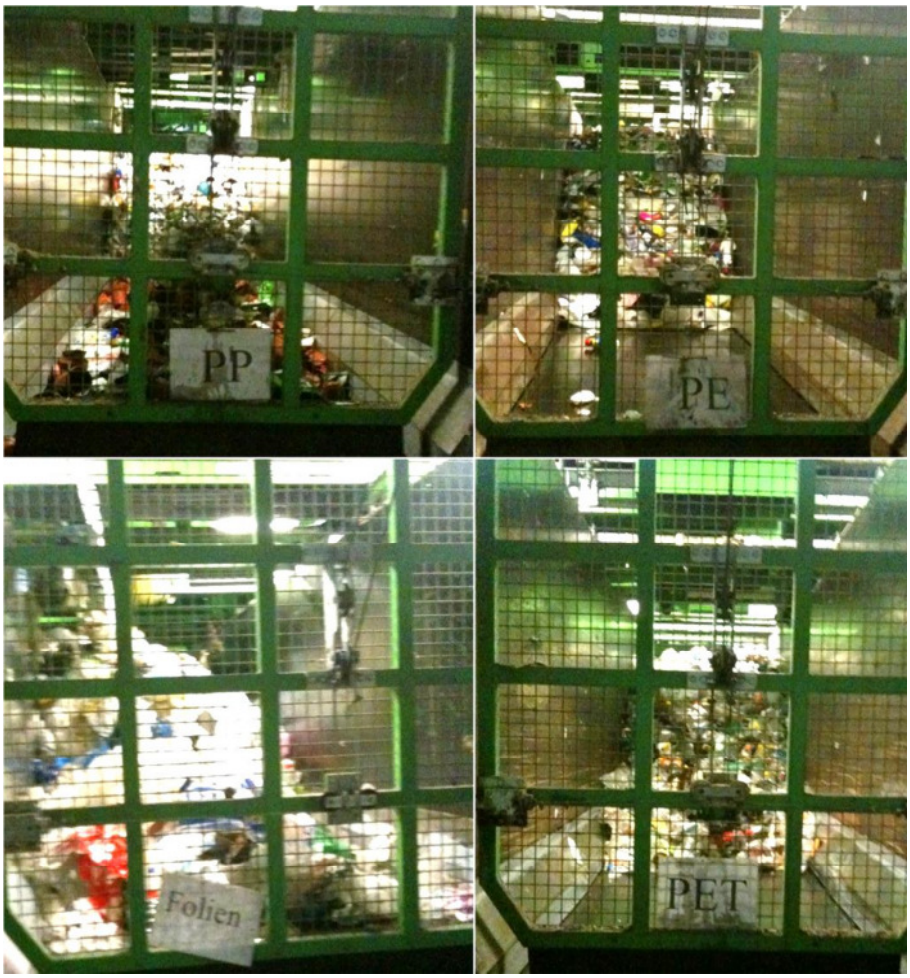

Figure 26: Different types of plastics

Figure 27: Pyromax pilot plant