Urban waste for biomethane grid injection and transport in urban areas

UrbanBiogas study tour in Munich

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UrbanBiogas website: www.urbanbiogas.eu

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1. Introduction

Biogas production from waste has the potential to contribute to the European waste and renewable energy targets. Adjacent upgrading to biomethane quality and grid injection in the natural gas distribution network is an opportunity to efficiently use renewable energy in urban areas. This approach, Waste-to-Biomethane (WtB), is promoted by the UrbanBiogas project. Core of the project is the implementation of five marketable WtB concepts for European cities: City of Zagreb (Croatia), Municipality of Abrantes (Portugal), City of Graz (Austria), City of Rzeszów (Poland), and City of Valmiera (Latvia).

The elaboration of the WtB concepts for the target cities is supported by the organisation of more than 130 events, including workshops, working group meetings, study tours and city exchange visits. One of these events was the organisation of a study tour to biogas plants treating the organic fraction of urban and municipal waste on the occasion of the Kick-off-Meeting of the UrbanBiogas project. The tour was organised by WIP Renewable Energies from Munich, Germany, and took place in the vicinity of Munich (Figure 1) on 18 May 2011.

The first visit was to the biowaste and biogas plant of Ganser Entsorgung in Kirchstockach. A meeting with the technology provider BTA was arranged. The second visit was to the waste and composting company Wurzer Umwelt in Eitting. This visit at Wurzer Umwelt included a tour to its biogas plant, composting facilities and waste separation system of packaging material. 18 participants attended the study tour.

Figure 1: Location of the biogas plants

2. Biogas plant of Ganser Entsorgung and BTA technology

The first visit of the study tour was to the biowaste and biogas plant of Ganser Entsorgung in Kirchstockach. This visit was hosted by BTA International, the technology provider of this plant.

BTA International offers technical solutions for hydromechanical processing and subsequent digestion of bio-wastes, domestic refuse, and miscellaneous municipal and industrial wastes. BTA had recognised that the separation of wastes into manageable fractions at highest possible purity and their appropriate treatment are prerequisites for an environmentally compatible handling of wastes. Moreover, proper and efficient treatment of wastes also results in economic success. BTA feels committed to the task of successfully merging these economic and ecological interests. Therefore, BTA International has developed the BTA® process to a pre-commercial stage already in the 1980s. This method ensures removal of all impurities at an early stage, and combines this step with operationally safe digestion of the organic fraction. The core of the BTA® process consists of the hydromechanical treatment by means of the BTA® Waste Pulper and the BTA® Grit Removal System. (www.bta-international.de).

The biowaste and biogas plant of Ganser Entsorgung has a designed capacity of 20,000 ton/year and treated 30,000 ton/year in 2006. It was started up in 1997 and processes biowaste from households in the vicinity of Munich with a high content of garden waste (>30%). The process is a BTA Process with two-stage digestion. The source of the subsequent description of the process is from BTA[1] (Figure 2).

Waste reception and pre-treatment

The delivered waste is registered with a vehicle scale and brought onto a flat bunker within the delivery hall. Using a front loader, it is fed into a screw mill and chopped roughly. A conveyor belt transports the waste via a magnetic separator to two BTA Waste Pulpers. In the pulpers, the waste is mixed up with water to produce a thick, pumpable suspension (pulp). Contaminants are separated and removed, either as heavy fraction (e.g. glass, stones, metals) or as light fraction (e.g. plastics, textiles). Fine contaminants like sand, little stones, and glass splinters are separated by the subsequent BTA Grit Removal System, before the pulp is stored in a suspension tank.

Hydrolysis and anaerobic digestion

The plant is based on a multi-stage digestion: Digestion is divided into two steps: hydrolysis and methanization in a fixed film reactor. Before being fed into the biological stage of the process, the pulp is separated into a liquid and a solid phase. The liquid phase with a high amount of already dissolved organic material is pumped directly into the methane reactor. The dewatered solids are mixed with process water and fed into the hydrolysis reactor to dissolve the remaining organic solids. After 2-4 days, the suspension is dewatered and the resulting liquid also fed into the methane reactor.

Digestate treatment

The resulting solid hydrolysis residue, contaminant free and low in salt, is further stabilized in the plant's existing composting facility together with garden waste. Most of the water is reused as process water in the pulpers. The effluent water is transferred into a cleaning system consisting of a flotation and nitrification/denitrification steps. The effluent is discharged into the public sewage system.

Biogas utilization

To utilize the biogas, it is fed into two CHPs (combined heat and power stations). The electricity thus produced then is available to meet the consumption of the plant itself. Surplus electricity is fed into the national grid. Waste heat is used for woodchip drying.

[1] http://bta-international.de/fileadmin/media/User_Files/Downloads/Datenblatt_Kirchstockach_en.pdf

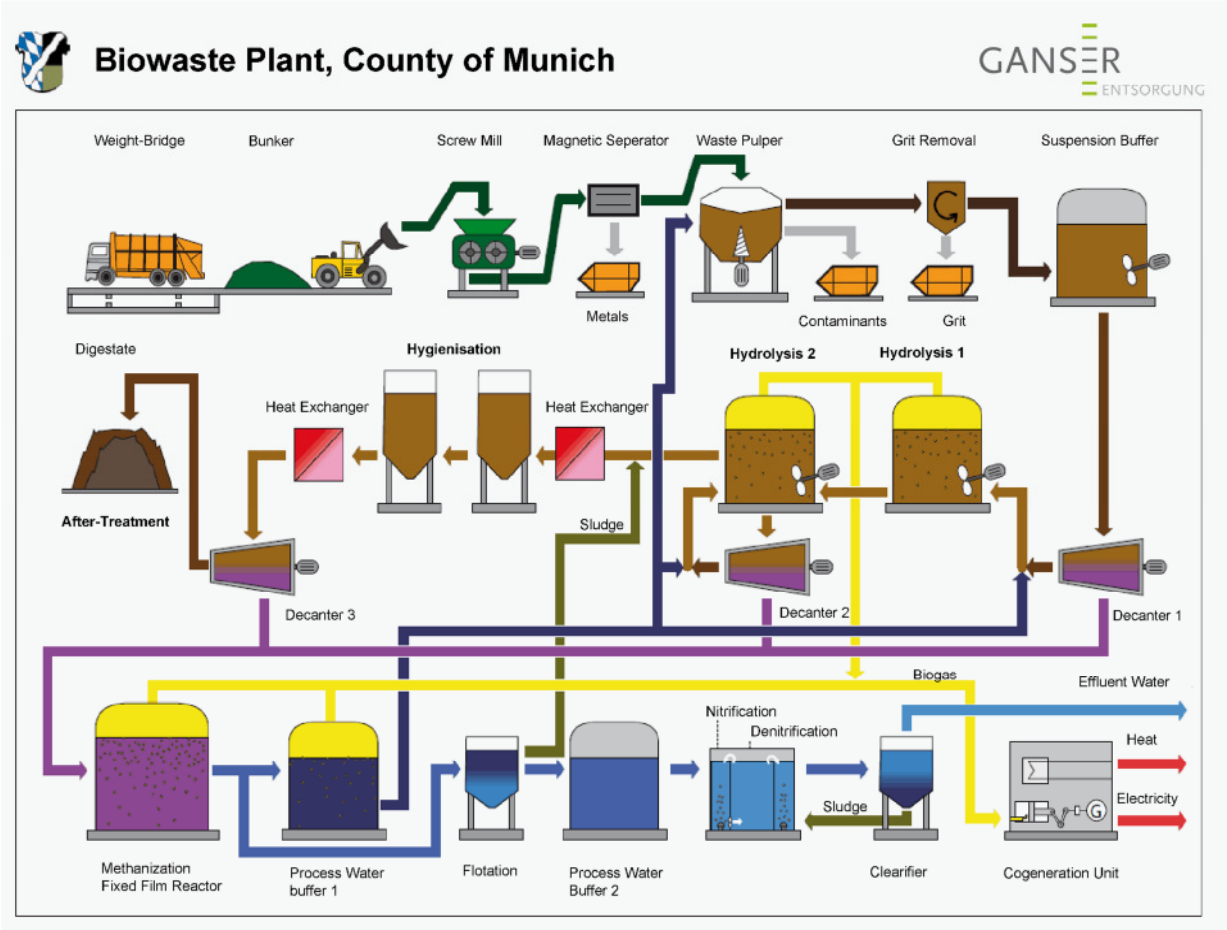

Figure 2: Flowchart of the biogas plant of Ganser

Figure 3: Presentation and discussions representatives of BTA International, the technology provider of the Ganser biogas plant

Figure 4: Waste reception hall of the Ganser biogas plant

Figure 5: Biomass delivery of organic household waste of the Ganser biogas plant

Figure 6: Heat of the CHP plant is used for woodchip drying at the Ganser biogas plant

Figure 7: Digesters of the Ganser biogas plant

Figure 8: At the top of the Ganser biogas plant

Figure 9: Solid fraction of digestate of the Ganser biogas plant

3. Agricultural biogas plant in Eitting

During the lunch break, the study tour participants had the opportunity to see a typical agricultural biogas plant in Eitting. The plant was set-up about ten years ago with an approximate capacity of 300 KWel. The plant was continuously extended and has now a capacity of about 700 KWel. Main feedstock is corn silage, but also food waste, manure and chicken litter are included. The participants had the chance to talk to the plant owner.

Figure 10: Agricultural biogas plant in Eitting

Figure 11: Lunch break in Eitting

4. Biogas plant of Wurzer Umwelt

The second visit was to the waste and composting company Wurzer Umwelt in Eitting. This visit at Wurzer Umwelt included a tour to its biogas plant, composting facilities and waste separation system of packaging material.

The biogas plant of Wurzer Umwelt uses organic municipal waste as feedstock. The organic waste is collected from the households which use “brown bins” for dumping. Wurzer Umwelt also treats and collects packaging material (e.g. plastic bottles, cans, aluminium covers) from the so called “yellow bags” from households. The yellow bags are sorted at Wurzer.

About 28,000 metric tons of biowaste from a collection area with over 500,000 inhabitants are processed in the biogas plant. Organic material is milled and cleaned from bulky non organic material before it is further sized (Figure 13). The material is heated in long heat exchanger tubes. The fermentation process of the biogas plant takes place in two horizontal fermenters. The fermentation process is fully automatically controlled.

The digestate still contains contaminants such as plastic particles (Figure 16) which is removed in the adjacent composting facility. The biogas is used in a CHP plant. Electicity is fed into the grid. Heat of the CHP plant is completely consumed in the different halls and facilities of Wurzer in winter. There is a lack of heat use in summer.

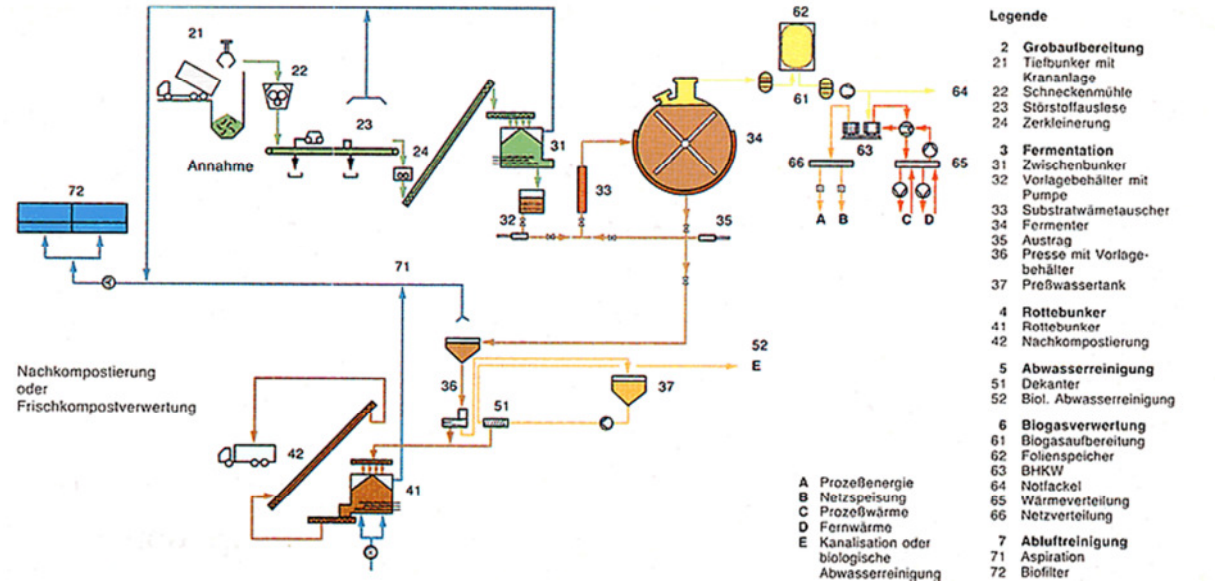

Figure 12: Flowchart of the biogas plant of Wurzer Umwelt

Figure 13: Facilities of Wurzer Umwelt

Figure 14: Waste separation in the administrative district of Erding, Germany: black, brown and blue bins for residual household waste, organic household waste, and paper, as well as the yellow bag for packaging material

Figure 15: Digesters of the biogas plant for organic household waste of Wurzer Umwelt

Figure 16: Solid fraction of digestate of the biogas plant of Wurzer Umwelt

Figure 17: Composting unit of Wurzer Umwelt

Figure 18: Sieving of biomass in the composting unit of Wurzer Umwelt

Figure 19: Delivery hall for sorted household waste (packaging material of the "yellow bag") of Wurzer Umwelt

Figure 20: Separation system for plastic bags and foils of Wurzer Umwelt

Figure 21: Separation system for sorted household waste of Wurzer Umwelt

Figure 22: Separation system for different plastic types of Wurzer Umwelt

Figure 23: Plastic material for recycling at Wurzer Umwelt

ANNEX I Participant list

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- Aldona Gostomska, Polish Biogas Association, Poland
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ANNEX III Agenda of the study tour

Wednesday 18 May 2011

Technical tour to biogas installations in the vicinity of Munich

8:00 Departure

9:00 **Visit of the biogas plant and waste company in Kirchstockach**: Operator: M. Ganser GmbH & Co (http://www.ganser-gruppe.de/index.php/energie-energiegewinnung-bioabfall.html); Feedstock: Organic waste from Munich (30,000 t/year); Technology: BTA Process with two-stage digestion (http://bta-international.de)

13:00 Lunch & visit of an **agricultural biogas plant**

14:00 **Visit of the biogas plant and compost plant in Eitting**: Operator: Wurzer Umwelt (http://www.wurzer-umwelt.de/kompostwerk.html); Feedstock: Organic waste from catering and private gardens (30,000 t/year)

17:00 End/ Departure