Urban waste for biomethane grid injection and transport in urban areas

# *UrbanBiogas study tour report:*

# *Study tour in Austria*

***15th and 16th of May 2013***

*WP 2 – Task 2.4, D2.3*

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(source: GEA)

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UrbanBiogas website: www.urbanbiogas.eu

# Contents

# 1. Introduction

Biogas and/or biomethane 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 or to use it as vehicle fuel are opportunities for a renewable energy production and use 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 Gdynia (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 core events was the organisation of a study tour to biogas plants treating the organic fraction of urban and other organic waste in Austria. The tour on the 15th and 16th of May 2013 was organised by Graz Energy Agency, Austria.

The tour started in Graz and the first plant visit was in Leoben, the second largest city in Styria. After a bus transfer to upper Austria the plant in Engerwitzdorf was visited. On the second day the first plant visit was in Wiener Neustadt and the second in Vienna.

All together 17 participants from Austria, Croatia, Germany, Latvia, Poland and Portugal attended the study tour. In total 4 project partners and 10 city representatives (some of the project partners are also city representatives and therefore added to the categoty city representatives) and stakeholders from the partner cities (city of Valmiera - Executive Vice President/Head of Municipal Administration; city of Zagreb - City Office for Economy, labour and enterprises; city of Rijeka - KD Cistoca; city Fürstenfeld with external consultant; city of Graz with 3 stakeholders/energy suppliers; city of Vienna).

Classified to the different categories this means:

- City representatives: 10
- Potential investors: 0
- Other stakeholders of the WtB value chain from target cities: 3
- Project partners: 4
- Others: 0

The invitation for this study tour was distributed by the project partners in their countries to motivate stakeholders from the target cities to participate. GEA also got in contact with the networks EUROCITIES, ICLEI, CLIMATE ALLIANCE in order to disseminate the study tour and also a newsletter was sent to about 150 business partners in Austria and Germany.


**Figure 1: Stations of the UrbanBiogas study tour in Austria (source: google maps)**

**Legend:** A: Graz; B: Plant Leoben; C: Plant Engerwitzdorf; D: Plant Wiener Neustadt; E: Plant Vienna; F: Graz

**Picture 1: Group photo in front of the gas tank of the biogas plant Vienna (16th May 2013) (source: WIP)**

## 2. Biogas/biomethane plant Leoben

**Picture 2: The biogas/biomethane plant Leoben (source: GEA)**

The first stop was at the biogas plant Leoben. A waste water treatment plant with cofermentation of organic urban waste. Mr. Resch from the company LE Gas and Mr. Ruprecht from Energie Steiermark presented the biogas and the biomethane upgrading plant. The biogas plant is operated by the LE Gas and the upgrading plant by the Energie Steiermark who is also the owner of the gas grid in Styria.

The waste water treatment plant in Leoben was built in the 1980s for Leoben and the surroundings.

In 2005 a very important and innovative research project from Energie Steiermark about fermentation tests, laboratory experiments and the analysis of different upgrading technologies for grid injection started in Leoben. This was the basis for the biogas and biomethane upgrading plant in Leoben.

The biogas plant was built in the years 2008 to 2010 and commissioned in 2010.

The main data of the plant are summarised in the following table:

| | |
|---|---|
| Feedstock | solid: organic urban waste, liquid: sewage sludge – about 50% / 50%<br>about 4.000 to 5.000 t/year organic waste from ”biotonne” and leftovers |
| Fermenter | Round main fermenter (2500 m³) and round secondary fermenter (2500 m³) |
| Upgrading | Chemical absorption - amine scrubbing;<br>$V_{biomethane}$: 160 m³/h |
| Biomethane use | Grid injection to local natural gas grid; 160 m³/h with 100 mbar |
| Residue | Dried and used in incineration plant |
| Start of plant operation | 2010 (reduced production in 2011 and 2012) |

**Table 1: Main data biogas/biomethane plant Leoben**

As coferments urban biowaste from the city of Leoben, food waste, fat, oil and leftovers are used. The residue is dried and used in an incineration plant.

The produced biogas is used at the moment 50% in the 3 Capstone micro-gas-turbines (à 200 $kW_{el}$) and 50% for the biomethane upgrading. The waste heat from the microturbines is used in the amine upgrading process.

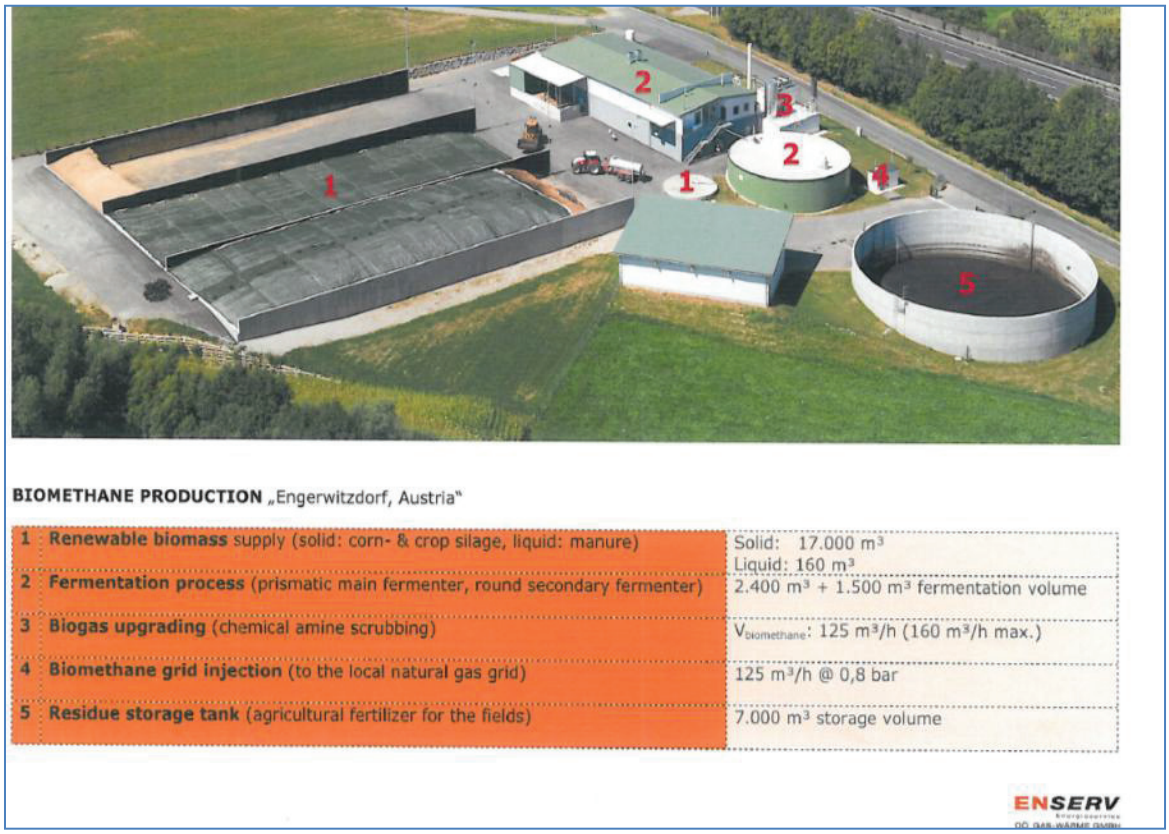
**Picture 3 and 4: Organic urban waste storage and separation plant (source: GEA)**


**Picture 5 and 6: Fermenters and micro turbine (source: GEA)**

The amine-upgrading plant is positioned in two 20ft steel containers. The upgraded biomethane is fed into the natural gas grid with a pressure level of 100 mbar.

**Picture 7 and 8: Amine-upgrading plant (source: GEA)**

# 3. Biogas/biomethane plant Engerwitzdorf

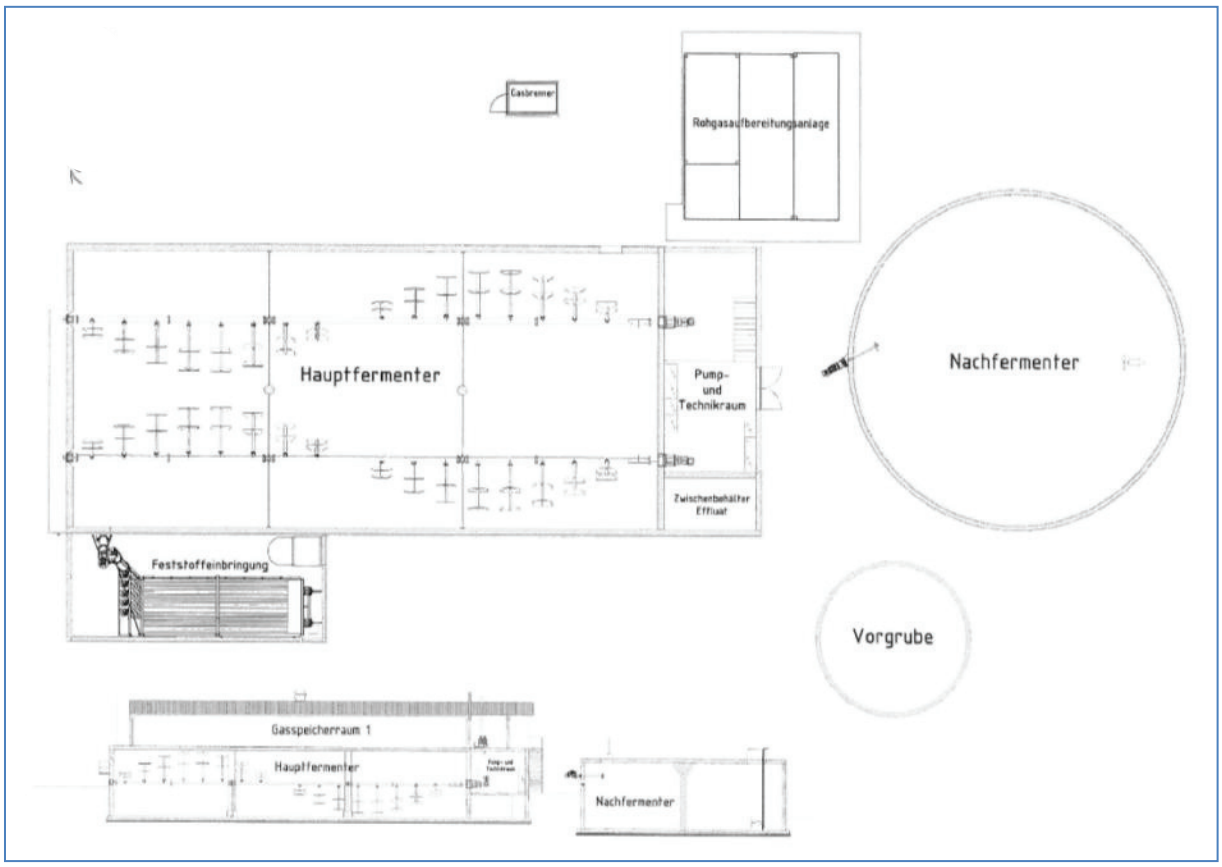



**Picture 9: Biogas/biomethane plant Engerwitzdorf (source: ENSERV)**

The biogas/biomethane plant in Engerwitzdorf is operated with corn- and crop silage and manure. Mr. Kirchmayer from the Oberösterreichischen Gas-Wärme GmbH presented the plant. The feedstock is mainly supplied by 4 farmers. These farmers also operate the biogas plant and they sell the biogas to the Oberösterreichische Gas-Wärme GmbH who is upgrading the biogas to biomethane and injecting this biomethane into their local natural gas grid at a pressure level of 0,8 bar.

| | |
|---|---|
| Feedstock | Solid: corn- and crop silage, liquid: manure<br>Solid: 17.000 m³; liquid: 160 m³ |
| Fermenter | Horizontal prismatic main fermenter (2.400 m³) and round secondary fermenter (1.500 m³) |
| Upgrading | Chemical amine scrubbing;<br>$V_{biomethane}$: 125 m³/h (max. 160 m³/h) |
| Biomethane use | Grid injection to local natural gas grid; 125 m³/h with 0,8 bar |
| Residue | Agricultural fertilizer for the fields; storage tank with 7.000 m³ |
| Start of plant operation | November 2010 |

**Table 2: Main data biogas/biomethane plant Engerwitzdorf**




**Picture 10: Biogas/biomethane plant Engerwitzdorf (picture: ENSERV)**

As the picture above shows, a horizontal prismatic main fermenter with 2.400 m³ is used. The residue storage tank is not covered. The residue is used as a fertilizer by the farmers operating the biogas plant.

**Picture 11 and 12: Feedstock storage and solid material supply (source: GEA)**


**Picture 13 and 14: Secondary fermenter and residue storage tank (source: GEA)**

Also at this plant there is a chemical amine scrubbing for max. 160 m³/h installed.

**Picture 15 and 16: Amine-upgrading plant; addition of propane and odourisation (source: GEA)**

# 4. Biogas/biomethane plant Wiener Neustadt


**Picture 17: Biomethane plant Wiener Neustadt (source: EVN)**

Mr. Domes from EVN Wärme GmbH who installed and is operating the upgrading and grid injection presented the upgrading plant in detail.

The upgrading plant in Wiener Neustadt is very interesting because it was the first industrial membrane technology in Austria (maybe even in Europe).

| | |
|---|---|
| Feedstock | primary and surplus sludge with about 8.200 t/a (about 3.100 t/a oDM) and liquid coferments with about 2.200 t/a oDM |
| Fermenter | round fermenters (2 x 3.500 m³) |
| Upgrading | Membrane technology;<br>$V_{biomethane}$: 120 Nm³/h |
| Biomethane use | Grid injection to local natural gas grid; 120 Nm³/h with 4 bar |
| Residue | Agricultural fertilizer |
| Start of plant operation | 2011 |

**Table 3: Main data biogas/biomethane plant Wiener Neustadt**

The feedstock for this plant is primary and surplus sludge and liquid coferments.

The residue is used as an agricultural fertilizer and a boiler for the offgas (50 to 70kW) is installed. Unfortunately this heat can not be used at the moment.


**Picture 18 and 19: Waste water treatment and fermenters (source: GEA)**

For the membrane technology it is very important to have a good gas quality without impurities (especially sulphur). Because of this there is a separate chemical washer (wet desulphurisation) installed.


**Picture 20 and 21: Wet desulphurisation (source: GEA)**

The upgrading and grid injection is also in this case installed in steel containers. Unfortunately it was not allowed to take pictures from the membranes and their installation.

**Picture 22 and 23: Upgrading plant (source: GEA)**

# 5. Biogas plant Vienna/Pfaffenau

**Picture 24: Biogas plant Vienna/Pfaffenau (source: MA48 Stadt Wien)**

The biogas plant in Vienna Pfaffenau is positioned directly beside the waste incineration plant in a very impressive building. As Ms. Nowak, Ms. Zaunbauer and Ms. Birkmeier told us the city of Vienna has the experience with their waste treatment plants that they are much more accepted within the population when they are looking nice.

The feedstock for the biogas plant is biowaste from the “biotonne”, leftovers and expired food. The actual yearly capacity is about 22.000 tons. The plant was built for a maximum capacity of 34.000 t/year.

The generated biogas is in this case directly used in a high temperature boiler with 1,7 MW. The heat is fed directly (together with the heat from the waste incineration plant) into the district heating net of Vienna.

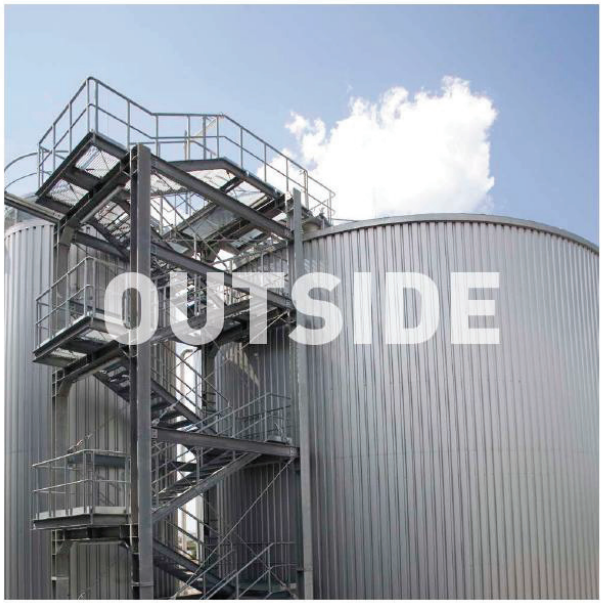
The residue is used for composting to an agricultural fertilizer.

| | |
|---|---|
| Feedstock | Urban biowaste (Biotonne), leftovers and expired food with actually about 22.000 t/year (max. capacity 34.000 t/year) |
| Fermenter | round fermenter (2.700 m³) |
| Biogas production | About 220 Nm³/h; 1,87 million Nm³/year |
| Biogas use | High temperature boiler with 1,7 MW for district heating net Vienna (supplies 1.100 households) |
| Residue | Composting to agricultural fertilizer |
| Start of plant operation | 2007 |

**Table 4: Main data biogas plant Vienna/Pfaffenau**

**Picture 25 and 26: Tiefbunker and delivery of the biowaste (source: GEA, MA48 Stadt Wien)**

**Picture 27 and 28: Turbomixer, separation and hygienisation (source: GEA)**





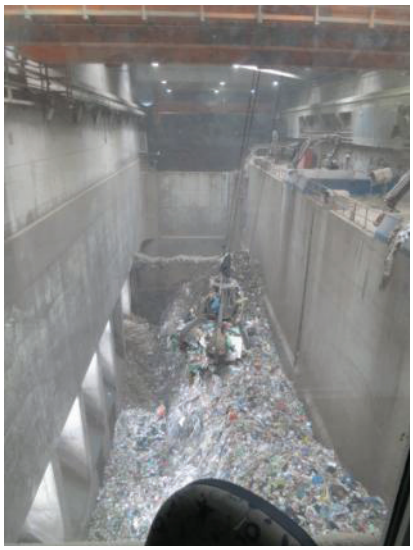
**Picture 29 and 30: Fermenter – outside and inside (source: MA48 Stadt Wien)**

**Picture 31 and 32: Desulphurisation and gas tank with 400 m³ (source: GEA)**


**Picture 33 and 34: High temperature boiler with 1,7 MW and heat exchanger to district heating net (source: MA48 Stadt Wien)**

## Waste incineration plant Vienna Pfaffenau:

There was also the chance to have a guided tour through the waste incineration plant Pfaffenau.

**Pictures 35 to 38: Waste delivery, tiefbunker, exhaust gas pipe, electric filters on the roof (source: GEA)**

# Annex II – Study tour programm and invitation

## Further information

**Registration and information:**
*Graz Energy Agency*
Kaiserfeldgasse 13/I, 8010 Graz
ONLINE-REGISTRATION
Claudia Fitz, +43 316/811848-11
office@grazer-ea.at, www.grazer-ea.at

**www.urbanbiogas.eu**

**Registration deadline:** 1st May, 2013

**Fees and expenses:**
The participation in the study tour is free of charge. Graz Energy Agency covers all expenses for the plant visits and the bus transfers in the frame work of the „UrbanBiogas" project, which is supported by the EU IEE programme. All other expenses (travel to Austria, accommodation, meals) are to be carried by the participants.

**Target group:**
Representatives of European Cities who are interested in biomethane production from Municipal Solid Waste, as well as project partners of the IEE project „UrbanBiogas".
As space is limited, priority is given to representatives from European Cities.

**Accompanied by:**
Ernst Meißner, Graz Energy Agency

Project

Invitation

## Urban Biogas Study Tour in Austria

15th May to 16th May, 2013


The **Urban Biogas study tour** comprises four plant visits with interesting utilization paths. **Experienced experts** will provide the audience background knowledge.

## Urban Biogas Study Tour through Austria

### Wednesday, 15th May 2013

08.15 **Pick up at hotel in Graz**

08.30 **Bus transfer from Graz to the biogas plant in Leoben**

09.30 **Plant visit in Leoben, LE Gas/Energie Steiermark**
*Sewage plant with co-fermentation of organic urban waste*
*Chemical absorption (amine gas treating)*
*130 Nm³/h biomethane grid injection*

11.30 **Bus transfer from Leoben to Engerwitzdorf**

13.30 **Lunch break**

14.30 **Bus transfer to plant in Engerwitzdorf**

15.00 **Plant visit in Engerwitzdorf**
*Organic waste*
*Chemical absorption (amine gas treating)*
*125 Nm³/h Biomethane grid injection*

17.00 **Bus transfer from Engerwitzdorf to Wiener Neustadt (estimated time of arrival at the hotel: 19.30)**

### Thursday, 16th May 2013

08.00 **Bus transfer to the biogas plant in Wiener Neustadt**

08:30 **Plant visit in Wiener Neustadt**
*Sewage plant with co-fermentation of organic urban waste*
*Membrane technology*
*130 Nm³/h biomethane grid injection*

10.30 **Bus transfer from Wiener Neustadt to Vienna**

11.30 **Plant visit in Vienna**
*Organic urban waste*
*2 plants in one location: biogas plant with 220 Nm³/h biogas and waste incineration plant*

13.30 **Bus transfer to Vienna airport (estimated time of arrival at the airport: 14.30)**
*Others: lunch break*

16.00 **Bus transfer from Vienna to Graz (estimated time of arrival at the hotel: 18.30)**