

Urban waste for biomethane grid injection and transport in urban areas

Project No: IEE/10/251



# Report on the inclusion of Waste-to-Biomethane strategies in the city development plans

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Authors: Ilze Dzene, Ekodoma, Latvia  
Flávia Duarte, Irradiare, Portugal  
Ernst Meißner, Graz Energy Agency, Austria  
Monika Kruhek, Zagreb City Holding, Croatia  
Željko Jurić, Energy Institute Hrvoje Požar, Croatia

Editor: Dominik Rutz, WIP, Germany

Contact: Ekodoma  
Ilze Dzene  
Email: [ilze@ekodoma.lv](mailto:ilze@ekodoma.lv), Tel: +371 67323212  
3-3 Nolikta vas Street  
LV1010, Riga, Latvia  
[www.ekodoma.lv](http://www.ekodoma.lv)

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## Abbreviations

AD	Anaerobic Digestion
CHP	Combined Heat and Power (co-generation)
CNG	Compressed Natural Gas
GHG	Greenhouse Gas (emissions)
LBM	Liquefied Biomethane
MBT	Mechanical – Biological Treatment (of waste)
MSW	Municipal Solid Waste
PSA	Pressure Swing Adsorption (biogas upgrading technology)
SEAP	Sustainable Energy Action Plan
TF	Task Force
WtB	Waste to Biogas/Biomethane
WtE	Waste to Energy

## Introduction

The objective of UrbanBiogas project is to stimulate the set-up of Waste-to-Biomethane (WtB) plants in five project target cities – Abrantes (Portugal), Gdynia (Poland), Graz (Austria), Valmiera (Latvia) and Zagreb (Croatia).

In UrbanBiogas project concepts for waste management, biogas and biomethane production, and biomethane use has been prepared for each target city. In order to include these concepts in the development plans of the target cities and to prepare for setting-up business agreements as preparation for real WtB production and use, several presentations at the city councils at different stages of the implementation of UrbanBiogas project activities were made and decision makers from city councils involved in the project activities.

This report gives an overview about activities in four project cities and share experiences and lessons learnt from interaction with city councils and municipal stakeholders.

# 1 Inclusion of the WtB concept in the development plan of Abrantes

## 1.1 Summary of the WtB concept for the city

Valnor and Valorlis are waste management companies that use only a fraction of the biogas produced of the total municipal solid waste available. For this reason, in the developed concepts the possibility to improve this production through the implementation of their AD plants and the installation of biogas upgrading systems was analysed. Currently, these companies use the produced biogas for electricity production through combustion.

The objective of the concept is to investigate the possibility of using together the biogas actually produced with the potential production to obtain LBM (Liquefied BioMethane).

## 1.2 Development planning in the city

In the area of intervention of MédioTejo21 are responsible for the implementation, management and application of national plans systems of waste management.

The waste management systems are mostly municipal companies and are responsible for the collection and treatment of MSW and waste from separate collection. In the area covered by MédioTejo21 there are three systems of waste management, which are:

1. Valnor responsible for waste management in Abrantes; Alter do Chão; Arronches; Avis; Campo Maior; Castelo Branco; Castelo de Vide; Crato; Elvas; Fronteira; Gavião; Idanha-a-Nova; Mação; Monforte; Nisa; Oleiros; Ponte de Sôr; Portalegre; Proença-a-Nova; Sardoal; Sertã; Sousel; Vila de Rei; Vila Velha de Ródão
2. Resitejo responsible for waste management in Alcanena, Chamusca, Constância, Entroncamento, Ferreira do Zêzere e Golegã, Santarém, Tomar, Torres Novas e Vila Nova da Barquinha.
3. Valorlis responsible for waste management in Pombal, Leiria, Marinha Grande, Ourém Batalha e Porto de Mós.

In each case the systems of waste management are responsible for best practices and optimizing the collection and treatment of waste. However, each municipality individually can make a commitment to invest in alternative forms of waste management and waste management assume in your municipality.

Currently there are three plans for Waste Management in the area covered by MédioTejo21, each is reviewed annually by the fund manager based on the improvements needed to the system of waste management.

## 1.3 Activities and implemented changes

Abrantes leads the region MédioTejo which is served by three systems of waste management: Valnor, Valorliz and Resitejo. Specifically, the municipality of Abrantes is served by the waste management system Valnor.

In all systems Waste Management Plan's investment company is set internally in the Administration meeting under supervision of the municipalities which ensures coordination between the municipal plans, including long-term, and the waste management system.

On March 8, 2013, the region of MédioTejo, Inter-municipal Community agreed to join the Covenant of Mayors. During the year 2013 the Sustainable Energy Action Plan was prepared. Among the measures included in the Regional SEAP are waste, where it is considered that the MSW should be forwarded in its entirety for recovery, for example for the production and use of biomethane into the vehicle fleet or perform the "upgrade" biogas to biomethane and introduce into the natural gas network.

It should be noted that the Regional SEAP and the SEAP particularly in Abrantes as key partner organizations includes waste management companies to implement these projects. Waste management companies are responsible for implementation of measures.

The approval of this plan in Executive Council is scheduled for soon at the deliberative organ of the MédioTejo region. This approval allows consolidating commitments to attracting and retaining investment in the use of biogas and biomethane.

### 1.3.1 Presentations and meetings with the city council representatives

A public consultation meeting was held in Leiria on 19<sup>th</sup> of March 2014 which counted on 60 participants.

This event was organized along with a network of cities from another project (climate partnership) in Leiria.

The presentations at the event were made by the mayor of Leiria, the coordinator of Climate partnership project, the minister of the environment and the local University and Polytechnic school.

Mr. Marcos Nogueira attended the event, presenting the concept to the audience and gathering some comments on how to include it on the municipality's planning.



**Figure 1: Marcos Nogueira, IrRADIARE**

The event had participants from local municipalities, waste management companies and representatives from other countries, such as Germany and Lithuania.

The event allowed a discussion on the strategic preference for LBM and on integration with sustainable mobility plans.

Some questions on the criteria to assess these kind of projects, as for example cost/benefits ratio and how it is critical for planning were also mentioned.



**Figure 2: Participants**

### **1.3.2 Changes in the development plan of the city implemented after the meetings**

During the project period, Valnor made some investments in respect of their units of MSW treatment.

Before the UrbanBiogas project in 2011, Valnor started to operate the unit in anaerobic digestion facilities in Valnor Avis. During the same year it started to operate Valnor unit utilization of biogas in the landfill Concavada (Abrantes), and started the preparation unit of fuel derived from waste.

In 2013 Valnor inaugurated the unit of anaerobic digestion of biological treatment of MSW and the preparation of fuel derived from waste which consolidated the pilot nature of the area required under the UrbanBiogas. During the same year the washing unit plastics from MBT started to operate.

In the investment plan approved by the administration in 2013, Valnor is planned enlargement unit anaerobic digestion and consequent production of biomethane. The use of biomethane will demonstrate that higher viability and payback, especially in view of the potential use of structural funding from 2016. The Valnor is on the Local support group of UrbanBiogas since its beginning. In the context of Waste Management Resitejo system has an investment that resulted in 2014 in the use of biogas system. The system is being tested. Being one too Resitejo integral system of MédioTejo region represented in the project by the county leader, Abrantes, these investments also allow the pilot to consolidate the region defined within the project UrbanBiogas nature. The Resitejo only began the participation in the local support group of UrbanBiogas in 2013.

Valorlis recently made significant investments in the generation of biogas from municipal solid waste and its automatic separation. The innovative nature of the project requires a period of consolidation and evaluation before new investments in the short term. Thus, new investment into the production or appreciation of the biogas may result from the positive evaluation of the proposed concept UrbanBiogas course of the project, demonstration of the feasibility of solutions to upgrade the premises of the other pilot regions UrbanBiogas, the articulation of private investments shareholders, and structural, and the evolution of the market offer for increasingly efficient solutions for screening, separation, digestion and conversion.

In both cases, Valorlis and Valnor the use of biomethane into fleets can be considered as ultimate objective the production of biogas based on urban solid waste, as set forth in the Report of the UrbanBiogas Concept and the Sustainable Energy Action Plan of the region MédioTejo.



## 2 Inclusion of the WtB concept in the development plan of Graz

### 2.1 Summary of the WtB concept for the city

The WtB-concept for Graz was developed from June 2012 till August 2013. The concept consists of three parts:

1. The waste management concept
2. The biogas and biomethane production concept
3. The biomethane use concept

#### Waste management concept

The Austrian waste management system is based on the waste framework directive 2008/98/EG, which was transposed into national law through the waste management law 2002 and the amendment BGBl.Nr.I 2011/9. In Austria the regulatory role of waste management is located mainly to the federal government and only some remaining areas (municipal waste), such as the organisation of waste collection and waste management associations and the charging scheme are a matter for the provinces. This situation forces the provinces in parallel with the federal waste management act (AWG 2002) to adopt national waste management laws. For Styria this is defined in the Styrian Abfallwirtschaftsgesetz (waste management law) 2004. A draft amendment to this law was published in April 2014.

Priority of the Austrian waste management is the protection of humans and the environment. The bases for this are low levels of emissions and efficient use of resources. In the field of waste treatment Austria is even today among the leading countries on an international scale.

The main targets of the Austrian waste management sector are:

- Avoidance of harmful effects on humans and on the environment
- As low as possible emissions of air pollutants or gases with an impact on the climate
- Conservation of resources (raw materials, water, energy, landscape, surfaces, landfill volumes)
- Waste recycling or the materials obtained from the same shall not present any greater hazard potential than comparable primary raw materials or products from primary raw materials
- Only such materials should remain as waste, which can be deposited without presenting any hazards for future generations

The goal-reaching shall be oriented according to the following hierarchy:

1. Waste avoidance
2. Preparation for re-use
3. Recycling
4. Other types of recovery (e.g. Energetic use)
5. Disposal

The city of Graz has a long history in waste separation. The separated waste collection started more than 25 years ago. On more than 34.000 sites in Graz (properties, households and public collection centres) the waste containers are positioned. For the following waste fractions different waste containers are foreseen: residual waste, paper, glass, light packaging, metal and organic waste. Textiles, bulky waste, hazardous waste, building rubble, waste oils etc. can be disposed at special collection centres.

The waste separation behaviour in Graz is quite good; it is clearly above the Austrian average. More than 90% of the population of Graz use the separated organic waste collection ("Biotonne") only 8% are self-composting their organic waste. The percentage of

the separated collected organic fraction in the municipal solid waste is in Graz 21% (two percentage points above the Austrian average). An evaluation of the remaining residual waste figured out, that with the remaining organic fraction in this residual waste and optimal waste separation behaviour this percentage could theoretically be increased to about 30 to 34%.

At the moment organic and green waste are mixed and pre-treated at the organic waste treatment plant Sturzgasse Graz and then treated in the composting plant in Frohnleiten (bio-mechanical organic waste treatment plant). Unfortunately, the potential energy from organic waste is not used optimal at the moment, but the landfill gas is used in two CHP plants for electricity and heat generation.

### **Biogas and biomethane production**

The estimated potential of organic waste, which could be utilized in the potential biogas plant Graz, accounts for approximately 48.000 t/a and consists of about 70% organic waste from the brown organic waste bins and the remaining part comes from food waste from restaurants caterings and the food industry, expired food from supermarkets and suppliers, and old bread from bakeries. About 70% of the organic waste arises directly in Graz, the rest comes from its surrounding districts.

For the WtB-plant in Graz a wet fermentation process is foreseen. With the above mentioned substrates about 5.300.000 m<sup>3</sup> biogas with a methane content of about 59% can be produced per year. After upgrading to biomethane about 3.200.000 m<sup>3</sup> biomethane would be available per year. Different upgrading technologies were analysed in the biogas and biomethane production concept with the main focus on PSA, amine scrubber and membrane technology. In the economic analysis the adsorption (PSA)-technology was considered. A connection to the natural gas grid on level 3 (<10 bar) is foreseen.

As several plant locations were in evaluation and no decision about one location was possible till the end of 2013 an estimation for an virtual plant location was created for the economic analysis. This virtual plant location was at the city boundary and as it figured out at the beginning of 2014 when a municipality was found which is interested in the WtB project of the city of Graz this estimation was quite correct.

### **Biomethane use**

The stakeholders of the WtB project of the city of Graz are the City of Graz/Holding Graz, the local energy supplier and local waste disposal company/companies. It is foreseen, that the biomethane should be shared between these partners.

Concerning the kind of use the following sales and utilisation concept for biomethane is planned in Graz

- For public transport in Graz (busses, taxi, etc.)
- For the fleet of the waste collecting trucks, the company cars of the involved companies/stakeholders and in general for corporate fleets
- Product "Naturgas" for industry and households – attractive feed-in tariffs for green electricity

The city of Graz has already 4 CNG busses and several CNG passenger cars and vans and CNG waste collection vehicles are in use. But it is necessary to strongly push the demand for biomethane to ensure a long term use of this product. A higher demand for biomethane should be created, e.g. through the organisation of campaigns and workshops.

Furthermore, the markets have to be boosted (e.g. the market for CNG-vehicles, especially for larger sized ones like trucks and busses) and the situation about the feed-in tariff for green electricity from CHP plants driven with biomethane has to be more transparent (total funding budget, confirmation of the feed in tariff immediately after request and not months/years later, etc.

## 2.2 Development planning in the city

The city of Graz has 30 departments. For the development planning the city council with the department for urban planning is responsible.

The department of urban planning is mainly in charge for:

- the Urban development concept (STEK)
- General issues of urban development
- Zoning plan
- Development planning
- Definition of traffic areas-road regulatory planning
- Executive director of the regional planning advisory board of the planning region Graz and its surroundings
- Design of public spaces (streets and squares)

The monitoring of the waste management is done by a sub-department of the department of environment in the city of Graz. The name of the sub-department is "Abfallwirtschaftscontrolling".

This sub-department is mainly in charge for:

- Management of the Waste Management Association of Graz
- Waste management plan for the city of Graz
- Information and consulting
- Statistical investigations
- Planning and control of waste management measures
- Definition of the schedule for waste collection

In the waste management plan for the city of Graz on one hand the actual waste amounts per category (key performance indicators), the ways of collecting them and the way how they are treated are documented and on the other hand the targets and strategies for the future are defined. At the moment the treatment of the organic waste is defined as an aerobic process (composting plants) as an anaerobic is not existent in the City of Graz up to now.

When a WtB plant will be realised in Graz this has the following effects:

- According if the plant location is in the city of Graz or in one of the surrounding municipalities this may affect the development planning. If the plant location would be in the administrative area of Graz this has to be considered in the urban development concept (STEK). As the plant location in the suburban area or in a municipality nearby Graz is preferred, no changes were foreseen in the STEK up to now.
- Separated waste collection is already implemented in Graz and this system is already integrated in the waste management plan of the city of Graz. The WtB plant will be implemented in the next update.
- As the organic waste and the green waste are mixed right now which is ideal for the composting-process this has to be adapted if a WtB-plant would be realised as for example tree-cut etc. is no ideal substrate for the fermentation process.

## 2.3 Activities and implemented changes

For the WtB project in Graz the strategic partners in the city council were defined at the beginning of the UrbanBiogas project in one of the first task force meetings. This is beside the mayor and the vice-mayor and their representatives the department of environment and the department of development planning. Representatives of these departments participated in many task force meetings and especially in the joint task force meetings.

One important effect out of these meetings was that a consortium between the potential partners for the WtB plant in Graz was formed in 2011/2012 with the main target to work out potential plant locations.

### 2.3.1 Presentations and meetings with the city council representatives

Most of the meetings with the city representatives were in combination with Task Force meetings and Joint Task Force meetings as it was a wish of the city council to be on one hand represented in all meetings by their representatives of the Holding Graz and on the other hand in Joint Task Force meetings also by the representative of the mayor and the vice mayor.

Meeting on 4<sup>th</sup> October 2011 with vice mayor and representatives from ministry of economy, family and youth and association of gas and heat distribution companies (Graz, Holding Graz)

This meeting was in combination with a biomethane task force meeting on biomethane and natural gas in transport sector.

Graz Energy Agency (GEA) presented the UrbanBiogas project and the concept for the WtB-plant in Graz. A main topic was the clarification of strategies and objectives of politics and important associations in the field of biomethane and natural gas use in the transport sector.

The vice-mayor of the city of Graz highlighted, that vehicles operated with natural gas or biomethane are environmental friendly, especially there are hardly any emissions of particles which is an advantage for the city of Graz and its problems with particles in the air. The city of Graz supports the investment in alternative cars and trucks.

#### Participants (city representatives in bold):

Name	Company/Organisation	email
<b>Lisa Rucker</b>	<b>Vice-mayor of City of Graz</b>	<a href="mailto:buengermeisterstellvertreterin.rueckerr@stadt.graz.at">buengermeisterstellvertreterin.rueckerr@stadt.graz.at</a>
Helmut Miksits	FGW, association of gas and heat distribution companies	<a href="mailto:office@gaswaerme.at">office@gaswaerme.at</a>
Josef Hochwald	BMWFJ, Ministry of economy, family and youth	
Boris Papousek	MD, GEA	<a href="mailto:Papousek@grazer-ea.at">Papousek@grazer-ea.at</a>
Birgit Baumgartner	GEA	<a href="mailto:Baumgartner@grazer-ea.at">Baumgartner@grazer-ea.at</a>

Meeting on 25<sup>th</sup> January 2012 with representatives of city of Graz/department of environment and department of finances, representatives of the local and national energy suppliers (Graz, GEA)

The main topic was to inform the representatives of the city and the local and national energy suppliers about the UrbanBiogas project and to discuss potential biomethane use concepts e.g. for CHP, transport sector, etc. Because of these topics it was also combined with a biomethane task force meeting.

Graz Energy Agency (GEA) presented the UrbanBiogas project and the concept about a WtB-plant in Graz.

Main „city relevant“ topics and results:

- Political target of the city of Graz: reduction of CO<sub>2</sub> emissions but also NO<sub>x</sub> and fine dust has to be considered (smog-situation in winter in Graz). City of Graz has subsidies especially for gas driven cars.
- Problems with the biogas/biomethane plant in Leoben (no production and feed-in at the moment) are communicated via media. So the population in Graz is sensitised. The question about the plant location for a WtB plant in Graz will be a very essential one.
- For more detailed analysis as for example for the evaluation of a potential plant location for a WtB-plant a separate group with the main players should be formed.
- Biogas/biomethane for the transport sector is an environment friendly and economic solution – the study of Graz Energy Agency concerning the “Biogas-Gesamtbewertung” figured out this quite good

**Participants (city representatives in bold):**

Name	Company/Organisation	email
Michael Hermann	E-Steiermark	<a href="mailto:Michael.Hermann@e-steiermark.com">Michael.Hermann@e-steiermark.com</a>
Johann Pressl	AK Steiermark	<a href="mailto:johann.pressl@akstmk.at">johann.pressl@akstmk.at</a>
Robert Mark	Energie Graz	<a href="mailto:R.Mark@energie-graz.at">R.Mark@energie-graz.at</a>
<b>Ulrike Temmer</b>	<b>Stadt Graz/A8</b>	<a href="mailto:Ulrike.Temmer@stadt.graz.at">Ulrike.Temmer@stadt.graz.at</a>
<b>Werner Prutsch</b>	<b>Stadt Graz/ Umweltamt</b>	<a href="mailto:Werner.Prutsch@stadt.graz.at">Werner.Prutsch@stadt.graz.at</a>
<b>Wolfgang Götzhaber</b>	<b>Stadt Graz/ Umweltamt</b>	<a href="mailto:Wolfgang.Goetzhaber@stadt.graz.at">Wolfgang.Goetzhaber@stadt.graz.at</a>
Boris Papousek	CEO, Grazer Energieagentur	<a href="mailto:Papousek@grazer-ea.at">Papousek@grazer-ea.at</a>
Daniel Schinnerl	PM, Grazer Energieagentur	<a href="mailto:Schinnerl@grazere-ea.at">Schinnerl@grazere-ea.at</a>

Meeting on 2<sup>nd</sup> October 2013 with the chief officer of the sub-department for Waste Management - Abfallwirtschaftscontrolling (Graz, Department of Environment)

After several telephone conferences with the department of environment and the sub-department of waste management a meeting was organized by GEA.

The main topics and results:

- In the waste management plan of the city of Graz the way of waste separation, the key figures and the actual way of treatment of the different waste sections is described in detail. Up to now the aerobic treatment of the organic waste is documented as at the moment the organic waste is composted.
- The organic waste resources as substrates from the “brown bins” for the WtB plant Graz were defined and potentials for the future evaluated.
- There are already many activities of the department of environment/sub-department of waste management to optimise the waste separation in the city of Graz. Joint activities within the UrbanBiogas project would be possible at the beginning of 2014.

**Participants:**

Name	Company/Organisation	email
DI Dr. Alexandra Loidl	Stadt Graz Referat für Abfallwirtschaftscontrolling	<a href="mailto:alexandra.loidl@stadt.graz.at">alexandra.loidl@stadt.graz.at</a>
DI Ernst Meißner	Grazer Energieagentur	<a href="mailto:Meissner@grazer-ea.at">Meissner@grazer-ea.at</a>

Meeting on 4<sup>th</sup> February 2014 with representatives of the city of Graz and the members of the board of the local energy suppliers and the Holding Graz, representatives of the Styrian chamber of trade and economy, the Energy Consultant of Styria and 3 universities in Styria (Graz, Energie Steiermark)

The representatives of the mayor and the vice-mayor of city of Graz participated to this Joint Task Force meeting. The use of the urban waste (organic waste and residual waste) as feedstock for the planned biogas/biomethane plant in Graz was one of the main topics. This event had a very important effect on the further joint discussions about the biogas plant in Graz.

The main “city relevant” topics and results:

- The waste resource of Graz has a high potential and should be used for the production of biogas/biomethane, heat and electricity – the exact actual amounts and a forecast for 2020 should be worked out for the next task force meeting
- The local energy suppliers have a high interest in the energetic use of these waste resources – “waste” heat can be used for the district heating net of Graz
- The biogas/biomethane plant for Graz is still in discussion but the plant-location is not cleared. A municipality nearby Graz is interested in the WtB concept. A plant location in the suburban area or in a neighbouring municipality is preferred.
- The city of Graz and the local energy suppliers have high interest in the in the product biomethane

**Participants (city representatives in bold):**

Name	Company/Organisation	Function
<b>DI Wolfgang Götzhaber</b>	<b>Stadt Graz Referat für Abfallwirtschaftscontrolling/ department for waste management controlling</b>	Referatsleiter
Mag. Dr. Gert Heigl	Energie Graz	Geschäftsführer
Univ.-Prof. DI Dr. Christoph Hochenauer	Technische Universität Graz - Institut für Wärmetechnik	Institutsleiter
Dr. Hans Jaklitsch	Wirtschaftskammer Steiermark	Institut für Wirtschafts- und Standortentwicklung
DI Wolfgang Jilek	Land Steiermark	Landesenergiebeauftragter
DI Olaf Kieser	Energie Steiermark	Vorstandsdirektor
<b>Mag. Christian Köberl</b>	<b>Stadt Graz/ city of Graz – representative of the mayor</b>	Büro des Bürgermeisters
<b>Thomas Lampesberger</b>	<b>Stadt Graz/ city of Graz – representative of the vice-mayor</b>	Büro der Umweltstadträtin
DI Wolfgang Malik	Holding Graz	Vorstandsdirektor
DI Ernst Meißner	Grazer Energieagentur	Projektleiter
DI Gerald Moravi	Steirische Gas-Wärme	Bereichsleiter Fernwärme
Mag. Barbara Muhr	Holding Graz	Vorstandsdirektorin
GF DI Boris Papousek	Grazer Energieagentur	Geschäftsführer
DI Johann Pressl	Arbeiterkammer Steiermark	Abteilung Wirtschaft, Energie
<b>DI Dr. Werner Prutsch</b>	<b>Stadt Graz Referat für Abfallwirtschaftscontrolling/ department for waste management controlling</b>	Abteilungsleiter
DI Christian Purrer	Energie Steiermark	Vorstandsdirektor

Name	Company/Organisation	Function
Univ.-Prof. DI Dr. Harald Raupenstrauch	Montanuniversität Leoben - Lehrstuhl für Thermoprozesstechnik	Departmentleiter
MMag. Werner Ressi	Energie Graz	Geschäftsführer
Prof. DI Karl Rose	Strategy Lab	energiepol. Berater
DWI (FH) Peter Schlemmer	Energie Graz	Leiter Fernwärme Ausbau & Betrieb
DI Robert Schmied	Holding Graz	Geschäftsführer
DI Erich Slivniker	Energie Graz	Bereichsleiter Ausbau und Betrieb
Ao.Univ.-Prof. Mag. Dr. Karl Steininger	Universität Graz - Institut für Volkswirtschaftslehre	Sprecher Forschungsschwerpunkt
DI Martin Zimmer	Steirische Gas-Wärme	Projektierung therm. Erzeugungsanlagen

Participation of the representative of the vice mayor to the Waste Task Force Meeting on 28<sup>th</sup> February 2014 (Graz, Energie Steiermark)

The main “city relevant” topics and results:

- Potential plant location for a biogas/biomethane plant in Graz is not cleared but a municipality nearby Graz is interested in the WtB concept. The city of Graz and the local energy suppliers are highly interested.
- The actual available organic waste from the city of Graz for a biogas/biomethane plant in Graz is roughly conforming to the data in the UrbanBiogas waste management concept from July 2012.
- It is important that the fermentation residues of a biogas/biomethane plant are going to be integrated in agricultural use again as these substrates are otherwise missing in the cycle as it works now in the city of Graz (organic waste is composted).

**Participants (city representatives in bold):**

Name	Company/Organisation	email
Dr. Ulrike Gelbmann	University of Graz ISIS - Institute of Systems Sciences, Innovation, and Sustainability Research	<a href="mailto:ulrike.gelbmann@uni-graz.at">ulrike.gelbmann@uni-graz.at</a>
Prof. Rupert Baumgartner	University of Graz ISIS - Institute of Systems Sciences, Innovation, and Sustainability Research	<a href="mailto:rupert.baumgartner@uni-graz.at">rupert.baumgartner@uni-graz.at</a>
DI Veit Ruprecht	Steirische Gas-Wärme GmbH	<a href="mailto:veit.ruprecht@e-steiermark.com">veit.ruprecht@e-steiermark.com</a>
Ing. Alex Luidolt	Planergy	<a href="mailto:alex.luidolt@planergy.at">alex.luidolt@planergy.at</a>
DI Walter Sattler	Holding Graz-Services Abfall	<a href="mailto:Walter.Sattler@holding-graz.at">Walter.Sattler@holding-graz.at</a>
<b>DI Dr. Alexandra Loidl</b>	<b>Stadt Graz Referat für Abfallwirtschaftscontrolling/ department for waste management controlling</b>	<a href="mailto:alexandra.loidl@stadt.graz.at">alexandra.loidl@stadt.graz.at</a>
DI Martin Zimmer	Steirische Gas-Wärme	<a href="mailto:martin.zimmer@e-steiermark.com">martin.zimmer@e-steiermark.com</a>
Dr. Helmfried Spiegel	Energie Steiermark	<a href="mailto:helmfried.spiegel@e-steiermark.com">helmfried.spiegel@e-steiermark.com</a>
<b>DI Dr. Werner Prutsch</b>	<b>Stadt Graz Umweltamt/ department of environment</b>	<a href="mailto:werner.prutsch@stadt.graz.at">werner.prutsch@stadt.graz.at</a>

Name	Company/Organisation	email
<b>Thomas Lampesberger</b>	<b>Stadt Graz, Büro der Umweltstadträtin/ Representative of the vice-mayor</b>	<a href="mailto:Thomas.Lampesberger@stadt.graz.at">Thomas.Lampesberger@stadt.graz.at</a>
<b>DI Wolfgang Götzhaber</b>	<b>Stadt Graz Umweltamt/ department of environment</b>	<a href="mailto:Wolfgang.Goetzhaber@stadt.graz.at">Wolfgang.Goetzhaber@stadt.graz.at</a>
DWI Peter Schlemmer	Energie Graz	<a href="mailto:p.schlemmer@energie-graz.at">p.schlemmer@energie-graz.at</a>
DI Thomas Schleifer	Energie Graz	<a href="mailto:t.schleifer@energie-graz.at">t.schleifer@energie-graz.at</a>
GF DI Boris Papousek	Grazer Energieagentur	<a href="mailto:papousek@grazer-ea.at">papousek@grazer-ea.at</a>
DI Ernst Meißner	Grazer Energieagentur	<a href="mailto:meissner@grazer-ea.at">meissner@grazer-ea.at</a>
Prof. DI Karl Rose	Strategy Lab	<a href="mailto:k.rose@strategylab.at">k.rose@strategylab.at</a>
DI Dr. Peter Gspaltl	Land Steiermark, A15	<a href="mailto:peter.gspaltl@stmk.gv.at">peter.gspaltl@stmk.gv.at</a>
Dr. Peter Pechtl	VTU Energy	<a href="mailto:peter.pechtl@vtu.com">peter.pechtl@vtu.com</a>

Participation of the department of environment and the department of development planning to Joint Task Force Meeting at 25<sup>th</sup> April 2014

In total 11 people participated this Joint Task Force meeting, mainly from the city of Graz, the local energy suppliers and from the department of development planning.

The main “city relevant” topics and results:

- There is a positive signal from a municipality nearby Graz which is interested in the WtB project of Graz according a potential plant location
- There is an update for the urban planning concept of the city of Graz in evaluation right now. Reserved areas should be defined now for plants foreseen in the near future.



Figure 3: Participants of Meeting at April 25<sup>th</sup>, 2014

**Participants (city representatives in bold):**

Name	Company/Organisation	e-mail
<b>DI Wolfgang Götzhaber</b>	<b>Stadt Graz Umweltamt/ department of environment</b>	<a href="mailto:Wolfgang.Goetzhaber@stadt.graz.at">Wolfgang.Goetzhaber@stadt.graz.at</a>
DI Wolfgang Jilek	Land Steiermark, Landesenergiebeauftragter	<a href="mailto:wolfgang.jilek@stmk.gv.at">wolfgang.jilek@stmk.gv.at</a>
<b>DI Nina Marinics-Bertovic</b>	<b>Stadt Graz Stadtplanungsamt/ department for development planning</b>	<a href="mailto:Nina.Marinics-Bertovic@stadt.graz.at">Nina.Marinics-Bertovic@stadt.graz.at</a>



Name	Company/Organisation	e-mail
DI Ernst Meißner	Grazer Energieagentur	meissner@grazer-ea.at
DI Gerald Moravi	Steirische Gas-Wärme	gerald.moravi@e-steiermark.com
GF DI Boris Papousek	Grazer Energieagentur	papousek@grazer-ea.at
DI Johann Pressl	Arbeiterkammer	johann.pressl@akstmk.at
<b>DI Dr. Werner Prutsch</b>	<b>Stadt Graz Umweltamt/ department of environment</b>	werner.prutsch@stadt.graz.at
DI Thomas Schleifer	Energie Graz	t.schleifer@energie-graz.at
DWI Peter Schlemmer	Energie Graz	p.schlemmer@energie-graz.at
DI Robert Schmied	Holding Graz	robert.schmied@holding-graz.at

*Participation of the representative of the Mayor and the department of environment to the Joint Task Force Meeting at 9<sup>th</sup> May 2014*

This Joint Task Force Meeting was especially organised to bring together all relevant actors of the waste management in the city of Graz. 26 people participated to this event and beside the technical experts of the waste management also the representative of the mayor of the city of Graz and a representative of the Styrian provincial government participated to this workshop.

The main “city relevant” topics and results:

- The organic urban waste amount from the city of Graz is still conforming to the data in the UrbanBiogas waste management concept from July 2012. This waste is “owned” by the city of Graz and so the city of Graz has the right to declare how this substrate should be used. Short and medium term contracts with waste management companies have to be considered.
- If the organic urban waste is used in a biogas/biomethane plant it has to be guaranteed that the digestate can be used in agriculture as this substrate is used right now in composting plants and this part would be missing if the digestate is used in another way.
- Concerning the WtB-plant for Graz a municipality nearby Graz has interest in the WtB-plant and detailed negotiations about the land site started right now. The members of the consortium Graz (city of Graz, local energy supplier, waste management company) are highly interested in the project.
- The biomethane produced in the potential plant Graz can be used by the consortium partners as foreseen in the Biomethane-use concept. One part can be used for example in (existing) CHP plants producing green electricity by substituting natural gas. If the existing subsidy scheme for such a fuel change is also relevant has to be discussed with ÖMAG.



Figure 4: Participants of Meeting at May 9<sup>th</sup>, 2014

**Participants (city representatives in bold):**

Name	Company/Organisation	e-mail
DI Josef Binder	Binder	j.binder@energie-center.at
Johannes Binder	Binder	
DI Willibald Ehrenhöfer	Forstbetrieb Franz Mayr-Melnhof-Saurau - Forstdirektion	w.ehrenhoefer@mm-forst.at
<b>DI Wolfgang Götzhaber</b>	<b>Stadt Graz Umweltamt/ department of environment</b>	Wolfgang.Goetzhaber@stadt.graz.at
DI Erich Gungl	Stmk. Landesregierung A 14	erich.gungl@stmk.gv.at
<b>Mag. Christian Köberl</b>	<b>Stadt Graz, Büro des Bürgermeisters/ representative of the Mayor</b>	christian.koeberl@stadt.graz.at
Franz Köberl	Elektrotechnik Köberl	
<b>DI Dr. Alexandra Loidl</b>	<b>Stadt Graz Referat für Abfallwirtschaftscontrolling/ department for waste management controlling</b>	alexandra.loidl@stadt.graz.at
Ing. Alex Luidolt	Planergy	alex.luidolt@planergy.at
DI Ernst Meißner	Grazer Energieagentur	meissner@grazer-ea.at
Dr. Christian Metschina	Biomasseverband, Landwirtschaftskammer Stmk.	christian.metschina@lk-stmk.at
DI Gerald Moravi	Steirische Gas-Wärme	gerald.moravi@e-steiermark.com
Mag. Jochen Pach	Holding Graz-Services Abfall	reinhard.padinger@joanneum.at
GF DI Boris Papousek	Grazer Energieagentur	papousek@grazer-ea.at
DI Johann Pressl	Arbeiterkammer	johann.pressl@akstmk.at
<b>DI Dr. Werner Prutsch</b>	<b>Stadt Graz Umweltamt/ department of environment</b>	werner.prutsch@stadt.graz.at
DI Dr. Christian Rakos	Propellets Austria	rakos@propellets.at
DI Veit Ruprecht	Steirische Gas-Wärme GmbH	veit.ruprecht@e-steiermark.com
DI Walter Sattler	Holding Graz-Services Abfall	Walter.Sattler@holding-graz.at
DI Thomas Schleifer	Energie Graz	t.schleifer@energie-graz.at

Name	Company/Organisation	e-mail
DWI Peter Schlemmer	Energie Graz	p.schlemmer@energie-graz.at
Mag. Hannes Schuster	Saubermacher	g.ziehenberger@saubermacher.at
Dr. Helfried Spiegel	Energie Steiermark	helfried.spiegel@e-steiermark.com
Ing. Josef Schützenhöfer	KWB	office@kwb.at
Ing. Helmut Wilfinger	IBHW (Ingenieurbüro)	h.wilfinger@ibhw.at
DI Martin Zimmel	Steirische Gas-Wärme	martin.zimmel@e-steiermark.com

### 2.3.2 Changes in the development plan of the city implemented after the meetings

The main target of all the meetings was to keep the city representatives informed about the process and to assist the process towards the realisation of a WtB plant in Graz. As the problem with the location for the plant was a very essential one it was very positive that a consortium of the main players (representative of the city of Graz/Holding Graz and the local energy supplier) was formed and they started to work out detailed analysis and discussions with municipalities nearby Graz.

In the meetings the representatives of the city declared that they are very interested in a WtB plant and after the meetings in April/May 2014 the negotiations about the land site started. The city of Graz and the Energie Steiermark declared as the partners of the potential WtB plant in Graz by signing letters of commitment their interest to realise this concept in Graz.

The separated waste collection is already existing in Graz and defined in the waste management plan. Adaptations concerning the WtB-plant will be done in the next waste management plan. As the waste treatment facilities are already installed only small adaptations would be necessary at these existing locations. As the potential plant location is planned in a municipality nearby Graz this has no direct effect to the development plan of the city of Graz. The necessary adaptations in the development plan of the interested municipality are ongoing in parallel with the negotiations about the land site.

### 3 Inclusion of the WtB concept in the development plan of Valmiera

#### 3.1 Summary of the WtB concept for Valmiera

WtB concept for Valmiera city was developed by ZAAO (waste management concept) and Ekodoma (Biogas/biomethane production and biomethane use concepts) from September 2012 until March 2014. The concept consists of three parts – (1) organic waste management, (2) biogas and biomethane production, and (3) biomethane use.

Waste management: Two scenarios for organic waste management were considered – collection of unsorted MSW (baseline scenario) and source separated organic waste collection. In mid-term a baseline scenario is preferred as a result of evaluation of the economic feasibility. Introduction of the source separated organic waste collection has many obstacles – mostly increase of waste management tariff for residents, additional costs for waste management company for installation of separate organic waste collection bins and increase in waste transportation costs. For the organic waste treatment 3 scenarios were evaluated:

1. Scenario (base scenario) – mechanical treatment of unsorted MSW at regional waste treatment centre located at Daibe landfill site by using the existing waste treatment infrastructure (MBT). Composting of the organic fraction and using the compost for daily cover of the landfill.
2. Scenario – Mechanical treatment of unsorted MSW at regional waste treatment centre and using the organic fraction for dry fermentation. Digested substrate is further aerobically stabilised and used for daily cover of the landfill.
3. Scenario – Source separated organic waste collection and wet AD.

In a mid-term the 2<sup>nd</sup> scenario was selected as the optimal in a given situation.

Biogas and biomethane production: This evaluation was based on the waste management concept with addition of one more scenario. Calculations were based on the organic waste amounts given and forecasted in the North Vidzeme Regional Waste Management plan for 2014-2020. Three waste management scenarios were evaluated: (1) Base scenario (unsorted MSW collection, mechanical treatment and composting), (2) Combined scenario (unsorted MSW collection, mechanical treatment and dry fermentation), and (3) Resource-efficiency scenario (source separated organic waste collection from households, wet AD). Two following scenarios were considered for biogas and biomethane production:

1. Combined scenario – unsorted MSW collection, mechanical treatment at Daibe landfill site, dry fermentation of organic fraction, use of biogas in existing CHP plant and use of biogas for upgrading starting from 2020. Digestate would be used for the daily cover of the landfill.
2. Resource-efficiency scenario – source separated organic waste collection from households from 2017, wet AD, use of biogas in existing CHP plant and use of biogas for upgrading starting from 2020. Digestate would be used as high quality fertilizer.

In a mid-term the combined scenario was selected as economically most feasible.

Biomethane use: Concept for biomethane use was developed as provisional future opportunity. Biogas upgrading and biomethane use under existing framework conditions is not economically feasible. Biomethane production (biogas upgrading and compression) and use is evaluated in a perspective starting from 2020. Three alternatives for biomethane use were considered:

1. Biomethane use as fuel for waste collection trucks of ZAAO
2. Biomethane use as fuel for public busses in Valmiera city

### 3. Biomethane use in public filling stations for private transport and municipality transport

From all these three hypothetical alternatives the less complicated from the implementation point of view is biomethane use in ZAAO waste collection trucks by constructing a biomethane filling station next to the biogas upgrading plant at Daibe landfill site. In order to be able to use biomethane for public busses, the long term planning is required. The city should plan in future a procurement of CNG busses and construct appropriate biomethane transportation and filling infrastructure.

Three potential locations of the new WtB plant were evaluated: (1) biogas/biomethane plant at Daibe landfill site, (2) new biogas plant in the vicinity of Valmiera city, and (3) delivery of collected organic waste to one of existing biogas plants near Valmiera. Since for the mid-term the combined scenario was selected and it is foreseen to use the existing waste collection system and infrastructure of Daibe waste management centre, the biogas upgrading facility also should be located at Daibe landfill site. Besides availability of the infrastructure this location has other benefits, e.g., distance from residential areas and therefore the public acceptance for this alternative is expected to be positive.

## 3.2 Development planning in the city

Valmiera city council is responsible for development planning of the city. The city council consists of 6 departments and one of them – Development and Project Management department – is responsible for sustainable development of Valmiera city and rational use of resources according to the Development Programme (including spatial plan) of Valmiera city, and other regional, national and European planning documents.

Valmiera city council is directly responsible for the organisation of the waste management service in the city. Valmiera city council in 1998 together with other 27 municipalities in the region has established regional waste management company ZAAO and currently owns 44% of the shares of the waste management company.

The main document that concerns waste management issues in the city is North Vidzeme Regional Waste Management Plan. At the time when UrbanBiogas project activities started, the waste management in the region was organised according to the North Vidzeme Regional Waste Management Plan 2006-2013. During the project lifetime – a new Regional Waste Management Plan 2014-2020<sup>1</sup> was prepared and approved.

Regarding the waste management, Valmiera city council has approved a municipal regulation No.119 “About waste management in Valmiera city”<sup>2</sup>. This regulation was adopted on 8 December 2011 and is in force since 4 January 2012. Regulation states that for legal entities, who are working with agricultural (food) product processing or production, food trading, and/or providing public catering services, a source separate collection of organic and kitchen waste is mandatory. This condition in the regulation was included based on a suggestion from ZAAO. However, in reality separately collected organic waste amounts from legal entities are very small and compliance with the regulation in this regard is not controlled.

Other planning documents concerning waste to biomethane issues are Development Strategy and Investment and Action Plan.

One of the priorities of the Development Strategy (2008 – 2014)<sup>3</sup> is addressing waste management problems in order to reduce the amount of generated and landfilled waste.

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<sup>1</sup> Zieme vidzemes reģionālais atkritumu apsaimniekošanas plāns, 2014.-2020. ZAAO, 2013.

<sup>2</sup> Valmieras pilsētas pašvaldības saistošie noteikumi Nr.119 “Par atkritumu apsaimniekošanu Valmieras pilsētā”. Valmieras pilsētas pašvaldības dome, 08.12.2011

<sup>3</sup> Valmieras pilsētas sociāli ekonomiskās attīstības programma 2008.-2014.gads. Attīstības stratēģija. Valmieras pilsētas pašvaldība, 2007

However, no actions are foreseen in the Investment and Action Plan (2008-2014)<sup>4</sup> in order to contribute to this priority. Investment and Action plan is structured in 25 fields of investment. One of them concerns improving the air quality in the city and is proposing improvements in the public transport sector. Use of biogas for public transport is mentioned, but no time frame for this action is set. The plan is to finance this action by the budget of the city council in public-private partnership.

Currently municipality is working on new policy planning documents – on Sustainable development strategy 2015-2030 and Development programme 2015-2020. It is planned that both documents will be given for public discussion by August/September 2014 and will be approved by November/December 2014.

### **3.3 Activities and implemented changes**

In general UrbanBiogas project partners ZAAO and Ekodoma were closely working together with the municipality on development and implementation of the waste to biomethane concept in Valmiera. Representatives from municipality were directly involved by participating in the Task Force meetings and in a study tour organised by UrbanBiogas project. In UrbanBiogas Task Force meetings city council was represented by Mr. Aigars Vītols (by that time the vice-Executive Director of Valmiera municipality) and Ms. Kristīne Melece – specialist in environmental communication of the city council.

ZAAO had several meetings and discussions with Valmiera city council about the waste management plan. As a result a provision of the installation of dry fermentation unit at Daibe landfill site was included in the new regional waste management plan.

Ekodoma have presented biogas/biomethane production concept and biomethane use concept to the representatives of the city council and was in direct communication about content of the letter of commitment that municipality have signed by the end of UrbanBiogas project committing to consider the issues related to WtB value chain in future development planning.

#### **3.3.1 Presentations and meetings with the city council representatives**

Within UrbanBiogas project in Valmiera additional dedicated presentations in the city council were not organised. This was because of the fact that key persons from the city council were directly involved into task forces and were well informed about UrbanBiogas activities.

However, the main outcomes of the project and strategic issues were also discussed with higher level decision makers in the municipality. This was organised in the way that decision makers (vice mayor, executive director, vice-executive director) were invited to join UrbanBiogas task force meetings where relevant issues were presented and discussed.

##### *Presentation of the UrbanBiogas project and planned activities on 18.10.2011*

The first meeting where UrbanBiogas project and planned activities were presented to the Valmiera city council took place on 18 October 2011 in ZAAO premises in Valmiera. This meeting was the first task force (TF) meeting and Mr. Aigars Vītols participated as representative of the Valmiera city council.

During this meeting the first insight about UrbanBiogas project was given, participants were informed about three concepts that will be developed during the project, and the role of the TF was discussed.

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<sup>4</sup> Valmieras pilsētās sociāli ekonomiskās attīstības programma 2008.-2014.gads. Investīciju un infrastruktūras plāns 2012.-2014.gadam. Valmieras pilsētas pašvaldība, 2012

It was agreed that city council will be directly involved in TF meetings and will follow the development of waste to biomethane concepts. During this meeting also possible exchanges with twin cities of Valmiera were discussed.



**Figure 5: Mr. Aigars V tols (3<sup>rd</sup> from the right) at the meeting on 18.10.2011**

*Participation of the representative of Valmiera city council at UrbanBiogas study tour in Austria, 15-16.05.2013*

Mr. Aigars V tols – the vice-executive director of Valmiera city council participated on a study tour organised by UrbanBiogas project in Austria, 15-16 May, 2013. His participation was very useful since it convinced Valmiera city council that WtB concepts work and that there are successful examples in the Europe.



**Figure 6: Mr. Aigars V tols (2<sup>nd</sup> from the left at the table) at UrbanBiogas study tour in Austria (Photo: D.Rutz)**

In a press conference at the end of the UrbanBiogas project when letter of commitment was signed in Valmiera, Mr. Aigars V tols explained to journalist that using waste for biomethane production is a future direction what Valmiera should follow. He reflected to the biomethane plants that we have seen in Austria and was convinced that it is possible to have something similar one day also in Valmiera.

### Presentation of biogas/biomethane production concept on 02.10.2013

Biogas and biomethane production concept was presented to Mr. J nis Baiks – the vice mayor of Valmiera city council on 02.10.2013. The meeting took place at premises of Valmiera city council.



**Figure 7: Presentation of biogas/biomethane concept to Mr.Baiks (1<sup>st</sup> from the left)**

The main purpose of this presentation and discussion was to get the feedback from Valmiera city council regarding potential location of the biogas plant and regarding which of the proposed scenarios would be favoured by the city council.

After the presentation Mr. J nis Baiks expressed the opinion of the city council that scenarios that would result in an increased waste management tariff are not preferred. Municipality will support activities of ZAAO and biogas productions only in case if it does not negatively affect the waste management tariff.

Regarding location – the preferred location is outside the city, but in case if biogas is used only for heat generation, the plant could also be located next to existing heating plant within the city. If the economical calculation would prove that it is beneficial to replace natural gas for heat generation with a biogas, this location might be considered.

However, since the aim of the UrbanBiogas project was to produce biomethane, this proposal was not further investigated as a scenario for biogas/biomethane production concept.

At this meeting for the first the city council was informed about the Letter of commitment that should be signed by the end of the UrbanBiogas project. J nis Baiks expressed his interest and readiness to sign this letter with a condition that Ekodoma and ZAAO will propose an economically reasonable solution for biogas/biomethane production from waste in Valmiera city.

### Presentation of the draft letter of commitment on 21.03.2014

The last presentation for Valmiera city council was given on 21 March 2014 at premises of the city council. The purpose of this meeting and presentation was to discuss the content of the letter of commitment. It was agreed that letter will be reviewed by the lawyers and that final agreed letter will be signed during a press conference by Mr.Aigars V tols who became a new executive director of Valmiera city on June 2013.



From Valmiera municipality three persons participated on the discussion – Ms. Evija Voitek ne (vice executive director of Valmiera city council), Mr.Gints B rti š (Financial Analyst of the council) and Ms.Krist ne Melece (responsible for environmental communication).



**Figure 8a: Participants of the meeting on 21.03.2014 (from the left – Ilze Dzene (Ekodoma), Krist ne Melece (Valmiera), M rti š Niklass (ZAAO), Guntis Kamzols (VTU Valmiera), Evija Voitek ne (Valmiera), Gints B rti š (Valmiera) and Aiga Barisa (RTU))**



**Figure 8b: Participants of the meeting on 21.03.2014**

One of the proposals made by Ekodoma was that Valmiera city council should support the public transportation company VTU-Valmiera when they are doing the procurement of new busses. It was suggested by Ekodoma that for preparation of technical specification of procurement, it should be evaluated whether it is not possible to procure biomethane (or CNG) busses.

Another suggestion was that Valmiera city council should take into account the results of the WtB concept during elaboration of development planning documents for the city.

Later during the negotiation process with a lawyer office of the city council it was agreed that at this point of time it is not possible to include the Waste-to-Biomethane concept into new development strategy of the city because it would mean indicating concrete sites and investments what should be done in the city. Since biogas plant will be constructed in Daibe landfill site (outside the city) some investments would be needed only for the development of the biomethane infrastructure within the city. However, this is planned only after 2020 and concrete investment plans at this point of time cannot be made.

### **3.3.2 Changes in the development plan of the city implemented after the meetings**

As a result of the activities of ZAAO who had several meetings and discussions with Valmiera city council about the waste management plan, a provision of the installation of dry fermentation unit at Daibe landfill site was included in the new regional waste management plan.

Besides that, in order to facilitate separate organic waste collection from legal entities in Valmiera city, ZAAO agreed with Valmiera city council that request for mandatory separate collection of organic and kitchen waste was introduced into the Regulation No.119 "About waste management in Valmiera city" (in force since 4 January 2012).

By signing the letter of commitment Valmiera city council have agreed to follow more strictly the compliance of organisations with a given regulation in terms of separately collected organic waste. City council agreed also to evaluate the opportunity for implementation of WtB concept steps in the future while new update of the development planning documents for the city will be planned. After 2020 the revision of the biomethane use concept for public transport in the city will be done.

## 4 Inclusion of the WtB concept in the development plan of Zagreb

### 4.1 Summary of the WtB concept for Zagreb

The City of Zagreb is annually producing around 250.000 tonnes of municipal solid waste (MSW) which is mostly being landfilled (92.6% in 2011) at the landfill site Jakuševac – Prudinec (life span of it has been extended by 2015) even though most of it is biodegradable (paper, cardboard, kitchen and green waste – 30%).

Republic of Croatia by EU laws has to divert 65% of biodegradable municipal waste of the total amount (by weight) of biodegradable municipal waste produced in 1997 from landfills by the end of 2020. Furthermore, the City of Zagreb must meet the goals of Landfill Directive and has the Obligation of Placing the Biofuels at the national market. Implementation of waste-to-biomethane (WtB) concept in the City of Zagreb would fulfil the requirements of the Directive, biofuel consumption, and reduction of GHG emissions and would contribute to the development of sustainable urban transport.

Pre-requisite for separate sorting of bio-waste, construction of biogas plant of any kind and possibility to have mid to long term contracts for bio-waste delivery, is the adoption of Waste management plan that is still pending. In that sense, the City of Zagreb and its Office for Energy, Environmental Protection and Sustainable Development are the main stakeholders in deciding in overall WtB framework in organisational, ownership, financing and operational aspect.

Developing separate waste collection system along with the increased number of recycling yards will significantly increase the quantity of separately collected bio-waste suitable for biogas production. The part of the currently collected bio-waste is used in a composting plant. Comparing to composting, the emissions to the air are significantly lower and easier to control in anaerobic digestion (AD) process as AD is conducted in closed reactors.

Bio-waste is separately collected from restaurants, schools and kindergarten canteens, market places, shopping centres and green waste from households. Even though it is questionable if the total potential amount of the bio-waste that could be collected is sufficient for the AD, WtB concept can be closed regardless on the waste management concept implemented for the City of Zagreb as biogas can be produced from both source separated bio-waste and bio-waste collected as bulk mixed MSW. From the point of energy sustainability, less process energy is needed if bio-waste is collected separately.

Also, the lack of education and awareness among citizens and inadequate penalties for polluters, could contribute to the unsatisfactory results in waste separation. However, the survey taken showed that citizens support WtB concept. Therefore, constant communication with the public seems to be the most important non-technical assignment. Namely, if source separated collection is chosen as waste management concept, its collection rate and quality of the bio-waste will depend on the willingness of the citizens to contribute.

One of the advantages of the overall implementation of IEE UrbanBiogas project in Zagreb has been the support of all important stakeholders. Additional advantage is that both starting (waste management operated by isto a branch) and ending (biomethane use in transport – branch ZET, urban public transport company that currently has 60 public transport busses powered by CNG; or biogas injected in the natural gas grid – branch GPZ, city gasworks company) are in the hands of branches of Zagreb City Holding – company in 100% ownership of the City.

Criteria for choosing the location for biogas plant construction should be: road access, neighbourhood acceptance, sufficient electrical power supply access, access to low to medium pressure natural gas grid, economic feasibility of the investment via maximisation of biogas production, availability of (additional) substrate, maximisation of useful energy obtained from biogas, sufficient space for the plant, the distance of waste water treatment

facility, minimal spatial alterations. Spatial Plan of City of Zagreb defines locations for overall waste management system for City of Zagreb:

- Location 1: Prudinec – area of existing land-filling site – overall plausible location
- Location 2: Resnik – joint areas of existing waste water management site and considered thermal waste processing plant – overall plausible location
- Location 3: Markuševac – area of existing composting plant
- Location 4: Dumove ki Lug

From technical, energy and economic point of view, it seems that organizing thermal (solid) and anaerobic (wet) waste treatment adjacent to the waste water treatment facility would create so called "industrial symbiosis" where the sum of performance of this symbiosis would be higher than adding each of the individual performances to the other. Industrial symbiosis is a subset of industrial ecology, with a particular focus on material and energy exchange. Given the efforts of the City of Zagreb on its green and sustainable profile already made, forming an industrial symbiosis while implementing WtB concept would be added value not only to the waste management but to the overall life standard of the citizens.

Biogas upgrading plant will, again, depend on the hourly production of biogas and the desired quality of biomethane. Produced biomethane should be injected in the natural gas grid or used in transport. Expected biomethane productions for all concerned scenarios are too little for capacities of planned filling stations of ZET. Consequently, the optimal solution could be biomethane grid injection in high pressure distribution grid. Due to the consumption patterns and gas grid features, pressurised water scrubbing or pressure swing adsorption (PSA) is proposed as upgrading technologies, suitable for high pressure distribution grid injection

Sales concept of produced energy (biomethane) could be a type of agreement with joint waste management and biomethane production company or with joint biomethane production company, GPZ (City Gasworks Company) and/or ZET (Urban Public Transport Company for the City of Zagreb).

## 4.2 Development planning in the city

Waste Management Plan for the Republic of Croatia has been adopted by the parliament in 2007 for the period from 2007 to 2015. The obligations of the counties and the cities were put forward to prepare their own corresponding plans by the end of that year. That obligation was supposed to be carried out in the City of Zagreb by the City Office of Energy, Environment and Sustainable Development. The first draft of the plan was prepared in May of 2009 and it was supposed to be accompanied by another document – Strategic Environmental Assessment. The writing of that document faced various problems so that final version was brought about in 2012. The Draft of the Plan and Strategic Assessment include, as they should, locations for the specific plants and the main controversy is centred on that aspect. The Waste thermal Treatment Plant location and the new landfill site are the main points of the citizen's uproar. For whatever reason, the mayor announced last spring that the thermal treatment plant of all municipal solid waste shall be replaced with MBT plant followed by Waste to Energy (WtE), presumably in the greater Zagreb region. The new Plan along that line is still in preparation.

The biogas plant is introduced in current documents as one of the main technical constituents of the waste management system proposed. For that reason official acceptance of the plan shall be powerful document for the future efforts in bringing about biogas production plant. Moreover, with MBT strategy finalized, the initial estimate of the plant capacity of 20.000 t of separately collected bio-waste could be extended to the capacity of about 70.000 t based on the estimate of bio-waste content in Zagreb MSW.

The new Croatian Waste Management law requires that Waste management Plans should be related to the period of six years with the possible revision during that time as seen fit.

The official adoption by the City Assembly of the documents specified is expected in couple of months so that actions concerning the biogas plant erection shall continue with official support. In that regard, the decision concerning all objects locations is particularly important since it will remove one of the crucial obstacles in defining final proposal for its construction.

### 4.3 Activities and implemented changes

In order to introduce UrbanBiogas project to the Mayor of Zagreb City and City Council representatives and to implement project tasks and activities, three meetings were held in the premises of Zagreb City Council:

- Meeting with the Mayor and Zagreb City Council representatives held on September 28, 2011 – introduction of UrbanBiogas project and presentation of its main activities
- Meeting with representatives of the City office for energy, environment protection and sustainable development held on September 25, 2013 – introduction of waste management, biogas production and biomethane use concepts
- Meeting with the Principal of the City Office for Economy, labour and enterprises held on February 13, 2014 – presentation of achieved results in the project and discussion of future plans for waste management in the City

#### 4.3.1 Presentations and meetings with the city council representatives

##### Meeting with the Mayor and Zagreb City Council representatives held on September 28, 2011

On September 28, 2011 the first meeting initiated and organised by Zagreb City Holding – isto a Division and UrbanBiogas team was held in the City Council premises (Trg Stjepana Radi a 1, Zagreb) with participation of the Mayor of the City Milan Bandić and City Council representatives.

#### Participants

Table 1: List of participants of the Meeting on 28.09.2011

Name	Company/Organisation	email
Milan Bandić	Mayor of the City	ured.gradonacelnika@zagreb.hr
Sandra Tucak-Zori	City office for energy, environment protection and sustainable development	sandra.tucak-zoric@zagreb.hr
Nevenka Preradović	City office for energy, environment protection and sustainable development	nevenka.preradovic@zagreb.hr
Miro Laco	The Mayor's Office	ured.gradonacelnika@zagreb.hr
Harun Omerbašić	The Mayor's Office	harun.omerbasic@zagreb.hr
Jadranka Veseli Bruvo	City Office for the Strategic Planning and Development of the City	strategija@zagreb.hr
Vesna Šimić	Služba za međugradsku i međunarodnu suradnju	vesna.simic@zagreb.hr
Branimir Valašek	Zagreb City Holding – isto a Division	branimir.valasek@zgh.hr
Dinko Sincić	Zagreb City Holding – isto a Division	dinko.sincic@zgh.hr
Bojan Ribić	Zagreb City Holding – isto a Division	bojan.ribic@zgh.hr
Monika Kruhek	Zagreb City Holding – isto a Division	monika.kruhek@zgh.hr

## Discussion

At the beginning of the meeting, Mayor of the City Mr. Milan Bandi welcomed the participants and afterwards Head of the Division Mr. Branimir Valašek, presented the agenda of the meeting.

The agenda of the meeting consisted of the introduction of the UrbanBiogas project, its activities and targets set. Current situation of waste management in the City was discussed. It was pointed out that City offices strive hard to solve the location problem for the waste infrastructure to be built, however at that given time it was still uncertain will that be an incineration plant, an MBT or something else. Representatives of the Zagreb City Holding explained that one of the tasks of the UrbanBiogas project is to assess the advantages and disadvantages of the possible locations for the biogas plant construction. It was agreed that the mentioned document will be useful tool for the City offices in deciding of the location.

Mayor welcomed and gave his support to UrbanBiogas project and offered help from the City offices in promoting project and its activities.

## Results/Agreements

It was agreed that the project will be further disseminated in other Croatian cities as well as in other parts of Europe. Since at the time when that meeting was held, Croatia still wasn't a member of EU, present participants agreed that this project will contribute significantly to the implementation of EU laws and policies which will ease the City to achieve the results set up by the Europe Union once when Croatia becomes a member state.

### Meeting with representatives of the City office for energy, environment protection and sustainable development held on September 25, 2013

The meeting between representatives of the City office for energy, environment protection and sustainable development (Mr. Marijan Maras, Mr. Miljenko Kovacević and Mr. Danijel Matic) and EIHP's UrbanBiogas team (Ms. Branka Jelavić, Ms. Biljana Kulišić, Mr. Goran Granić and Mr. Željko Jurić) was held on 25<sup>th</sup> of September, 2013 in the Energy Institute Hrvoje Požar (Savska cesta 163, Zagreb). The meeting was conducted in order to present the final results of the "Waste to Biomethane" concepts for the City of Zagreb.

## Participants

**Table 2: List of participants of the Meeting on 25.09.2013**

Name	Company/Organisation	email
Marijan Maras	City office for energy, environment protection and sustainable development	marijan.maras@zagreb.hr
Miljenko Kovacević	City office for energy, environment protection and sustainable development	miljenko.kovacevic@zagreb.hr
Danijel Matic	City office for energy, environment protection and sustainable development	danijel.matic@zagreb.hr
Goran Granić	Energy Institute Hrvoje Požar (EIHP)	ggranic@eihp.hr
Branka Jelavić	Energy Institute Hrvoje Požar (EIHP)	bjelavic@eihp.hr
Biljana Kulišić	Energy Institute Hrvoje Požar (EIHP)	bkulisic@eihp.hr
Željko Jurić	Energy Institute Hrvoje Požar (EIHP)	zjuric@eihp.hr

## Discussion

At the beginning of the meeting, Mr Goran Granić (director of EIHP) welcomed the participants and briefly presented the importance of the implementation of the "Waste to Biomethane" concept.

The main author of biogas/biomethane concept, Ms Biljana Kuliši (EIHP), presented the final results of the biogas and biomethane production on potential locations of the City of Zagreb. The concept could contribute to fulfilment of several mandatory and voluntary goals that the Croatia already has obliged to (Landfill directive, RES directive, placing biofuels on national market and GHG emission savings from waste and energy sectors). The obligations of the Republic of Croatia are also obligations on the level of the City of Zagreb and the implementation of the "Waste to Biomethane" concept will help in fulfilment of the obligations. Ms Kuliši stressed that development of the concept for the City of Zagreb will depend on the waste management concept and utilisation of biodegradable municipal waste potential for biogas production.

Given the fact that there are too many uncertainties related to the waste management system in general in Croatia, to build biogas and biomethane production for the City of Zagreb upon one scenario only seems providing too little decision-making ground for the City. In that sense, Ms Kuliši proposed to follow up available feedstock as presented in the D.3.3. Waste management concept for the City of Zagreb as Scenario 1 (Reference scenario), but add three additional scenarios:

- 2. Scenario: meeting the IEE UrbanBiogas long-term goal by 2020 – tapping 70% of bio-waste
- 3. Scenario: the City of Zagreb fulfilling the Landfill directive at dynamic as foreseen in the Accession Treaty
- 4. Scenario: separation of bio-waste at the Centre for Waste Management or worse-case scenario.

In the respect of possible locations for biogas production, Ms Kuliši admitted that this question became more controversial than expected and that is why EIHP proposes to give the emphasis on the methodology how to assess a potential location than to select exact location for biogas and biomethane production. The intention is to provide technical support for future decision makers when actual location(s) will be discussed. She has demonstrated the methodology on four potential locations in the City of Zagreb.

In the concept, possible technology options for biogas and biomethane production were analysed. Produced biomethane should be injected in the natural gas grid or used in transport. Ms Kulisic said that expected biomethane productions for all concerned scenarios are too little for capacities of planned filling stations of ZET. The optimal solution could be biomethane grid injection in high pressure distribution grid. Due to the consumption patterns and gas grid features, pressurised water scrubbing or pressure swing adsorption (PSA) is proposed as upgrading technologies, suitable for high pressure distribution grid injection.

At the meeting, economic parameters of biogas and biomethane production were also discussed. Economic figures do not indicate positive values but social and environmental parameters indicate multiple benefits for the citizens of the City of Zagreb. The appropriate solution should be implementation of the so called "industrial symbiosis"<sup>5</sup>, which could decrease the production costs of biomethane. From technical, energy and economic point of view, it seems that organising thermal (solid) and anaerobic (wet) waste treatment adjacent to the waste water treatment facility would create "industrial symbiosis", using synergy effects of different processes on the same location. On that way, waste management and renewable energy production (heat, power and biofuels) will be integrated, based on the least cost principle. Implementation of the "industrial symbiosis" will also increase the possibility of benefiting the concept from EU funds.

Mr. Marijan Maras (Head of the City office for energy, environment protection and sustainable development) very positively appraised efforts of Energy institute Hrvoje Požar and Zagreb holding – Subsidiary isto a for preparation of "Waste to Biomethane" concept. He was interested in waste management part of the concept. The amount of available

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<sup>5</sup> Industrial symbiosis is a subset of industrial ecology, with a particular focus on material and energy exchange.

feedstock for biogas and biomethane production was discussed, as well as advantages and disadvantages of possible location for biogas plant. One of the main problems is the status of Waste management plan of the City of Zagreb. The Plan with chosen location for biogas plant should be adopted during the year 2014.

Mr. Maras was also interested in economic parameters of biomethane production. Ms. Kuliši stressed that Economic parameters does not indicate positive values but social and environmental parameters indicate multiple benefits for the citizens of Zagreb. Biomethane production is needed financial support (e.g. feed-in tariffs). Additionally, secondary legislations are necessary for determination of technical standards for biomethane and for priority grid access of biomethane.

### Results/Agreements

As mentioned before, the final results of the “Waste to Biomethane” concept was presented and discussed at the meeting. Representatives of the meeting were agreed with the concept proposal.

The photo documentation of the meeting is shown below (Figures 9 and 10).



Figure 9: Presentation of the WtB concept for the City of Zagreb – 25.9.2013



Figure 10: Discussion of the main problems in the realization of the WtB concept



### Meeting with the Principal of the City Office for Economy, labour and enterprises held on February 13, 2014

On February 13, 2014 the third meeting was initiated and organised by UrbanBiogas team members from Zagreb City Holding – isto a Division and Energy institute Hrvoje Požar. The meeting was held in the City Council premises (Trg Stjepana Radi a 1, Zagreb) with participation of the Principal of the City Office for Economy, labour and enterprises Mrs. Mirka Jozi in a role of Mayor's deputy as well as people from City Office for EU projects.

### Participants

**Table 3: List of participants of the Meeting on 13.02.2014**

Name	Company/Organisation	email
Mirka Jozi	City Office for Economy, labour and enterprises	mirka.jozic@zagreb.hr
Igor Delak	Office for EU programmes and projects	igor.delak@zagreb.hr
Mirela uri	Office for EU programmes and projects	mirela.duric@zagreb.hr
Dinko Sin i	Zagreb City Holding – isto a Division	dinko.sincic@zgh.hr
Bojan Ribic	Zagreb City Holding – isto a Division	bojan.ribic@zgh.hr
Monika Kruhek	Zagreb City Holding – isto a Division	monika.kruhek@zgh.hr
Željko Juri	Energy Institute Hrvoje Požar (EIHP)	zjuric@eihp.hr
Bruno Židov	Energy Institute Hrvoje Požar (EIHP)	bzidov@eihp.hr

### Discussion

At the beginning of the meeting Principal of the City Office for Economy, labour and enterprises Mrs. Mirka Jozi welcomed the participants and afterwards Mr. Dinko Sin i from Zagreb City Holding team introduced them with the agenda.

The agenda of the meeting consisted of the presentation of achieved results of UrbanBiogas project. Representatives of Zagreb City Holding and Energy institute Hrvoje Požar pointed out the necessity for the project to receive a positive assessment from the City Council and the Mayor itself for the conduction of further activities of the project even after the official end of the project implementation. The project representatives have tried to show the necessity and the importance of the project tasks and results for the future of the City of Zagreb and its waste management policies.

Current situation of waste management in the City was discussed as well as the national and EU legislative, since Croatia in the meantime became a member of the Europe Union. Two main obstacles to the construction of the biogas plant still existing were discussed – Waste Management Plan still didn't receive a final approval and the location for the biogas plant construction hasn't been determined as yet.

### Results/Agreements

Mrs. Mirka Jozi expressed her interest and support to the project and in the name of the City offices congratulated Zagreb City Holding and Energy Institute representatives for the achieved results. It was agreed that she will present the main outcomes of the meeting to the Mayor who is expected to give a written support for the continuation of the actions that will ultimately lead to the biogas plant construction and biomethane production in the City.

The photo documentation of the meeting is shown below (Figures 11 and 12).



Figure 11: Presentation of the UrbanBiogas results to the Mayor's deputy on February 13, 2014



Figure 12: Discussion of waste management plans for the City

#### 4.3.2 Changes in the development plan of the city implemented after the meetings

As already stated, the main document which officially defines all the elements of the waste management is the Waste Management Plan which for the city of Zagreb is still in the stage of being prepared for the City Assembly adoption. The biogas production is included in its final version and with the support of all city officials who have been informed about the UrbanBiogas project; we hope that we stand the reasonable chances of realization of the whole undertaking.

## Conclusions

In this report an experience in four UrbanBiogas target cities regarding work with city councils is described and results towards inclusion of WtB strategies in the city development plans are provided.

Each city has chosen the individual approach about how to address the decision makers in the city council. Either they were directly involved in the task force meetings or were addressed through dedicated presentations given by UrbanBiogas project partners for high-level decision makers at the city council.

In Portugal, Abrantes the relevant decision makers were addressed through involving them in the local project support group activities (alternative to the Task Force).

In Austria, Graz representatives from the city council (Mayor and vice Mayor), the department of environment with the sub-department for waste management and the department for urban planning participated in several meetings within the UrbanBiogas project (mainly Task Force and Joint Task Force meetings).

In Latvia, Valmiera representatives from the city council were involved in TFs and in other UrbanBiogas project activities (e.g. international study tour). Higher level decision makers were invited to join meetings where relevant issues that affected development plans of the city were discussed.

In Croatia, Zagreb, dedicated presentations were given directly at the Mayor's office, the City office for energy, environment protection and sustainable development and at the City office for economy, labour and enterprises.

In Abrantes the effort resulted in concrete investment plans and measures concerning WtB value chain were included in SEAP of the region.

In Graz the separated waste collection is already implemented in the waste management plan. The city of Graz and the local energy supplier as partners in the consortium of the WtB plant declared their interest to realise the WtB-plant in Graz with signing letters of commitment.

In Valmiera installation of dry fermentation plant for biogas production from organic waste at Daibe landfill site was included in the new regional waste management plan. A request for mandatory separate collection of organic and kitchen waste was introduced into the Regulation No.119 "About waste management in Valmiera city". City council committed to evaluate the opportunity for implementation of WtB concept steps in the future development planning documents for Valmiera city. After 2020 the revision of the biomethane use concept for public transport in the city will be made.

In Zagreb the biogas production is included in the final version of the Waste Management Plan of the city but its adoption is still pending. Generally, WtB concept is supported by all city officials who have been informed about the UrbanBiogas project during the organised meetings. Now, the only thing left that will enable stimulation of investments in biogas plant construction is the final adoption of the Waste Management Plan.