

Urban waste for biomethane grid injection and transport in urban areas

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Report on the sustainable waste management trainings

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UrbanBiogas website: www.urbanbiogas.eu

Contents

Introduction	4
1. Summary of Urban Waste Management Training in Valmiera - Latvia	5
1.1. Description of the Training Seminar in Valmiera	5
1.2. Conclusion	7
2. Summary of Urban Waste Management Training in Zagreb – Croatia	8
2.1. Description of the Training Seminar in Zagreb	8
2.2. Conclusion	10
3. Summary of Urban Waste Management Training in Abrantes – Portugal	11
3.1. Summer School – 9 th of July	11
3.2. Summer School – 10 th of July	14
3.3 Summer School – 11 th of July	20
3.4 Summer School – 12 th of July	24
3.5. Conclusion	26

Introduction

The UrbanBiogas objective is to promote the use of organic urban waste for biogas production in 5 European cities in order to inject biomethane into the natural gas grid and to use it in transport.

The Core of this project is the development of five marketable WtB concepts for five European cities.

Within this project's duration there will be organized more than 130 events, including workshops, working group meetings, study tours and city exchange visits.

The UrbanBiogas Project is supported by the Intelligent Energy Europe Programme of the European Commission, being the Consortium composed by 11 partners and coordinated by the WIP Renewable Energies, German company.

From Mart 2012 till July 2012 in 3 target cities a training course specifically for city representatives (of the target cities and of other cities in the target countries) were organised (total: 3 training courses) by EIHP, IRRADIARE, and ZAAO.

Speakers of the training were the UrbanBiogas representatives of the target cities and invited speakers. The training courses were held in national languages.

The content of the training was on waste management practices and biogas production from waste sources. Essential subjects of the training program were economics of different waste management options, public acceptance of the waste management system, technical solutions, and biogas production. Best practice examples (Task 2.1) were presented at the training courses.

1. Summary of Urban Waste Management Training in Valmiera - Latvia

In the framework of the WP3 of the UrbanBiogas project, the training seminar in urban waste management was organised in the City of Valmiera. The purpose of the seminar was to promote the separate waste collection, as the first step of the “Waste to Biomethane” concept, among local inhabitants, teachers and other interested parties. Organizational, technical and economical solutions of different waste management options were presented on the seminar.

Preparation of the training seminar started in October 2011 during waste management task force meeting, by choosing themes for training in order to cover essential subjects of the training program.

An invitation by e-mail was sent to the companies and individuals.

The waste management training seminar was held on 20th March 2012 in environmental education centre of ZAAO in Valmiera district. There were 14 participants and a trainer at the seminar.

1.1. Description of the Training Seminar in Valmiera

The seminar was opened by Ieva Vegere from ZAAO. She welcomed the participants and presented participants with program of training seminar.

The first presentation was about UrbanBiogas project activities. During this presentation project objectives, project partners and other basic information about the project have been presented.



Figure 1 Waste management training in Valmiera

The second presentation was about the role of environmental education in the development of waste management sector.

SIA ZAAO has been active in the sphere of environmental education since 2011. ZAAO environmental education activities are aimed at educating, informing and participation of the local community in improvement of environmental quality in one's place of residence. To provide modern, environmentally friendly waste management and pollution reduction in the

surrounding environment, ZAAO offers both general and specific information. The contents and presentation methods of environmental education and information depend on waste producing target groups. The most important target groups are regional municipalities, ZAAO clients, educational institutions, and the community in general.

During the training the legislative framework of biological waste separate collection and treatment in Latvia was analysed. European countries have to fulfil the Landfill Directive 1999/31/EC and the Waste Directive 2006/12/EC to reduce land filling of the biodegradable part of municipal solid waste to 35%. The Renewable Energy Directive (RED) 2009/28/EC also has to be complied.



Figure 2 Participants of waste management training

The use of biowaste as a resource allows moving closer to EU's common objectives by reducing the amount of waste disposed in landfills. Also by using biowaste to produce something (biogas, compost) the reuse of waste materials is increased. If the biowaste is used to produce the biogas then the biogas upgrading to biomethane quality and the distributing the biomethane through natural gas network is an opportunity to efficiently use renewable energy in urban areas and increase the energy independence of country.

In Latvian waste legislation only composting is mentioned as a product of biowaste and is mostly related to the green waste. Carried out studies in Latvia shows that 40 % of unsorted municipal waste c European countries have to fulfil the Landfill Directive 1999/31/EC and the Waste Directive 2006/12/EC to reduce land filling of the biodegradable part of municipal solid waste to 35%. The Renewable Energy Directive (RED) 2009/28/EC also has to be complied.

The use of biowaste as a resource allows moving closer to EU's common objectives by reducing the amount of waste disposed in landfills. Also by using biowaste to produce something (biogas, compost) the reuse of waste materials is increased. If the biowaste is used to produce the biogas then the biogas upgrading to biomethane quality and the distributing the biomethane through natural gas network is an opportunity to efficiently use renewable energy in urban areas and increase the energy independence of country.ontains is organic waste. This is a great amount that can be recycled to avoid waste disposal. Unfortunately the organic waste management is not developed in Latvia.

Waste sorting and different biological waste treatment technologies were discussed during the training.

The training seminar was finished with final discussion on biogas production from biowaste and excursion to the ZAAO waste sorting line.



Figure 3 Excursion to the ZAAO waste sorting line

1.2. Conclusion

The training seminar in waste management was fruitful event for the participants. Positive opinions on the seminar were identified by evaluation forms, gathered from seminar's participants.

2. Summary of Urban Waste Management Training in Zagreb – Croatia

In the framework of the WP3 of the UrbanBiogas project, the training seminar in urban waste management was organised in the City of Zagreb. The purpose of the seminar was to promote the separate waste collection, as the first step of the “Waste to Biomethane” concept, among decision makers, local government officials and other interested parties. Organizational, technical and economical solutions of different waste management options were presented on the seminar.

Preparation of the training seminar started in March 2012, by choosing possible lecturers and themes at the meeting with representatives of Zagreb City Holding (Waste management division – Podružnica Čistoća), in order to cover essential subjects of the training program. At the meeting, preliminary agenda of the training seminar was defined.

In the next step, the target group was recognized. An invitation by e-mail was sent to the companies and individuals involved in the waste management sector and/or interested in biogas production from bio-waste. Beside the direct e-mails, the announcement about the urban waste management training seminar was issued on the EIHP’s web-site (<http://www.eihp.hr/>).

The urban waste management training seminar was held on 14th June 2012 in Zagreb, in the appropriate multimedia conference room of Energy Institute Hrvoje Požar. The seminar was very well attended. There were 37 participants at the seminar, including 8 lecturers.

Brief information on the UrbanBiogas project and information about the training seminar, as well as all presentations can be found on the following EIHP’s web page: http://www.eihp.hr/english/projekti/urban_biogas.html.

2.1. Description of the Training Seminar in Zagreb

The seminar was opened by Ms Branka Jelavić from EIHP (head of Department for Renewable Energy Sources and Energy Efficiency). She welcomed the participants and presented EIHP’s important recently finished and ongoing RES projects, with special focus on biogas.



Figure 4 Welcome speech - Ms. Branka Jelavić (EIHP)

In the second presentation, Mr Željko Jurić (EIHP) presented UrbanBiogas project activities. He presented project objectives, project partners and other basic information about the project. He gave an overview on performed and expected activities in the implementation of the UrbanBiogas project. The Waste-to-Biomethane concept was promoted in the project. It means the use of the organic urban waste fraction for biogas and biomethane production in order to inject biomethane in the natural grid and to use it in transport.

Furthermore, Mr Željko Stošić from Ministry of Environmental and Nature Protection presented waste management regulatory framework in Croatia and international obligations under Landfill (1999/31/EC) and Waste (2006/12/EC) directives. According to the Treaty concerning the Accession of the Republic of Croatia to the EU, Croatia shall ensure a gradual decrease in the amount of biodegradable municipal waste going to landfills. The first target is to reduce the share of biodegradable municipal waste deposited on landfills to 75% of the total amount (by weight) of biodegradable municipal waste produced in 1997, by the end of 2013. The prompt action on national and local level should be done in order to achieve this target.

In the next presentation, good practice examples of waste management and logistics of organic urban waste in EU's cities were shown. Mr Marin Miletić from EIHP explained different concepts implemented in numerous EU countries: Italy, Spain, France, Germany, Austria, Ireland, UK, Estonia, Denmark and Sweden. Separate waste collection system in Lille Metropolitan area (France) is one of the examples. Green garden waste and kitchen waste produced by private households in Lille is collected by door-stop bio-waste collection with trucks. Additionally, food waste from public canteens and restaurants is also collected. Digestible parts of the bio-waste are used for biogas production, while digester residues for compost production. The produced biogas is upgraded to bio-methane, transported to a filling station and used as vehicle fuel for public transport (buses) and injected in the gas grid.

Mr Bojan Ribić presented waste management in the City of Zagreb, as well as performed activities on biogas production. Currently, the main portion of municipal solid waste is disposed at the landfill site Jakuševac, while small fraction of collected bio-waste is used in a composting plant. In the last couple of years large efforts have been made to increase the quantity of separately collected bio-waste in Zagreb. In order to more precisely determine the possibilities and costs of citywide source separated waste collection, the pilot project "Mamutica" is currently underway. Developing a waste separation system along with the increased number of recycling yards will significantly increase the quantity of bio-waste suitable for biogas production.



Figure 5 Presentation of waste management and activities on biogas in the City of Zagreb - Mr. Bojan Ribić (Čistoća)

Next presentation was dedicated to greenhouse gas (GHG) emission reduction measures in waste management in Croatia. Ms Andrea Hublin presented total national GHG emissions and contribution of waste sector to total emissions. Dominant emissions in waste sector were solid waste disposal on land. The growing trend in CH₄ emission from waste disposal sites in last five years was presented, but also the potential of mitigation measures. Implementation of the separate waste collection system leads to the reduction of the amount of waste on disposal sites. It has significant potential for GHG emission reduction.

Finally, possible financial mechanisms for biogas plants using organic urban waste as substrate were given in the presentation of Mr Marko Karan. He presented four possible financing mechanisms: conventional (corporate) financing, project financing, leasing and ESCO model (contracting for biogas) of financing; giving examples of pros and cons for each of the presented generic models. Furthermore, he explained characteristics of developed financial markets in EU and gave comparison with situation in Croatia. In addition, Bank requirements in developed EU biogas markets with sound practice of financing biogas plants were also presented. He stressed the importance of good preparation of the project, including obtaining appropriate approvals/licences and contracts with all interested parties, before entering communication with financial institution, and ended his presentation with snapshot of current situation and prospects of Croatian RES market in terms of financing.

The training seminar was finished with final discussion on desirable urban waste management options and related issues, in order to fulfil international obligations. After final discussion, Mr Robert Bošnjak closed the seminar.



Figure 6 Discussion after presentations of good practice examples of waste management in EU and waste management practice in the City of Zagreb

2.2. Conclusion

The training seminar in urban waste management was fruitful event for the participants. Positive opinions on the seminar were identified by evaluation forms, gathered from seminar's participants (24 participants evaluated the seminar). Organization of the seminar will help in implementation of separate waste collection system in the City of Zagreb, as important step in realization of the "Waste to Biomethane" concept.

3. Summary of Urban Waste Management Training in Abrantes – Portugal

In Abrantes Urban waste management training was held during the Summer school. The Urbanbiogas Summer School was held between the 9th and 12th of July. The activities undertaken in this action consisted of trainings, visits and recreational activities.

The objective of the Summer School was to provide the participants an opportunity to get to know the Urbanbiogas project and also the points of interest in the region in what regards energy production, biogas and waste management.

Additionally this event was important to attract national entities with an interest in participating in the Local Support Group to the implementation and dissemination of UrganBiogas projects' results.

This action was limited to 20 participants in order to have a restricted audience targeted primarily for municipal technicians, students and companies. The expressions of interest, however, were 50.

The visits in the Summer School resulted from the direct involvement and cooperation with the entities that integrate the LSG.

3.1. Summer School – 9th of July

The Summer School was initiated at 10:30, on the 9th of July, and was attended by the Mayor of Abrantes, Maria do Céu Albuquerque, who gave a warm welcome to the participants and presented the program for the four days of the Urbanbiogas Summer School.



Figure 7 Opening Session of Summer School. Maria do Céu Albuquerque – Mayor of Abrantes

After the presentation of the Summer School program it was initiated the training action oriented by the Fraunhofer Institute for Wind Energy and Energy System Technology, represented by Henning Hahn.

In the first session it was presented a case study of biogas production from waste. In this presentation were characterized the raw materials (waste) to the digestives, the technical specifications of the process of digestion and production of biomethane, obtainment of biogas and electric energy production from the biogas produced.

The coffee break was preceded by the presentation of the speaker Henning Hahn from the Fraunhofer Institute that addressed the process of project finance for biogas production as well as the specifications for the success of these proposals. In this presentation it was also discussed the funding mechanisms in the UE for biogas projects.



Figure 8 Henning Hahn's presentation - Fraunhofer Institute

During the lunch break, the participants had the chance to experience a fully electric small utility vehicle, the Renault Twizy.



Figure 9 Test-drive in Renault Twizy

The afternoon session began with a presentation by Henning Hahn with the characterization of the technology used to produce biogas. In this presentation it was mentioned the general aspects of the technology of biogas production. It was also presented the new developments in technology, state of the art in Europe and the most relevant economic aspects.



Figure 10 Henning Hahn's presentation - Fraunhofer Institute

Upon completion of the training by the Fraunhofer Institute, the participants went to the visit to the Coal-fired Power Plant TejoEnergia. The TejoEnergia powerplant consists of two groups, each one equipped with a steam generator, a turbine-generator group and a main transformer. The average annual production of this plant is about 5 million MWh, representing 5 to 10% of the total consumption in Portugal.



Figure 11 Visit to the Coal-fired Power Plant TejoEnergia



Figure 12 Visit to the Coal-fired Power Plant TejoEnergia

After visiting the Coal-fired Power Plant the participants had the opportunity to do some recreational activities in Aquapolis in Abrantes.

The activities organized by MT21 with the cooperation of the Municipality of Abrantes included canoeing, soccer and beach volleyball.



Figure 13 Recreational activities within the Summer School

3.2. Summer School – 10th of July

The second day of the Summer School started at 10am with a visit to the solid waste treatment and upgrading integrated center of Valnor in Avis.

A reception was given by the Valnor CEO Pinto Rodrigues and by Sara Geraldo who explained the strategy of Valnor, the area of operation and the main processes.



Figure 14 Reception at Valnor by Pinto Rodrigues and Sara Geraldo



Figure 15 Reception at Valnor

The visit to the solid waste treatment and upgrading integrated center of Valnor allowed the knowledge of the reception line and sorting of urban waste, of the section of end-of-life vehicles as well as of the electrical and electronic equipment waste. Additionally it was possible to observe a section of used tire collection and the anaerobic digestion process and biogas production.

With respect to household waste, when arriving at Valnor facilities undergo by a separation process by size, followed by a separation of metals which are mixed with the MSW (Municipal Solid Waste). This separation is done in an automatic line. After automatic separation, a manual one is made as well as routing separation of waste for the various ranks of recycling and recovery.



Figure 16 Visit to the solid waste treatment and upgrading integrated center



Figure 17 Visit to the solid waste treatment and upgrading integrated center. Entrance of the waste for the automatic separation line



Figure 18 Visit to the solid waste treatment and upgrading integrated center. Manual separation line

The residues targeted for organic recovery are then crushed and sent to a storage room / pre-treatment by anaerobic digestion.



Figure 19 Visit to the solid waste treatment and upgrading integrated center. Solid fraction with organic appreciation potential

The set of residues are subsequently brought to the capture tunnels where the biogas is produced and collected. The retention time varies between 10 and 15 days.

After the digestion process is complete the resultant compound is directed to the recovery farm. The biogas produced is transported to the gasworks and then to energy recovery.

This unit has an installed capacity of 25.000 tonnes of BMW's (Biodegradable Municipal Waste) having capacity to produce 110KWh of energy for each tonne of BMW's processed, resulting thus in 2750 GWh / year for marketing.



Figure 20 Visit to the solid waste treatment and upgrading integrated center of Valnor. On the left, the gasometer and the right the setup with bike generators



Figure 21 Visit to the solid waste treatment and upgrading integrated center of Valnor. Left the compound after anaerobic digestion and right biofilters for odors removing

After the visit to anaerobic digestion treatment, it was possible to visit other ranks, including dismantling monsters of end of life vehicles.



Figure 22 Visit to the solid waste treatment and upgrading integrated center of Valnor. Tares taken from end-of-life vehicles

As a result of end-of-life vehicles dismantling a waste is originated, mainly electrical cables, which is handled by Valnor with a device that automatically separates the copper from synthetic material, as shown in the image below.



Figure 23 Visit to the solid waste treatment and upgrading integrated center of Valnor

On the left, the equipment that makes the separation of copper from synthetic material of wires removed from end of life vehicles and at the right the copper resulting from separation. The Dismantling unit of monsters was also visited by the participants, being represented in the figure below the space where mattresses and sofas are dismantled.



Figure 24 Visit to the solid waste treatment and upgrading integrated center of Valnor. Monsters treatment plant - mattresses dismantling at left and at right sofa dismantling

The afternoon visit, in Valnor unity, was initiated by acknowledging the processing unit of used cooking oil and waste treatment row of selective collection.



Figure 25 Visit to the solid waste treatment and upgrading integrated center of Valnor. À esquerda fileira de plástico e à direita fileira de vidro provenientes da recolha seletiva

Used oils treatment is carried out in an installation dimensioned for this purpose, able to collect 250.000 liters of used cooking oil, which is traduced into 200.000 liters of biodiesel per year. The biodiesel produced in this facility is fully used in Valnor fleet vehicles.



Figure 26 Visit to the solid waste treatment and upgrading integrated center of Valnor. Left, model of used cooking oils processing and at right biodiesel supply for fleet vehicles Valnor

The excess of oils treatment results in glycerine which is used for no intensive production of soap (exclusively used in Valnor sanitary installations). After Valnor visit, the afternoon session was held in order to give participants the opportunity for a brief intervention in Summer School.

The first presentation was made by Simbiente, represented by Ana Costa and Joana Correia. With this presentation was transmitted to the participants the national context, in what regards the use of natural resources for electricity production. Additionally it was also presented the ranking for Portugal and Europe, concerning the potential for waste production and use.

The second presentation was made by ESTG Polytechnic Institute of Portalegre, represented by Paulo Brito. Paulo Brito made a brief presentation of the Central and gasification study of biomass ESTG of Polytechnic Institute Portalegre. The pilot plant is located in Portalegre and has a didactic function is the study of biomass energy potential as well as optimize the operating conditions of its gasification. This optimization is done considering the energy aspects and environmental perspective also related to the quality of emissions from flaring.

The third presentation was oriented by Sysadvance company, represented by Patrick Barcia. Patrick Barcia introduced technologies and their use for the purification of biogas produced from waste. The purification technology used, "Methagen" includes a system for H₂S removal, a pretreatment Scrubber and biological activated carbon filter followed by a PSA (Pressure Swing Adsorption) dry without liquid effluent and, in the end of the process, pressurization is made an injection into the natural gas network.

The last presentation was made by Juan Pablo IrRADIARE who presented the case studies of European cities with recovery of biogas from waste. After the afternoon session, in the end of the day, was organized by MT21 in cooperation with the Abrantes Municipality a break with gastronomic typical sweets of Abrantes.

3.3 Summer School – 11th of July

On the third day of the Summer School, the visit began in Valorlis and was accompanied by João Rita from Valorlis.

In this visit it was possible to visit the ORC (Organic Recovery Center) of Valorlis. The plant receives waste from Alta Estremadura and West, having the capacity of 50,000 tons/year of MSW and serving approximately 719.000 inhabitants.

The ORC treatment process of Valorlis begins with the reception of the waste transported and the first mechanical treatment is "open-bags". After the first treatment stage, the waste is conveyed to a sieve and then separated by size.



Figure 27 Visit to the solid waste treatment and upgrading integrated center of Valoris. "Open-bags" in the reception room of waste

In this stage, the bigger amount of waste is sent for selective separation, recyclable fraction is sent for recycling and non-recyclable fraction is sent for production of RDF (Refuse Derived Fuel). A smaller fraction is sent to a buffer supply line at each cycle.



Figure 28 Visit to the solid waste treatment and upgrading integrated center of Valorlis. Fraction with larger recycling potential

After thickened, the waste is stored in the suspension tank which will feed the digesters in a continuous way.



Figure 29 Visit to the the solid waste treatment and upgrading integrated center of Valorlis. Digestors

In the organic digesters, the matter is degraded by anaerobic digestion. Consequently originates biogas production which is transferred to the gasometer. The biogas is then stored in a gasometer, after being used to produce electricity.



Figure 30 Visit to the solid waste treatment and upgrading integrated center of Valoris. Gasometer at the left and at right motor generators

The sludge resulting from the process is directed to composting to produce organic concealer.



Figure 31 Visit to the solid waste treatment and upgrading integrated center of Valorlis. Monitoring of compost heaps

The percentage of waste that does not suffer treatment described above, are taken to the landfill.



Figure 32 Visit the landfill in operation with biogas capture of Valorlis. Landfill cells

The afternoon training focused on practical examples of waste management and awareness on this topic. The session began with the intervention of Natércia Santos, who presented a project undertaken at Polytechnic Institute of Portalegre that focuses on the potential of incorporating eggshell residue in ceramics industry. Then, Filipe Melo from Resitejo (association management and waste handling Médio Tejo covering six municipalities associated with MT21) presented the strategy for communication and environmental awareness in its covered area.

André Silva and João Garcia of MédioTejo21 presented the basic steps and economic burden estimated for a facility waste production .

Jorge Gaspar presented the Waste Management System in th college as well as the major procedures in the facilities. Ines Silva from IrRADIARE presented a case study of the structure within the European Covenant of Mayors, an Action Plan for Sustainable Energy, as an example, for a Portuguese city.



Figure 33 (1) Natércia Santos – Instituto Politécnico de Tomar; (2) André Silva e João Garcia – MédioTejo21; (3) Jorge Gaspar – Escola da Cavalaria de Abrantes; (4) Inês Silva – IrRADIARE

After the training session, it was made a visit to the Museum.



Figure 34 Visit to the Museum

3.4 Summer School – 12th of July

The last day of Summer School was characterized by a diversity of visits in Serta 's Municipality. The visits began in the Biomass Central of Palser.

The Biomass Central is responsible for the electricity production (3,000 KVA) from biomass.

The feedstock for this facility is clean biomass from the forests of the region, producing electricity and coke. The coke resulting from the process is not, at present being valued despite the company is investigating the best system for the use of this product.



Figure 35 Visit to Biomass Central Palser facilities

After the visit to the Plant, the participants visited the wind farm in Pinhal Interior Sul, in substation Fundeiro.

It has five windmills, of sixty-four existing in Pinhal Interior Park. This subparque represents a 23.1 GWh annual production of 336.1 GWh of park production capacity. Pinhal Interior Sul Park is responsible for the reduction of 194 thousand ton/year of CO₂ emissions and the reduction of fuel imports in around 110 thousand tons/year.



Figure 36 Visit to Pinhal Interior Sul Park

Afterwards was made a visit to the Water Central of Cabril. This facility is managed by the Central Production Centre, Tejo-Mondego. Cabril Central has an annual average production of 304.9 GWh and is in watershed of Zêzere.



Figure 37 Visit to Hydro Central Production of Cabril

The Closing Session of the Urbanbiogas Summer School was held in the Municipality of Sertã, being represented by the Mayor the Municipality, José Farinha Nunes.

3.5. Conclusion

The Summer School participants visited important places in Abrantes and Médio Tejo e Pinhal Interior Sul Region that allow to differentiate this region in what concerns electrical energy production under the more diverse forms, thermoelectric, wind, hydro, biomass and biogas from waste.

During the Summer School, the training revealed to be essential not only to disseminate the Urbanbiogas Project as to obtain data on small or pilot projects in the region and close by municipalities that are being developed so that the environmental and energetic sector are in constant development.

Considering that many participants of the Summer School were students, in this area, was prepared a participation certificate.

In general, this training action has allowed very positive results, since it was possible to show to a pre determined public a group the important concepts from the sustainable waste management to the enhancement through the biogas production on a theoretical basis with trainings and visits on a more practical form.