Urban waste for biomethane grid injection and transport in urban areas

Project No: IEE/10/251

Urbanbiogas Summer School

Training on urban waste management, biogas and biomethane

WP 4 – Task 4.2

WP 3 – Task 3.3

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Authors: Mónica Martins, Energy Agency MédioTejo21 on behalf of Câmara Municipal de Abrantes
Flávia Duarte, IrRADIARE, Lda.

Editors: Marcos António Nogueira, IrRADIARE Lda

Contact: flavia.duarte@irradiare.com
IrRADIARE, Science for Evolution
Rua Marcos Portugal, 8-A
1495-091 Algés
http://www.irradiare.com

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UrbanBiogas website: www.urbanbiogas.eu

Contents

1 Abreviations

MT21	Energy Agency MédioTejo21
WP	Work Package
UE	European Union
WtB	Waste to Biomethane

2 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.

The Portuguese Partners are the Municipality of Abrantes, representing the Médio Tejo and Pinhal Interior Sul regions.

3 Summer School

3.1 Objective

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.

3.2 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 1 – 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.

Figure 2 – Henning Hahn's presentation - Fraunhofer Institute

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.

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

Figure 3 –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 4 – 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 5 –Visit to the Coal-fired Power Plant TejoEnergia

Figure 6 – 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 7 – Recreational activities within the Summer School

3.2.1 Participants on the 9th of July

Table 1: Summer School participants on 9/07/2012

Nome	Empresa/Organização	Email
Ana Leonor Mendes	Student of Instituto Politécnico de Tomar	leonor_vmendes@hotmail.com
Ana Marques	-	-
Anca Martins	Student of Instituto Politécnico de Tomar	anca_martins@hotmail.com
Andreia Gonçalves	Student of Instituto Politécnico de Tomar	andreiafilipasantos3@hotmail.com
Carolina Fontinha	Student of Universidade de Lisboa	carolina.fontinha@gmail.com
Filipe Melo	Resitejo	filipe.melo@resitejo.pt
Joana Jacinto	Student of Universidade de Lisboa	joanamjacinto@gmail.com
João Siopa	Student ofStudent ofUniversidade de Lisboa	joao_ls@hotmail.com
Magda Alves	Student of Instituto Politécnico de Tomar	magda_silva_alves@hotmail.com
Marco Silva	Student of Universidade de Lisboa	slbsilva18@hotmail.com
Miguel Carvalho e Branco	Student of Instituto Superior Técnico	miguasbranco@hotmail.com
Pedro Augusto Marques	Researcher for the Indutrial Ecology Center	pedro.marques@dem.uc.pt
Sandra França	ERSE	SFranca@erse.pt
Tiago Jerónimo	Municipality of Chamusca	cmc.ambiente@mail.telepac.pt
Cátia Carvalheira	Student of Instituto Politécnico de Tomar	catia.carvalheira@gmail.com
Inês Silva	IrRADIARE	ines.silva@irradiare.com
Rui Henriques	IrRADIARE	rui.henriques@irradiare.com
Carla Rei	MT21	carla.rei@mediotejo21.net
Joana Correia	Simbiente	joana.correia@simbiente.com
Ana Costa	Simbiente	ana.costa@simbiente.com
André Silva	MT21	andre.silva@mediotejo21.net
João Garcia	MT21	joao.garcia@mediotejo21.net
Mónica Martins	MT21	monica,martins@mediotejo21.net

3.3 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 8 – Reception at Valnor by Pinto Rodrigues and Sara Geraldo

Figure 9 – 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 10 – Visit to the solid waste treatment and upgrading integrated center

Figure 11 – Visit to the solid waste treatment and upgrading integrated center

Entrance of the waste for the automatic separation line

Figure 12 – 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 63 – 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 74 – 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 85 – 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 96 – Visit to the solid waste treatment and upgrading integrated center of Valnor

Tires 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 107 – 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 118 – 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 19 – 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 20 – 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 Scruber 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.

Figure 12 – (1) Ana Costa - Simbiente; (2) Paulo Brito – Escola Superior Técnica de Gestão de Portalegre; (3) Patrick Barcia - Sysadvance (4) Juan Pablo - IrRADIARE

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.

Participants on the 10th of July

Table 2: Summer School participants in 10/07/2012

Nome	Empresa/Organização	Email
Ana Leonor Mendes	Student of Instituto Politécnico de Tomar	leonor_vmendes@hotmail.com
Ana Marques		-
Anca Martins	Student of Instituto Politécnico de Tomar	anca_martins@hotmail.com
Andreia Gonçalves	Student of Instituto Politécnico de Tomar	andreiafilipasantos3@hotmail.com
Carolina Fontinha	Student of Universidade de Lisboa	carolina.fontinha@gmail.com
Filipe Melo		filipe.melo@resitejo.pt
Joana Jacinto	Student of Universidade de Lisboa	joanamjacinto@gmail.com

Nome	Empresa/Organização	Email
Ana Leonor Mendes	Student of Instituto Politécnico de Tomar	leonor_vmendes@hotmail.com
Ana Marques		-
João Siopa	Student of Universidade de Lisboa	joao_ls@hotmail.com
Magda Alves	Student of Instituto Politécnico de Tomar	magda_silva_alves@hotmail.com
Marco Silva	Student of Universidade de Lisboa	slbsilva18@hotmail.com
Margarida Silva	Professor of E. S. Tomar Jácome Ratton	margarida.silva.abt@gmail.com
Miguel Carvalho e Branco	Student of Instituto Superior Técnico	miguasbranco@hotmail.com
Patrick Bárcia	Sysadvance, S.A.	patrick.barcia@sysadvance.com
Pedro Augusto Marques	Researcher for the Indutrial Ecology Center	pedro.marques@dem.uc.pt
Sílvio Monteiro	Sysadvance, S.A.	Silvio.Monteiro@sysadvance.com
Sílvia Dias	Student of Universidade Nova de Lisboa	silviamadias@gmail.com
Tiago Jerónimo	Municipality of Chamusca	cmc.ambiente@mail.telepac.pt
Carla Rei	MT21	carla.rei@mediotejo21.net
Joana Correia	Simbiente	joana.correia@simbiente.com
Ana Costa	Simbiente	ana.costa@simbiente.com
André Silva	MT21	andre.silva@mediotejo21.net
João Garcia	MT21	joao.garcia@mediotejo21.net
Mónica Martins	MT21	monica,martins@mediotejo21.net

3.4 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 22 – Visit to the 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 23 – Visit to the the solid waste treatment and upgrading integrated center of Valoris

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 24 – 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 25 – 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 136 – 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 147 – 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 158 – (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 169 – Visit to the Museum

Participants on the 11th of July

Tabela 3: Summer School participants on 11/07/2012

Nome	Empresa/Organização	Email
Ana Leonor Mendes	Student of Instituto Politécnico de Tomar	leonor_vmendes@hotmail.com
Anca Martins	Student of Instituto Politécnico de Tomar	anca_martins@hotmail.com
Andreia Gonçalves	Student of Instituto Politécnico de Tomar	andreiafilipasantos3@hotmail.com
Carolina Fontinha	Student of Universidade de Lisboa	carolina.fontinha@gmail.com
Filipe Melo		filipe.melo@resitejo.pt
Joana Jacinto	Student of Universidade de Lisboa	joanamjacinto@gmail.com
João Siopa	Student of Universidade de Lisboa	joao_ls@hotmail.com
Magda Alves	Student of Instituto Politécnico de Tomar	magda_silva_alves@hotmail.com
Marco Silva	Student of Universidade de Lisboa	slbsilva18@hotmail.com
Margarida Silva	Professor in E. S. Tomar Jácome Ratton	margarida.silva.abt@gmail.com
Miguel Carvalho e Branco	Student of Instituto Superior Técnico	miguasbranco@hotmail.com
Patrick Bárcia	Sysadvance, S.A.	patrick.barcia@sysadvance.com

Nome	Empresa/Organização	Email
Ana Leonor Mendes	Student of Instituto Politécnico de Tomar	leonor_vmendes@hotmail.com
Pedro Augusto Marques	Researcher for the Indutrial Ecology Center	pedro.marques@dem.uc.pt
Pedro Santos	-	-
Sandra França	ERSE	SFranca@erse.pt
Sílvio Monteiro	Sysadvance, S.A.	Silvio.Monteiro@sysadvance.com
Sílvia Dias	Student of Universidade Nova de Lisboa	silviamadias@gmail.com
Tiago Jerónimo	City Council of Chamusca	cmc.ambiente@mail.telepac.pt
Carla Rei	MT21	carla.rei@mediotejo21.net
Joana Correia	Simbiente	joana.correia@simbiente.com
Ana Costa	Simbiente	ana.costa@simbiente.com
André Silva	MT21	andre.silva@mediotejo21.net
João Garcia	MT21	joao.garcia@mediotejo21.net
Mónica Martins	MT21	monica,martins@mediotejo21.net

3.5 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 30 – 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 3117 – 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 32 – 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.

Figure 33 – Closing Session in the Municipality of Sertã

Mayor José Farinha Nunes

Participants on the 12th of July

Table 4: Summer School Participants on the 12/07/2012

Nome	Empresa/Organização	Email
Ana Leonor Mendes	Student of Instituto Politécnico de Tomar	leonor_vmendes@hotmail.com
Anca Martins	Student of Instituto Politécnico de Tomar	anca_martins@hotmail.com
Andreia Gonçalves	Student of Instituto Politécnico de Tomar	andreiafilipasantos3@hotmail.com
Carolina Fontinha	Student of Universidade de Lisboa	carolina.fontinha@gmail.com
Filipe Melo		filipe.melo@resitejo.pt
Joana Jacinto	Student of Universidade de Lisboa	joanamjacinto@gmail.com
João Siopa	Student of Universidade de Lisboa	joao_ls@hotmail.com
Magda Alves	Student of Instituto Politécnico de Tomar	magda_silva_alves@hotmail.com
Marco Silva	Student of Universidade de Lisboa	slbsilva18@hotmail.com
Margarida Silva	Professor in E. S. Tomar Jácome Ratton	margarida.silva.abt@gmail.com
Miguel Carvalho e Branco	Student of Instituto Superior Técnico	miguasbranco@hotmail.com
Pedro Augusto Marques	Investigator on the Center for the Industrial Ecology	pedro.marques@dem.uc.pt
Tiago Jerónimo	Municipality of Chamusca	cmc.ambiente@mail.telepac.pt
Carla Rei	MT21	carla.rei@mediotejo21.net
Joana Correia	Simbiente	joana.correia@simbiente.com
Ana Costa	Simbiente	ana.costa@simbiente.com
André Silva	MT21	andre.silva@mediotejo21.net
João Garcia	MT21	joao.garcia@mediotejo21.net
Paulo Mariano	Municipality of Sertã	mariano@cm-serta.pt

4 Summer School questionnaires

Following this event and attending to the number of visits made, IrRADIARE has developed a Summer School Evaluation Questionnaire for the participants (Annexe 1). This questionnaire has allowed acknowledging if the actions organized corresponded to the participants' expectation. The results obtained are presented below.

In what regards the first day:

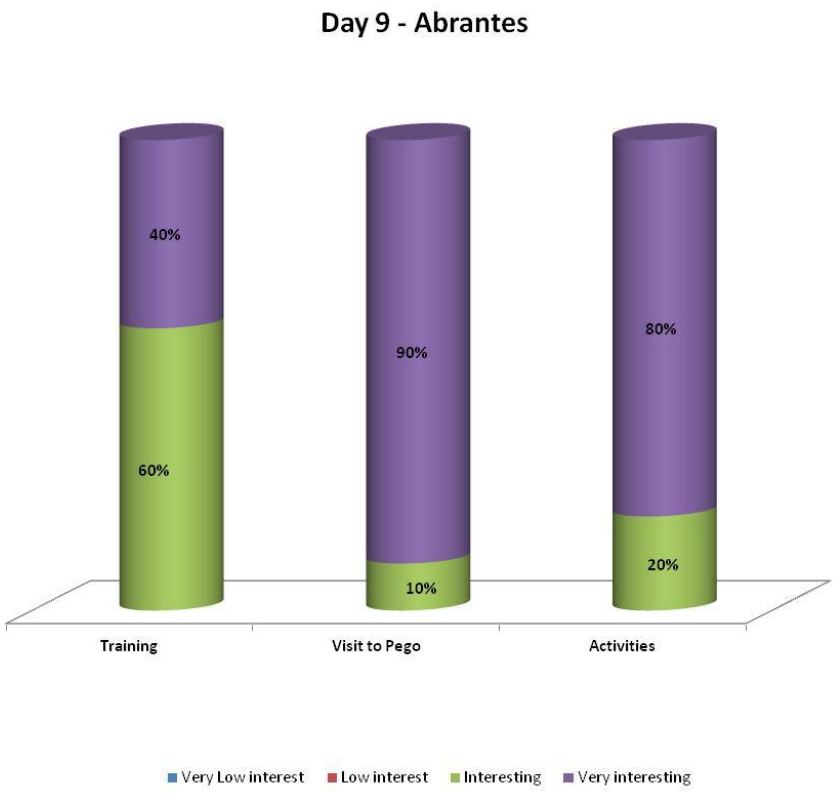

Figure 34 – Participants' satisfaction on the 1st day of the Summer School

The participants' satisfaction on the 2nd day is presented below.

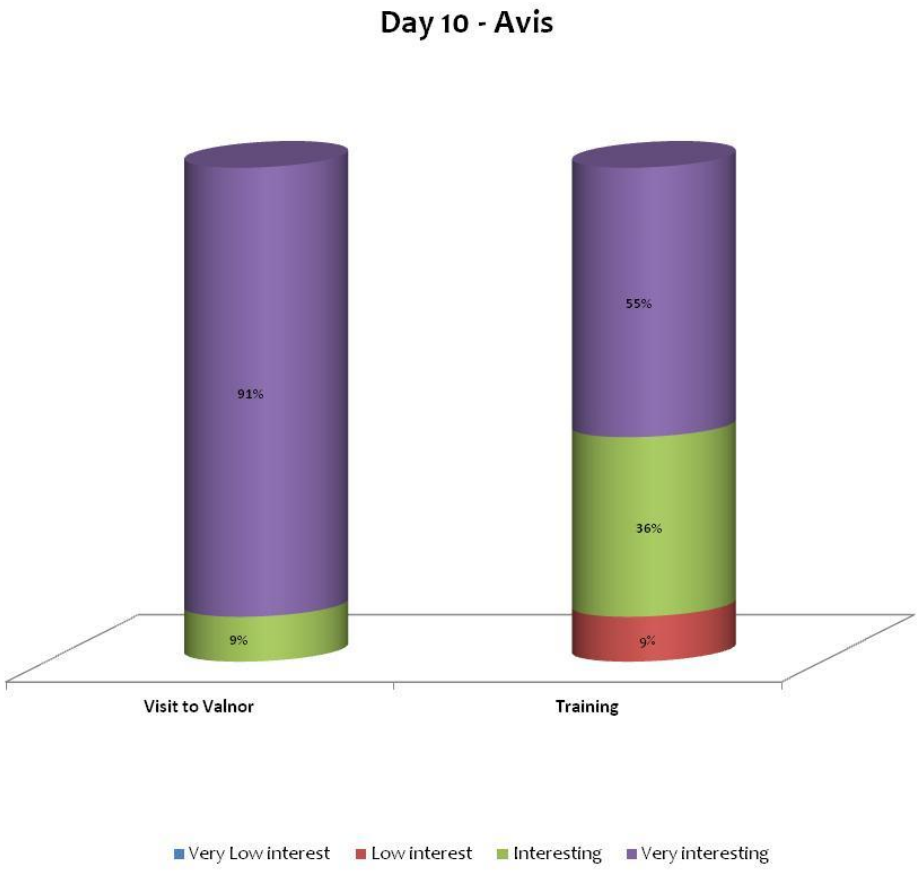

Figure 35 – Participants' satisfaction on the 2nd day of the Summer School

On the 3rd day the obtained results were:

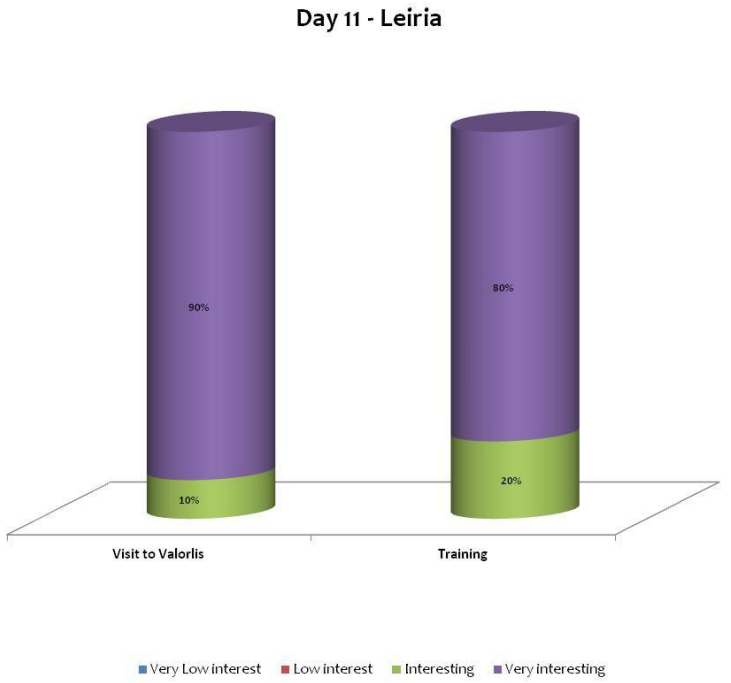

Figure 36 – Participants' satisfaction on the 3rd day of the Summer School

On the last day, that occurred in Sertã, composed only by visits, the inquired satisfaction was as follows:

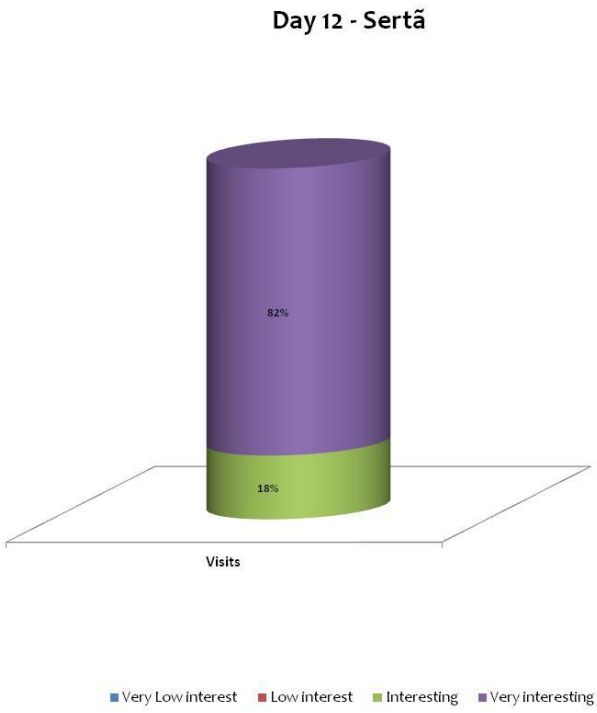

Figure 37 – Participants' satisfaction on the last day of the Summer School

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 reveled 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 (Annexe 2).

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.

6 ANNEXES

ANNEXE 1

Summer School Evaluation Questionnaire

Urbaniogas Project

A Summer School contemplou um conjunto de visitas e workshops, no contexto do projeto Urbanbiogas, apoiado pelo Programa Intelligent Energy for Europe. Este projeto tem como objetivo promover soluções de valorização de resíduos urbanos para a produção de biogás para injeção na rede de gás natural e utilização como combustível para transportes.

No contexto da Summer School gostaríamos de conhecer a sua opinião quanto às visitas e workshops realizados.

O preenchimento deste inquérito demora apenas alguns minutos sendo importante para averiguar o seu grau de satisfação. A sua opinião servirá também como base para o planeamento de futuros eventos.

1. Como teve conhecimento da Summer School?

Divulgação por e-mail _____

Divulgação pela Universidade _____

Outro (por favor especifique) _____

2. Classifique os eventos da Summer School:

Utilize a seguinte escala: 1- Muito pouco interessante 2- Pouco interessante 3- Interessante 4- Muito Interessante

	1 Muito pouco interessante	2 Pouco interessante	3 Interessante	4 Muito interessante
Dia 9 – Abrantes				
Formação em sala				
Visita à Central do Pego				
Atividades				
Dia 10 - Avis				
Visita à Valnor				
Formação em sala				
Dia 11 – Leiria				
Visita à Valorlis				
Formação em sala				
Dia 12 – Sertã				

Visitas				

	1 Muito pouco interessante	2 Pouco interessante	3 Interessante	4 Muito interessante
Globalmente, como avalia a Summer School?				

Observações: _____

3. Que sugere como temas para próximos eventos?

_____

4. De um modo geral, como expressaria, numa frase*, a sua experiência na Summer School:

**Esta frase poderá ser utilizada para futuros eventos da mesma série.*

Muito obrigado pela sua opinião!

ANNEXE 2

Summer School Certificate

URBAN BIOGAS
www.urbanbiogas.eu

Certificado

SUMMER SCHOOL

Certifica-se que _____ participou na Summer School que decorreu entre os dias 9 e 12 de Julho de 2012. A formação foi composta por 9 horas de formação em sala e 13 horas de visitas técnicas, com a intervenção das seguintes entidades (por ordem de participação): Câmara Municipal da Abrantes; Fraunhofer Institute for Wind and Energy System Tecnology; Pegop; Valnor; Simbiente; Instituto Politécnico de Portalegre; Sysadvance; IrRADIARE; Valorlis; Instituto Politécnico de Tomar; Resitejo; MédioTejo21; Escola de Cavalaria de Abrantes; Palser; Parque eólico do Pinhal Interior; Central Hidroeléctrica do Cabril; Câmara Municipal da Sertã.