THE BIOGAS MARKET IN SOUTHERN AND EASTERN EUROPE: PROMOTING BIOGAS BY NON-TECHNICAL ACTIVITIES

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ABSTRACT: Currently, the biogas sector in Western Europe is faced by rapid technical and non-technical developments and innovations, and biogas markets are growing at a considerable pace. In contrast, the biogas market in Southern and Eastern Europe is rather small, although the potential is promising especially if organic wastes are used for anaerobic digestion. In order to support the biogas market in Southern and Eastern Europe the BiG>East project (Contract No. EIE/07/214) is supported by the European Commission under the Intelligent Energy for Europe Programme. The paper gives an overview about the current biogas market and the biogas potential in Bulgaria, Croatia, Latvia, Romania, Slovenia and Greece. Furthermore, it describes the main barriers of biogas production and proposes different measures to overcome these barriers in the target countries. Finally, the paper discusses the most promising strategies to support the biogas market in Southern and Eastern Europe.

Keywords: biogas, anaerobic digestion, barriers to bioenergy, socio-economic aspects

1 INTRODUCTION

Europe's current situation with exploding fossil energy prices and rising dependency on energy imports makes it highly necessary to produce and valorise biogas in terms of heat, electricity and fuel. In 2006, about 5.35 Mtoe of biogas were produced for energy uses in the European Union [1]. Nevertheless, the potential is estimated at much more than 20 Mtoe. Currently, the biogas sector in Western Europe is faced by rapid technical and non-technical developments and innovations, and biogas markets are growing at a considerable pace. In Germany, more than 3 700 biogas plants are installed (2007). The biogas is mainly used in combined heat and power (CHP) installations in Germany, but new applications such as biogas up-grading to vehicle fuel (in Jameln) and for feeding into the grid (e.g. in Pliening, Kerpen and Straelen) have come into operation. Also Austria and Denmark have considerable biogas markets including more than 500 biogas plants [2].

In contrast, the biogas market in Southern and Eastern Europe is rather small, although the potential is promising especially if organic wastes are used for biogas production. According to the recent EU's Directive 2006/12/EC on waste, Member States shall take appropriate measures to encourage the use of waste as a source of energy [3].

In order to support the biogas market in Southern and Eastern Europe the BiG>East project "Promoting Biogas in Eastern Europe – Mobilization of Decision Makers and Training for Farmers" (Contract No. EIE/07/214) is supported by the European Commission under the Intelligent Energy for Europe Programme.

2 THE BiG>East PROJECT

The general objective of BiG>East (Figure 1) is to promote the production and use of biogas as a secure and sustainable energy source in six target countries of Eastern and Southern Europe: Bulgaria, Croatia, Latvia, Romania, Slovenia and Greece. This will be achieved by knowledge transfer from project partners with extensive, long-term expertise of Western Europe to farmers, biogas plant operators and decision makers in Southern and Eastern Europe. The BiG>East project is coordinated by WIP Renewable Energies and includes twelve organisations which elaborate the following tasks of the BiG>East project [4]:

- Studies on the **biogas potential and barriers** in the target countries
- Development of training **handbooks** for farmers in English and national languages
- Implementation of 18 pilot **training courses** for farmers
- Identification of **promising sites** for the set-up of new biogas plants
- Organisation of 12 **mobilization campaigns** for decision makers and funding bodies
- Dissemination of project results via **workshops**, technical **study tours** and presentations

Figure 1: BiG>East logo

The BiG>East project was launched at the Kick-Off-Meeting in Munich in October 2007. The two-days meeting was accompanied by a study tour to two innovative biogas plants in Germany in order to build capacity among the consortium (Figure 2).

Figure 2: BiG>East study tour to the biogas plant in Pliening, Germany, which feeds methane into the natural gas grid (Oct. 2007)

BiG>East (Contract No. EIE/07/214) is supported by the European Commission under the Intelligent Energy for Europe Programme. Further information about the BiG>East Project is available on the project website: www.big-east.eu.

3 THE BIOGAS MARKET IN SOUTHERN AND EASTERN EUROPE

The production and wide-range utilisation of biogas offers many benefits for Bulgaria, Croatia, Latvia, Romania, Slovenia and Greece. Within this, it is necessary to identify barriers and constraints that currently prevent low-cost biogas production and full exploitation of available biogas potential. Overcoming these barriers would not only allow these countries to use biogas, but would also help to meet European environmental objectives and reduce energy imports from abroad. Therefore, the environmental implications and the sustainability of biogas production and use in Eastern European countries are important issues.

The increased utilisation of biogas could be integrated to national environmental action programmes in order to reduce climate relevant methane emissions. The production of biogas can also help meeting waste management plans of the target countries. Biogas production based on waste such as animal manure, sludge and other wastes should be prioritised since the sustainability and environmental benefits of these methods are unequivocal.

Furthermore, biogas production has the potential to increase income of farmers and decrease the need for agricultural subsidies. The plantation of dedicated energy crops for co-digestion can strengthen rural areas, especially in Eastern Europe. However, the development of biogas installations in Western Europe which are based on energy plants has slowed considerably, mainly due to rising commodity prices.

In the following, an overview of the current situation in target countries of the BiG>East project is presented.

3.1 Bulgaria

Bulgaria has a large potential of biomass that can be used for energy production. About 60% of the country is agricultural land and approximately 30% is woodland. Currently, biomass accounts for 3.7% of the total energy consumption, the majority of which is used in rural areas. The consumption of firewood is followed by residential consumption of wood briquettes produced from forest wastes and sawmill residues. In addition, waste from agricultural and farming activities is produced in large quantities. Furthermore, Bulgaria generates considerable amounts of landfill gas from about three million tonnes of municipal solid waste per year. The utilisation of available sustainable biomass sources and the implementation of new biogas technologies for heating purposes and the production of electricity will create opportunities for the Bulgarian energy market. Although the potential is very high no new biogas plants were installed in recent years.

3.2 Croatia

Currently, in Croatia one biogas plant is in operation and 2-6 plants are planned. The interest of farmers in anaerobic digestion is increasing due to the high potential

of agricultural wastes (manure). 486 000 cows, 123 000 pigs and 12 000 000 chicken produce approximately 14 million tons of manure. Theoretically, this could be used for the production of annually 413 million m³ biomethane and 1.5 TWh of electricity. The legislative framework for biogas production in Croatia is promising. A national energy law was introduced in 2001 and complemented by a renewable energy law in 2007. The renewable energy target for Croatia is 5.8% in 2010. Thereby, 2% have to be produced by combined heat and power generation. The electricity feed-in tariff for small-scale plants (<1 MW) is 0.1644 €/kWh and 0.1425 €/kWh for larger plants.

The main barriers for biogas production in Croatia are the high investment costs as well as complete omission of biogas plants in regional spatial planning. Namely, location permit is mandatory item for gaining eligible producer status for RES-E feed-in tariff and absence of location in spatial planning is significantly prolonging already complicated permit procedure of 10 steps. Agriculture in Croatia is based on many small-scale farms which cannot afford these costs and are afraid of the investment risk. Small-scale biogas plants (<100 kW) would be an opportunity, but revenues are too low. Another barrier is that at least 60% of the biogas project has to originate from national sources in order to gain full feed-in tariff. Otherwise, the feed-in tariff could be lowered by 7%.

3.3 Greece

Renewable Energy Sources contributed 5.5% (1.6 Mtoe) of the Greek Total Primary Energy Supply in 2006. Biomass accounted 57% and covers mainly thermal needs. Biogas from landfills, wastewater treatment plants and a couple of industrial applications contributed 36 ktoe mainly for electricity generation. The installed capacity of electricity generation from biogas was 24 MW. The gross electricity generation from biogas was 92 GWh [5].

During the 80's a few efforts for biogas energy exploitation applications were carried out in Greece. The feedstock was in principal animal excrements and wastes from food processing industries, such as oil olive mill wastes. Some of these efforts were demonstration projects which were terminated after initial enthusiasm and insurance of scientific support [6].

Currently (2007) in Greece fifteen biogas plants are in operation [7]. Most energy was produced in the area of Athens due to the operation of the Municipal Wastewater Treatment Plant (MWTP) of Psytallia and the Sanitary landfill (SL) of Ano Liosia, which treat liquid and solid wastes respectively.

Although Greece has a promising potential of organic wastes (animal manure, sewage sludge, organic fraction of the municipal solid wastes, agro-industrial wastes and by-products), currently there is no farm scale biogas plant in operation. Moreover, in the framework of the calls for permits to generate electricity by Independent Power Producers (IPPs) by the Hellenic Regulation Authority for Energy (RAE) most applications cover landfill plants and MWTP. There are currently some 5-6 biogas plants in Greece in different project phases from planning to trial operation.

The development of Renewable Energy Sources has been among the major energy policy lines of Greece. It is seen as an important contribution to the improvement of the Greek environmental indicators and, in particular, to the abatement of CO_2 emissions. Legal and financial incentives are the tools of the government's strategy to support renewable energy technology investments.

Furthermore, in recent year a favourable climate has been created, both in public and at the political level, for the substitution of conventional energy sources, mainly because of the environmental problems associated with their use and particularly with the greenhouse effect [8].

The Minister of Development finalised the new law 3468/2006, for the promotion of RES and in order to speed up the licensing procedures and to reform the electric energy production from renewable energy sources. The new feed-in tariff for electricity from biogas is 0,073 €/kWh but it depends on the used technology.

According to the provisions of the revised 2nd Greek National Programme for Climate Change, it is estimated that Anaerobic Digestion of pig manure (35% of the total breeding animals in 2010 and 50% of the total breeding animals in 2015 respectively) can reduce greenhouse gas emissions by 60 000 t CO_{2eq} in 2010 and 83 000 t CO_{2eq} in 2015.

Although social pressure, economic conditions and legislation improved the framework for biogas production, there are still barriers (mainly non-technical) to overcome in Greece, especially for the materialization of small scale biogas plants. The main barriers are public perception, experience and awareness mainly on farm scale and industrial biogas applications, lack of heat sale and high investment costs, time consuming licensing procedure, and lack of "gate fees" for waste disposal.

3.4 Latvia

Due to the available biomass resources, the biogas potential of Latvia is very promising. However, at the moment, there are only three biogas plants with cogeneration units in operation [9]. One plant uses sludge from waste water and two plants are installed on landfill sites. Their total installed capacity is 7.5 MW_{el}. There are no agricultural biogas plants in Latvia.

Studies indicate that the highest biogas potential is available in agricultural areas and will mainly come from manure. The total defined biogas potential in Latvia is about 120 million m^3 per year (81% from agricultural production, 9% from products of animal origin, 5% from municipal waste, 3% from food processing waste and the remaining 2% from sewage treatment plants).

Latvia underlies EU obligations and is determined that in 2010 renewable energies will cover 49.3% of domestic electricity consumption, including a significant contribution from agricultural biomass. In this context, the Ministry of Environment has prepared a Biomass Production and Development Programme for 2006 to 2011. The programme focuses on biogas and identifies several barriers for biogas production and development.

Besides the lack of statistical data and potential calculations, the limited availability of biogas production technologies is a problem for the development of the biogas sector. Likewise, the absence of clear investment and financial support possibilities for biogas projects causes, that only few pilot projects are available. The very low information level on biogas production and utilization causes a low cooperation level between involved institutions and decision makers.

3.5 Slovenia

Slovenia has a large potential for biogas production from farm residues and waste treatment plants. Up to now, there are only five agricultural biogas power plants in operation (4 MW_{el}) and several others are in the planning process. In addition, there are four landfill plants (3.7 MW_{el}) and six biogas plants for sewage sludge (2 MW_{el}).

The biggest biogas power plant is Nemščak with a capacity of 1.3 MW located in Ižakovci near Murska Sobota. The by-products of one of the biggest Slovenian food production entities are used for the production of energy. The plant represents a technological update of the existing purifying system for manure from farming. Up to now, most of the residues together with waste water were treated in a biological purification plant. With the new plant however, the efficiency of treatment, as well as the energy efficiency is improved significantly.

A good overview on existing biogas plants in Slovenia as well as feasibility studies is given by BUTALA et al. (2007) [10].

One reason for the unexplored biogas potential in Slovenia is the low feed-in tariff of 0.12 €/kWh which is guaranteed for only ten years and decreases by 5% after five years of operation.

3.6 Romania

Romania is covered by 40% of agricultural land and 27% of forest. The share of biomass energy within the country's energy matrix is almost 10%. Currently, biomass is mainly used for heating purposes, direct burning for cooking and water heating [11].

The research in the biogas sector started at the Romanian Experimental Center for Bacterial fertilizers more than 50 years ago. In the late 1970's, a first industrial installation was implemented with an output of 2 000 m³/day. In late 1980's, about ten installations were in operation and produced more than 30 million m³/year at waste water treatment plants.

During the same period, several smaller applications with an output between 5 and 50 m³/day were developed and implemented. In late 1980's almost 25 000 units were in operation. However, after 1990 interest and investment in biogas plants decreased dramatically. No major investment in the sector has been done after 1990 and even the maintenance work on already existing facilities was stopped.

Today, the number of large pig and cattle biogas units is decreasing significantly and only very few projects have been developed and implemented after 1990.

3.7 Summary of the biogas sectors

Until today, in Bulgaria no biogas plants are installed so far. In Croatia, the first biogas plant has been installed and several are currently planned and constructed. Due to the available biomass resources, the biogas potential of Latvia is very promising, but at the moment, there are only three biogas plants for waste materials in operation. In Slovenia there are only five agricultural biogas plants in operation and several others are in the planning phase. The biogas market in Greece is slightly more developed. Currently, there are 15 biogas plants in Greece. The produced biogas mainly comes from sewage sludge and MSW landfills. The situation in Romania is different since it has a track of biogas research and production since more than 50 years. However, only very few biogas plants have been developed and implemented after 1990.

4 NON-TECHNICAL BARRIERS

Biogas technologies are well established and developed in countries like Germany, Austria and Denmark. Research is still needed in order to improve cost efficiency, energy balances, and life cycle emissions, but biogas technologies are available and framework conditions are favourable.

Non-technical barriers such as the limited access to new technologies and unsuitable framework conditions are among the main barriers for the creation of a sound biogas market in Southern and Eastern Europe. Although some countries recently introduced renewable energy policies, there is still lack of supporting policies and legislation. It is expected that this barrier will be overcome in the medium and long term since all EU-27 member states have to implement and fulfil European Directives in the field of agriculture, energy environment, and waste. However, this will take time and needs to be accelerated. New legislation is needed to improve prerequisites for investments which will also be driven by increasing fossil energy prices.

Another main barrier for the implementation of biogas plants in Southern and Eastern Europe is the lack of interest, knowledge and awareness. In many countries available information about biogas in very limited. For instance, publications on the newest technical and scientific results about biogas technologies are missing and basic literature in national language is rare. Furthermore, there are insufficient pilot installations in order to convince policy makers, farmers or waste companies. Many stakeholders like politicians, financiers, or decision makers do neither know about the numerous technical and non-technical opportunities to implement biogas plants nor about social and environmental benefits. Finally, there is a lack of communication between different stakeholders about new energy technologies [12].

5 MEASURES TO OVERCOME BARRIERS

Due to the fact that biogas technologies are mature and available in some European countries, the main challenge is to overcome the above mentioned non-technical barriers. Emphasis of the BiG>East project is given on measures to reduce these barriers.

5.1 Access to information

An important barrier which inhibits biogas development in Southern and Eastern Europe is the lack of information which can be divided into three categories. Firstly, it is costly for exporting manufacturers from Western Europe to gain information on biofuel potentials, barriers, policies, and legislation of the target countries. Secondly, there is only very limited information on biogas technologies available for stakeholders in Southern and Eastern Europe. Finally, information on biogas potential, barriers and policies have to be easily accessible for decision makers in the target countries.

The BiG>East project aims to improve this information flow within these categories. Reports on

biogas potentials and barriers are currently being developed and will be published in August 2008. These reports will provide information for exporting manufacturers from Western Europe and for decision makers from Southern and Eastern Europe. An overview about European legislation including several directives and regulations was already elaborated [3] and is available on the BiG>East website. A biogas handbook will be elaborated in seven languages and will give basic information about technical aspects of biogas production for stakeholders in the target countries.

5.2 Mobilisation Campaigns

In order to promote biogas technology in Europe, it is crucial to inform and mobilize decision makers such as municipalities, politicians, utilities, environmental NGO's, project developers, funding bodies, waste management authorities, and SME's. Without the involvement of these decision makers and sufficient political support it will be impossible to realize biogas projects.

Decision makers are addressed in the framework of the BiG>East project by the implementation of so-called mobilisation campaigns. In order to make biogas technology as attractive as possible for decision makers, specific show cases are developed for Bulgaria, Croatia, Latvia, Romania, Slovenia and Greece including most promising sites for biogas production. These sites are identified by using guidelines [13] and assessment studies. The technical feasibility of biogas plants on these sites are presented to decision makers in the course of 12 mobilization campaigns. Local implementation strategies will recommend concrete site-specific activities towards the construction of new biogas plants.

Figure 3: Mobilisation Campaign in Croatia (Feb. 2008)

The first mobilisation campaign of the BiG>East project was implemented at the premises of the national BiG>East project partner Energy Institute Hrvoje Pozar (EIHP) in Zagreb, Croatia, in February 2008 (Figure 3). The interest in this event was large and 46 stakeholders attended the mobilisation campaign. The mobilisation campaign was promoted via several media and a special issue of the Croatian weekly business magazine "Lider" was dedicated to the BiG>East project [14]. A radio report "Pisele piše – a show mostly on environmental protection" was broadcasted by Radio 101. Furthermore, a report was published in the daily national newspaper "Vjesnik". As response to the variety of press releases, stakeholders started to provide feedback on the BiG>East project and EIHP has received several project proposals related to new biogas plants.

5.3 Biogas Training

Capacity building is one of the key measures for the development of a sound biogas market. Within the BiG>East project, 18 biogas training courses for farmers and future biogas plant operators will be implemented in Bulgaria, Croatia, Latvia, Romania, Slovenia and Greece. This will increase the awareness among farmers and activate their willingness to work in the field of biogas. Training will increase the quality of operating and maintaining biogas plants and avoid safety and health hazards, as well as malfunctioning installations.

The courses will be organised by national partners of the BiG>East consortium and supported by external lecturers. Several BiG>East members already participated in a train-the-trainers seminar which was organised in the framework of the "BiogasRegions" project supported by the European Commission in the Intelligent Energy for Europe Programme. The first BiG>East training course will be implemented in late 2008.

In order to support the training course, a Biogas Handbook is currently being developed by the BiG>East consortium. The Handbook will be published in English, Bulgarian, Croatian, Latvian, Romanian, Slovenian and Greek and issued in August 2008. The handbooks will be available for download on the BiG>East website.

5.4 Export Opportunities for Manufacturers

The development of biogas markets in Eastern Europe will provide future business opportunities for biogas equipment suppliers and for project developers which are currently from Western European countries. This is crucial for many biogas technology manufacturers e.g. from German since the development of the German biogas market decreased rapidly in the last month. This was due to increasing commodity prices and due to mistakes in the planning process. Many plants were built on "the green field" where no demand for heat exists. In many cases only electricity was fed into the grid and the heat was wasted. Once the commodity prices increased, the revenues from electricity were not enough to guarantee profitability of the plant. This lesson has to be considered for future biogas installations.

Nevertheless, BiG>East helps to establish a new biogas market for engineering companies and equipment suppliers. Training activities and mobilization campaigns provide an excellent framework to supply the market of Eastern Europe with high quality know-how and equipment.

6 CONCLUSIONS

In conclusion, the BiG>East project has the potential to increase biogas production in Southern and Eastern Europe through a bundle of non-technical supportive measures. Emphasis is given to awareness rising, European cooperation and capacity building. This supports the European Union to meet its renewable energy targets and to react on the waste problem which is very serious in many countries. Economies of scale will be reached and the renewable energy market in Europe will be strengthened.

REFERENCES

[1] EURObserv'ER (2007) Biogas Barometer. – No 179 May-June 2007

[2] RUTZ D., JANSSEN R. (2008) Support for the biogas Market in Southern and Eastern Europe. – forum.new power Special 2008; TH Mann Verlag, Gelsenkirchen, Germany, pp. 20-21

[3] RUTZ D., JANSSEN R., PRASSL H. (2008) Assessment of Biogas Policies in the Europen Union. – BiG>East Publication, WIP Renewable Energies, http://www.big-east.eu/downloads/Task_3_1_ Policies%20in%20EU_final_20080310.pdf

[4] RUTZ D., JANSSEN R., EPP C., HELM P. (2007) Förderung von Biogas in Osteuropa : Mobilisierung von Entscheidungsträgern und Training für Landwirte. – Proceedings of the 16. OTTI Symposium Bioenergie, Bad Staffelstein, Germany, pp. 223-228

[5] GREEK MINISTRY OF DEVELOPMENT (2007) 1st report on Long-term Energy Planning of Greece 2008-2020, part I.

[6] BOUKIS I. AND A. CHATZIATHANASSIOU (2000) State of Biogas production, energy exploitation schemes and incentives in Greece, 1st World Conference on Biomass for Energy and Industry, pp. 1346-1349.

[7] CRES Energy Policy and Planning Division Database.

[8] SIOULAS K., D. MAVROGIORGOS, A. CHATZIATHANASSIOU (2003). An assessment of social and environmental impacts and benefits associated with the development of the AnDigNet project, 2nd International Conference on Ecological Protection of the Planet Earth, 5-8 June 2003, Sofia, Bulgaria.

[9] DZENE I. (2008) Bioernegy use in Latvia - forum.new power Special 2008; TH Mann Verlag, Gelsenkirchen, Germany, pp. 24-26

[10] BUTALA V., AL-MANSOUR F., STRITIH U., ZUPAN G. (2007) Biomass – Renewable Energy Source for Electricity and heat Production in Slovenia – Potentials, Best Case Examples and Feasibility Studies. – Proceedings of the 16th European Biomass Conference and Exhibition, Berlin, Germany, pp. 2456-2459

[11] OFITERU A., ADAMESCU M., BODESCU F. (2008) Biogas and biodiesel market prospects in Romania. - forum.new power Special 2008; TH Mann Verlag, Gelsenkirchen, Germany, pp. 21-24

[12] RUTZ D., JANSSEN R. (2007) Nichttechnische Maßnahmen zur Förderung von Biogas in Osteuropa: Das BiG>East Projekt. – Proceedings of the 3. Forum Bioenergie, Solarpraxis, Berlin, Germany

[13] EPP C. RUTZ D. KÖTTNER M., FINSTERWALDER T. (2008) Guidelines for Selecting Suitable Sites for Biogas Plants. - BiG>East Publication, WIP Renewable Energies, www.big-east.eu

[14] LIDER (2008) Bioplin: Hrvatska ima potencijala za tristotinjak bioplinskih postrojenja. – Lider, broj 126, godina IV, veljace 2008, cijena 15kn