Project: BiG>East

(EIE/07/214)

WP 7

Mobilization Campaigns for Decision Makers

Local Implementation strategy for biogas projects in Greece

Contribution to Deliverable 7.3

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With the support of:

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1. Colophon

This report was compiled in the frame of the BiG>East project (EIE/07/214), which is supported by the European Commission within the Intelligent Energy for Europe programme. The objective of this report is to underline the follow up activities for the decision makers about the utilization of biogas as renewable and sustainable energy source.

The scope of this report is to give recommendations and guidance on how to implement biogas plants on the dedicated sites but also to other promising areas in Greece. It combines experience from the implementation of the WP 7: Mobilization Campaign for Decision Makers but also summarizes the results of the other WPs and the promotion of biogas within BiG>East project.

The report is one of a series of six reports dealing with the target countries of the BiG>East project: Bulgaria, Croatia, Greece, Latvia, Romania, and Slovenia. The target group of this report is mainly Politicians, Researchers and Decision makers.

2 Introduction

During 2007 the produced biogas in Greece derives mainly from landfills, wastewater treatment plants and a couple of industrial applications. Although Greece has a promising potential of organic wastes and especially animal manure currently there was no farm scale biogas plant in operation at the beginning of the project (2007). During 2007 fifteen biogas plants were in operation in Greece as it is shown in **Figure 1**[1]. The collection of the required data was done through a country wide field survey at biogas plants covered by CRES every year. The 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.

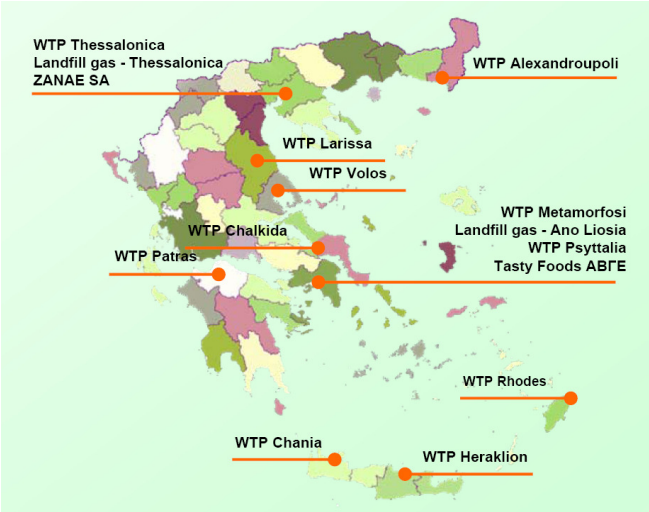

Figure 1: Biogas plants in Greece (in operation during 2007)

[1] CRES Energy Policy and Planning Division Database.

During the project lifetime three industrial and two agricultural biogas plants have been constructed in Greece. Furtherore, in the framework of the calls for permits to generate electricity by Independent Power Producers (IPPs) by the Hellenic Regulation Authority for Energy (RAE), ten applications for such permits (biogas plants) were submitted during 12/2008-02/2010 for agricultural and industrial biogas projects (installed capacity of appox. 17.6MW) [2].

The law for RES (law 3468/2006) is dedicated to 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 law sets the environment in the electricity generation, the guaranteed market price is increased and the market time expands from 10 to 20 years. Furthermore, the licensing deadlines are being reduced. Although the pricing tariff system for electricity production from RES and CHP systems set a tariff of 73€/MW for biogas plants the electricity prices are rather low. A higher electricity price should be examined based on the form of Biomass (there was no differentiation according to biomass form).

During December 2009, a new RES law was drafted by the Ministry of Environment and after a period of public consultation the law is ready to be approved by the Greek parliament. This law amends the law 3468/2006 in order to further promote RES and speed up the licensing procedure. The proposed feed-in tariffs for electricity production from RES and CHP systems has special provisions for biogas (article 5 sets a feed-in tariff of €220/MWh for agricultural and industrial biogas plants up to 3MW, and €200/MWh for plants above 3MW).

3 Mobilization campaigns

The main scopes of the campaigns were to:

- Promote the idea of the biogas exploitation as a secure and sustainable energy source,
- Motivate and convince the decision makers to support new biogas plants in Greece and especially the farm scale ones.
- Inform and present the latest developments in the field of biogas in Europe and Greece (the campaign was supported for that reason by experts on that field from the BiG>East project consortium and Greek specialists and biogas plant operators)
- Present the Biogas roadmap for future steps toward wider biogas exploitation in Greece.
- Present the developed Biogas Show Cases to the audience and achieve public awareness and acceptance for the necessity of the implementation of such schemes in Greece.

[2] Regulatory Authority for Energy (RAE), www.rae.gr

1st campaign: Athens, October 20, 2009

The 1st Mobilization Campaign took place in Athens (Divani Palace Acropolis Hotel, Tuesday, October 20, 2009) and was combined with the 4th project meeting (CRES premises and Divani Palace Acropolis Hotel, October 19 & 20, 2009). The campaign entitled "Biogas: A secure and Sustainable Energy Sources" and last from 8:30-13:00 in a half day event and it was dedicated to present the latest development in the biogas field in Greece and Europe and BiG>East project achievements. The realization of this event was held by the Centre for Renewable Energy Sources and Saving (CRES) with the support and actual participation of the BiG>East partners.

Participants: 114

The campaign was implemented in two sessions:

- in the morning session the biogas state of the art in Europe and in Greece was presented by the BiG>East partners following by discussion on the opportunities and obstacles for the further biogas penetration in Greece.
- In the afternoon session several case studies were presented along with the main steps for planning a biogas plant and the BiG>East Project activities in Greece.

The campaign was attended by: the project partners, experts on AD technology, representatives of pig and poultry breeding units, employees of public enterprises as well as state services, representatives of local government organizations, policy makers and other relevant professional persons, Energy developers, Energy companies, Energy sector investors, Technology providers, NGO's, social partners and the general public, Journalists, Representatives from chambers, Oil companies.

The interest for the Campaign was high reflected not only to the 114 participants but also to the interest of many of the participant to get more information. Thus, many of the participants got in touch with CRES representatives during and after the event (via telephone and e-mails) for specific biogas matters and further cooperation.

2nd campaign: Thessaloniki, February 4, 2010

The 2nd Mobilization Campaign took place in Thessaloniki (International Exhibition Center, Thursday, February 4, 2010). The campaign entitled "Biogas: A secure and Sustainable Energy Sources" and last from 15:30-20:00 in a half day event and it was dedicated to present the latest development in the biogas field in Greece and BiG>East project achievements. The realization of this event was held by the Centre for Renewable Energy Sources and Saving (CRES) with the support of the Pan-Hellenic Confederation of Unions of Agricultural co-operatives (PASEGES). The Campaign took place as a parallel event during the AGROTICA 2010: 23rd International Fair for Agricultural Machineries, Equipment and Supplies, the biggest agricultural exhibition in South – Eastern Europe.

Participants: 68

The campaign was implemented in two sessions:

- in the first session the biogas state of the art in Greece was presented by biogas experts along with the BiG>East Project activities in Greece following by discussion on the opportunities and obstacles for further biogas penetration in Greece.
- In the second session several Greek case studies were presented.

The campaign was attended by: experts on AD technology, representatives of agricultural unions, employees of public enterprises as well as state services, representatives of local government organizations, policy makers and other relevant professional persons, Energy developers, Energy companies, Energy sector investors, Technology providers, NGO's, social partners and the general public, Journalists, representatives from chambers.

The interest for the Campaign was high reflected not only to the 68 participants but also to the interest of many of them to get more information from the speakers. Thus, many of the participants got in touch with the speakers during the event and CRES representatives during and after the event (via telephone and e-mails) for specific biogas matters, further information and cooperation.

All the material presented at the events were available at CRES and BiG>East web-site. Furthermore, it was strongly recommended to the audience to visit the BiG>East web-site www.big-east.eu and especially the Greek version for further and more detailed information and the translated project Deliverables. The report on the Mobilization Campaigns provides more details on the campaigns.

4 Local implementation strategy

4.1 Local Implementation Strategy for the Showcases

During the two (2) Mobilization Campaigns in Greece the two show cases for "Agrinio" and "Schimatari" were presented. The aim of the showcases presentation was to motivate and convince the participants but especially the policy makers to support new biogas production facilities in Greece. Hardcopies of the Guidelines and Show Cases were also available for the participants.

The Guidelines of the BIG>EAST project and the main principles for the identification of biogas sites were applied to three specific areas in Greece (SCHIMATARI, AGRINIO, TRIKALA). The result of this analysis was the assessment of the suitability for biogas production and utilization in these areas. Following to this step, 2 Biogas Show Cases were selected and further analyzed in order to motivate and convince the decision makers to support new biogas plants in Greece (SCHIMATARI and AGRINIO).

The basic characteristics and a brief description of the two selected Show Cases are given below. More details can be found in the Deliverable 6.4

Show case 1: «Schimatari»

Based on the mapping of the two Prefectures (Evia and Viotia) a promising site for biogas exploitation based mainly on pig manure can be located in the greater area between Evia island and the mainland. The planned biogas plant shall be operated with the input material of liquid manure from pigs, cows and chicken manure, fat, blood from slaughterhouse, dairy waste (Whey), katsigaros (waste of olive oil production) and food waste (total feadstock of about 200,000t/year). The input materials come from agricultural and industrial companies in the nearby area of the plant. The plant can be located to the mainland in the greater area of Schimatari - Inofyta.

The plant is based on co-digestion of different types of feedstock in a two step process – first step thermophilic digester made at silo digesters at approx. 50-52^{o}C, and secondary digesters made at storage tanks operated on lower temperature (in practice 40-45^{o}C). The total amount of CH_4 production is approx. 3.7 Mm^3 (approx. installed capacity 1.7 MWe). In this case it is assumed that the biogas is utilised in a gas engine for the production of electricity for sale to the grid (14 GWh/year) and for heat production (16 GWh/year). The heat is mainly used for the process (approximately 60%) and no external heat sale is assumed (an alternative is the excess heat to be used in the nearby area, e.g. for space heating or other uses of the military campus). The plant as proposed will require a site of approx. 2.6 ha.

The table below summarises the basic data and financial assumptions applied for the needs of the assessment and calculation of the economic forecast and the main results. The BIG>EAST calculation model was used, allowing the preliminary estimations (it is important to note that the results generated by the model should be only used as indicative and subject of change).

Technical data		
Scenarios	*1: electricity revenues*	*2: electricity &compost revenue**
Feedstock	*206,310t/year*	*206,310t/year*
CH_4 production	*3,742,897m_3/year*	*3,742,897m_3/year*
Electricity for Sale	*13.205.000kWh/year*	*13.205.000kWh/year*
Heat for Sale	*6,499,000kWh/year*	*6,499,000kWh/year*
Liquid fertilizer/local use	*188,801 t/year*	*188,801 t/year*
Fibre	*10,910 t/year*	*10,910 t/year*
Financial structure		
Investment Costs	*7,750,000€*	*7,750,000€*
Electricity Price	*0,08014€/kWh*	*0,08014€/kWh*
Nominal Heat Price	*0€/kWh*	*0€/kWh*
Nominal Gate fee	*0€/t*	*0€/t*
Nominal Fibre Price	*0€/t*	*20€/t*
Nominal Waste Treatment Price	*0€/t*	*0€/t*
Results		
Earning before Interest	*729,050€*	*960,988€*
Internal Return Rate (IRR)	*6.15%*	*11.26%*
Capital Cost	*697,044€/year*	*697,044€/year*
Total Earnings	*32,006€/year*	*263,945€/year*

* In order to improve the revenue a scenario with nominal fertilizer price of 20€/t gives better results

Show case 2: «Agrinio»

Based on the mapping of the Prefecture of Aitoloakarnania a significant biogas potential in the region comes mainly from manure in the area of Agrinio and dairy waste (whey) with co-digestion of maize silage, thus a biogas plants can be located in the greater area of Agrinio city. The planned biogas plant shall be operated with the input material of liquid manure from pigs, dairy waste (whey), maize silage, katsigaros (waste of olive oil production) and fat, blood from slaughterhouses. The input materials come from agricultural and industrial companies in the vicinity of the plant. The farmers' harvest is directly brought to the place of the plant and discharged into the reception bunker (total feedstock of about 320,000t/year). The plant can be located in the nearby area of Agrinio city (eg. Spolaita or Stratos community at a distance of 10km approx. NW of Agrinio city).

The plant is based on co-digestion of different types of feedstock in a two step process – first step thermophilic digester made at silo digesters at approx. 50-52^{o}C, and secondary digesters made at storage tanks operated on lower temperature (in practice 40-45^{o}C). The total amount of CH_4 production is approx. 9.7 Mm^3 (approx. installed capacity 4.4 MWe). In this case it is assumed that the biogas is utilised in a gas engine for the production of electricity for sale to the grid (36.7 GWh/year) and for heat production (41.8 GWh/year heat production). The heat is mainly used for the process (approx. 36%) and no external heat sale is assumed (an alternative is the excess heat to be used in the greenhouses in the nearby area). The plant as proposed will require a site of approx. 3 ha.

The table below summarises the basic data and financial assumptions applied for the needs of the assessment and calculation of the economic forecast and the main results. The BIG>EAST calculation model was used, allowing the preliminary estimations (it is important to note that the results generated by the model should be only used as indicative and subject of change).

Technical data		
Semarios	*1: electricity revenues*	*2: Electricity & compost revenue**
Feedstock	*319,028t/year*	*319,028t/year*
CH_4 production	*9,743,841m^3/year*	*9,743,841m^3/year*
Electricity for Sale	*35,309,000kWh/year*	*35,309,000kWh/year*
Heat for Sale	*27,037,000kWh/year*	*27,037,000kWh/year*
Liquid fertilizer/local use	*281,892t/year*	*281,892t/year*
Fibre	*19,941t/year*	*19,941t/year*
Financial structure		
Investment Costs	*11,450,000€*	*11,450,000€*
Electricity Price	*0,08014€/kWh*	*0,08014€/kWh*
Nominal Heat Price	*0€/kWh*	*0€/kWh*
Nominal Gate fee	*0€/t*	*0€/t*
Nominal Fibre Price	*0€/t*	*20€/t*
Nominal Waste Treatment Price	*0€/t*	*0€/t*
Results		
Earning before Interest	*1,118,197€*	*1,578,634€*
Internal Return Rate (IRR)	*7.44%*	*13.54%*
Capital Cost	*1,133,436€/year*	*1,133,436€/year*
Total Earnings	*54,761€/year*	*445,198€/year*

* In order to improve the revenue a scenario with nominal fertilizer price of 20€/t gives better results

In all the case studies the solid fertiliser (the fibre fraction) will sold as solid fertilizer and the liquid fertiliser will be supplied to farms where it can be utilised. Furthermore, the owner of the plant can be a private investor, a consortium or even a Public Private Partnership (PPPs).

Implementation of the showcases

The basic organizational structure and risk management are common for both the Show cases.

The owner of the plant can be either a private investor or consortium or even a Public Private Partnership (PPPs). Till now in Greece it seems that private investment with funds is a more flexible solution. The ownership has to be clarified and the structure of agreements between the plant owner and the ones dealing with the plant has to be structured. The important issue in setting up the organisation is that the ones that have an influence on normal operation also take the risk and gain the advantages.

Construction

It is assumed that the plant is constructed by local contractors in relation to an engineering project/specification and a split tender in more packages. The engineering can be based on commercial plants in Europe. The advantages of taking in local contractors are possible low prices, advantages for local economy and easier later service and possible rebuilding. To control construction a local site manager is recommended as well as to engage the future operation manager at least 3 month before technical completion of the plant.

Feedstock providers

- The manure is picked up from the farms and transported to the biogas plant. The transport can be made in own tankers or the service can be purchased from an external contractor.
- It is assumed that the industries supplied the waste products to the plant themselves or by contractors.
- The logistics of silage (in Show AGRINIO) depends on the agreement between the plants owner and the farmers (eg. storage facilities in the biogas plant or partially storage to the farms).

Risk Management

The projects will be positive for the local agriculture and the local environment as well as the overall environment. The project can also be a positive as a show case for development of commercial biogas plants in Greece. To enable implementation of the plant it has to be made bankable. This requires that assumptions used in this show case have to be confirmed by contracts or Letters of Intent (LoI). Based on these confirmations the project economy can be reviewed. At least the following assumptions have to be "changed" into agreements/LoI or possible standard conditions:

Biomass:

- Supply of manure (including possible treatment fees and on amount to be returned and to be disposed to other farmers)
- Cost, supply and storage of the silage in Show Case AGRINIO (including possible use of residues instead of energy crops).
- Supply of industrial residuals, food waste etc. including possible gate fees
- Area for spreading of the nutrients and liquid fertilizer storage facilities.
- Possible sales of fertilizer (fibre).

Energy:

- Sales of electricity
- Connection charges
- Possible sales/utilisation of heat (industrial purpose, fibre drying, cooling etc.)

Economy

- Finance – in particular possible grants

Location

- Possible site – planning issues and price
- Demand for planning approvals

Organisation

- Agreements from participant partners
- Possible organisation/ownership of the project
- Complex of agreements (principles) for operation the plant

Beside these the investor or the consortium has to agree on form of organisation, possible own finance and guarantees etc. In general all agreements and Letters of Intent will be made as depended agreements/LoI where they will be in operation when (if) the project is implemented.

The projects can be feasible under the right conditions in relation to biomass input and finance (mostly if can be combined with compost sale and treatment fees). It is recommended that the principle agreement of finance and the overall organisation is made as the first step because it will give the best possible situation for the biogas company negotiating agreements on in particular supplies of waste.

When the finance and the overall organisation is agreed the overall clarifications can be made stepwise as well as a stepwise detailing of the project so that the biogas organisation can assess impacts of the agreements made and decision taken during the detailing and clarification in a detailed feasibility study/action plan.

It is worth mentioning that there is investment interest in all the identified sites for biogas exploitation. In the framework of the calls for permits to generate electricity by Independent Power Producers (IPPs) by the Hellenic Regulation Authority for Energy (RAE) two applications

It is worth mentioning that there is investment interest in all the identified sites for biogas exploitation. In the framework of the calls for permits to generate electricity by Independent Power Producers (IPPs) by the Hellenic Regulation Authority for Energy (RAE) an application was submitted in December 2008 for a biogas plant with installed capacity of 1,36MWe in the Community of Fiki (Trikala Prefecture). In August 2009 an application was submitted in Viotia (Tanagra) for abiogas plant with installed capacity of 2.1 MW and in February 2010 an application was submitted in Agrinio (Stratos) for a biogas plant with installed capacity of 3.4 MW^2.

4.2 Local Implementation Strategy for Biogas plants

The main market for biogas production in Greece is the electricity market and the heat market is a small one (internal use to the AD plants for the process heat). Nowadays there is a mature «Energy Market» in Greece concerning the AD technology (eg. technology vendors, plant designers and operators). Nevertheless what is needed is the further strengthening and growth of the local energy industry (this will promote the implementation of biogas projects and will reduce the high investment costs). According to Law No. 3428/27.12.2005 "Liberalization of Natural Gas Market" (Officail Gazette 313/A/2005) article 39: "The use of Natural Gas Systems pursuant to the provisions of this law is also allowed for the transmission of biogas, gas produced from Biomass and other kinds of gases, provided that it is so possible from a technical point of view and the technical specifications are met, after taking into consideration the quality requirements and the chemical features thereof".

The access to financing resources and the development of adequate financial instruments are only two of a series of many parameters dealing with a biogas project financing. In Greece it seems that from a farmer point of view and despite the existence of public subsidies the Finance options but also the high investment costs are crucial issues and of high risk

Biogas projects still need high investment costs. Taking also into consideration that a) project financing remains a major concern, b) the revenue comes mainly from the new pricing tariff system for electricity production for RES, c) externalities are not assessed and monetized, d) there in no "gate fees" in Greece, e) the «polluter pays» principle is not efficiently applied, further improvement of the financial and economical instruments for the support of RES and especially biogas project are needed.

The law for RES (law 3468/2006) is dedicated to the promotion of RES and set a tariff of 73€/MWh for biogas plants. Although higher electricity price must be examined based on the form of Biomass this incentive guarantees a regular income for the plant owners. A new RES law was drafted by the Ministry of Environment during December 2009 and after a period of public consultation the law is ready to be approved by the Greek parliament. This law amends the law 3468/2006 in order to further promote RES and speed up the licensing procedure. Among others, the proposed feed-in tariff for electricity production from RES and CHP systems has special provisions for biogas increasing significant the feed-in tariff for biogas projects (article 5). The Law is in its last phase before entering into force after a period of public consultation (draft Law). This will attract new biogas projects.

The last decade new biogas plants were constructed and operated, but there are still barriers which affect to biogas exploitation and deployment in Greece. Nevertheless, as the gas penetrates more and more to the Greek energy market the biogas production can contribute towards to energy diversification, security and efficiency. Currently, three industrial and two agricultural biogas plants have been constructed in Greece and 10 applications for electricity generation licences were submitted during 2008-10 for agricultural and industrial biogas projects.

Among the main issues of a local implementation strategy can be underlined the following:

- At political level a strong commitment concerning the exploitation of biogas as a sustainable energy and environmental choice is a clear signal. This commitment will affect the other levels too (eg. regulatory, institutional, administrative, financing etc) at national, regional and local level. Also, a strong commitment of the Local Authorities is needed and Local Plans can be developed in promising areas.
- Nowadays there is still lack of knowledge and adequate information not only to the farmers but also to the industries (owners) and the general public about the possible energy exploitation of wastes, their final uses (eg. electricity, heat, injection to the natural gas grid, transport fuel) and benefits. Public Awareness in all levels is needed. Campaigns and training courses at a local level must be further implemented.
- Agricultural and animal wastes are a matter of special concern due to the high potential and their spatial distribution almost allover Greece. Taking into account that the livestock farming is extensive the potential users of biogas production are mainly livestock units and especially medium and large ones. In some cases there is still lack of knowledge about the technical potential of wastes in a certain area and their biogas exploitation alternative. Parameters like stable supply of raw material and feedstock composition are fundamental for the biological process and biogas production. In some cases the seasonal production of some wastes like agro-industrial residues (eg. citrus processing industries, or olive oil mill residues) is crucial for the successful implementation of a biogas scheme and needs very careful examination. Feedstock mapping and biogas potential at local level can help.
- Capacity building of farmers can improve the acceptance and even farmers' participation in such schemes. In any case farmers' involvement in a biogas project is important for the success of the schemes (eg. supplies of the raw material, receive the fertilizer, operate or participate in the biogas plant).
- A biogas plant must be adapted to the particular regions and must be accepted from neighbours and the general public. Thus apart from its economical and technological viability a biogas plant must have also "environmental and social compatibility" based on thorough examination of the project and public awareness and participation from the very early stages. Local plans can help. The Greek Special Framework for the Spatial Planning and Sustainable Development for the Renewable Energy Sources-RES set some general criteria in order to exclude some areas or land uses for biogas exploitation schemes. The plan doesn't recommend specific sites (eg. like in wind parks). For biogas plants the most suitable sites are considered those located near to the «feedstock» production and availability. Local authorities participate in one way or another to the permitting procedure of a biogas project and have to know not only the procedure, but also the legislative provisions and land uses.
- A main factor for future successful implementation of a farm scale biogas projects that must be further considered (impact of human factor on the implementation of new biogas projects) is the lack of many projects in the agricultural sector. The successful operation of new biogas plants will motivate new investors.

- A «Biogas Guide» would be useful for the general public, the RES investors and the public Administration and Authorities. BiG>East Biogas HANDBOOK can assist all the involved parties (farmers, investors, general public, administration).
- The penetration of Anaerobic Digestion schemes in Greece concerning farm scale applications (biogas exploitation from animal manure and agricultural residues) are getting specific attention during this period. Further capacity building of the local communities is a necessity.
- During the lifetime of a biogas project (eg. permission, construction and operation phase) a wide range of involved parties (eg. authorities, developers, subcontractors, feedstock providers, farmers) are participated in one way or another (direct or indirect) in the project development. Thus, among other, the next elements are necessary to be ensured:
    1. Clear roles, responsibilities and benefits to every single project party.
    2. Foundation of a project Co-ordinator (even in the case of a farm plant).
    3. Stakeholders' commitment and involvement from the early stages of the project development.
    4. Stakeholders support during the project lifetime (plant planning, construction and operation).
    5. Communication between the project developers and the project beneficiaries.

The BiG>East project was implemented in the proper time for Greece. Although Greece has an important experience in biogas (especially in WWTP biogas and landfill gas) the farm scale and industrial biogas plants are getting more attention this period. The new feed-in tariff for electricity production from biogas will be a strong incentive for new biogas plants. The capacity building of the stakeholders and the public awareness will also help toward the wider biogas exploitation.