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Barriers for biogas implementation in Croatia

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Introduction

This report on barriers for biogas implementation in Croatia was elaborated in the framework of the BiG>East project, which is supported by the European Commission in the Intelligent Energy for Europe Programme.

The following text describes barriers to implement biogas projects in Croatia. The aim of the report is to point out current status of legal framework and market situation related to biogas in order to facilitate improvements in the area.

This report could serve as guidelines to researchers, local authorities as well as national government where to place their efforts towards biogas utilisation in Croatia, from one side, and biogas stakeholders – farmers, investors, biogas plant operators – what kind of obstacles they might face in development of a biogas project, on the other hand.

In short, the basic framework for biogas development in Croatia has been set, providing the legal framework on RES-E, financial support by banks and state support whereas cooperation with local authorities seems to be crucial. The main barrier that can be highlighted is the general low level of awareness of biogas utilisation possibility and possible benefits to the local community.

1. Market barriers for biogas implementation

Biogas is the least explored renewable energy source in Croatia with emerging awareness. From the macro level, little specific interest was devoted due to its linkage with agriculture sector that has been passing structural problems, and waste collection that is primarily managed as one of many duties by public non-profit orientated utility companies at local level.

However, the awareness about the use of biogas is raising bottom-up by farmers looking for diversification of their business and foreign investors from countries of developed biogas activity such as Austria and Germany. The Austrian chamber of economy is the most active in promotion and linking Austrian technology with Croatian potentials. A Mobilization campaign on biogas in Croatia within IEE BiG>East project (implemented on February 2008) has demonstrated significant interest by all stakeholders in biogas utilization.

Occasionally, the interest between technology representatives and feedstock providers collide as the farmers and/or local authorities are not well informed on the possibilities and capacities needed for biogas plants and foreign investors are mostly focused on sales of their equipment. The situation could be demonstrated from a biogas session at a national conference on renewables held in Osijek on May, 2007.

The last official number on biogas potential in Croatia from cattle was published in 1998 (BIOEN-National Energy Programme on utilization of biomass and waste) as 2 PJ/year or 556 GWh/year. At the aforementioned conference, the following numbers on biogas potential are presented¹:

¹ Source: ASS GmbH&Co. KG, Axis d.o.o.; L-Plan Group, Enavis biogas

- Cattle 444 000
- Pigs 1 347 000
- Poultry 11 778 000
- Sheep 587 000
- Goats 86 000

> 14m m³ of manure >418m m³ methane >1.5 TWh/year of electricity

The lack of official data on biogas potential has been providing sufficient space for private companies to assess either local or national biogas potential that differs from company to company and does not have to be necessarily the correct one. It is not to say that the private companies are unable to assess biogas potential but to point out that local stakeholders should base their decision upon reference numbers from an independent authority.

Continuing on the controversies on actual biogas potential, different projects are showing different relations among biogas plant capacity, investments, feedstock source etc. (table 1).

Table 1: Biogas projects presented in Osijek conference on RES, 2007

Project: Item:	Biogas plant Jakuševac	Poultry farm Rosulje, Dvor na Uni	Agri-cooperative Jagodnjak	Žito d.o.o. Osijek	BP Bjelovar
Investment	3.8 m€	1.4 m€	1.8 m€ + 1.3 m€	200 000 €	
Feedstock source	landfill gas	108 000 chickens	6 000 pigs and 800 cows, fodder + 8 000 pigs, 1 500 cows, fodder	72 000 pigs	
Substrate	47 probes -gas collecting ca- pacity of 700 m ³ /day	2 600 t/yr of chicken manure			4 000 t/yr of cow&pig dung and feed
Rationale		89 000 €/yr sav- ings from heat and electricity bills	Payback period: 2.3 years	Payback period: 2.9 years; IRR: 32%	
Installed capacity			504 kW _{el} 597 kW _{th} + 1 081 kW _{el} 1 483 kW _{th}		80 kW
Energy pro- duction	6 GWh _{el} sold to the grid	1 GWh _{el} 1.92 GW _{th}			540 MWh _{el} 680 MW _{th}
Source:	EIHP	Veterinarska stanica d.o.o.	Bioplin-baranja d.o.o.	Žito d.o.o.	Faculty of Me- chanical and Naval Engineering, Uni- versity of Zagreb

The above stated example is indicating a possibility to have a first biogas plant with negative demonstration effect due to the inadequacy of technology and feedstock that could withdraw positive efforts towards biogas utilization development.

The main barrier in fuel availability is that biogas substrate still does not have price tag on it. Livestock manure management is not enforced in practice (Nitrate directive is about to be enforced) while disposal of household waste is charged by square meter of living area which does not provide incentive for its utilization. Waste management reform should change this practice but it is difficult to predict when the aimed changes will occur in practice. Households are not obliged to separate waste which makes landfill gas utilization only alternative in that sense.

The Croatian energy policy is today directed towards increased efficiency, security of supply and diversification, market deregulation, the use of renewables and environmental protection. Specifically, both the National Energy Strategy of Croatia (adopted by the Croatian Parliament in April 2002, *Official Gazette* 38/02) as the highest strategic document dealing with energy issues, and the Energy Law (*Official Gazette* 68/01, 177/04 and 76/07) being the highest energy related law, clearly identify the utilisation of renewable energy sources as a matter of national interests. As such, there are no direct 'on-the-paper' policy barriers which can be identified in Croatia.

Until recently, the biggest barrier to RES-E production was the lack of legislative framework, but this barrier has been resolved with the adoption of the package of five sublaws which define incentives and obligations regarding electricity production from RES. However, these sublaws are not covering the RES-H production. In addition, the biofuel production is not covered with legislation, too. The Government has announced transposition of biofuels directive in the national legislation by the end of 2008. Nevertheless, it cannot be foreseen when heat and biofuels related sublaws will be enforced. Possibility of feeding biogas in the natural gas grid is mentioned only by the main Law on Natural Gas Market and there is no official information if somebody is working on biogas sublaws. Thus, the legislative barriers are expected to continue in the near future until the first biogas plant operator acquires the eligible producer's status and starts selling electricity from biogas to the grid.

The only document that focuses its attention to biogas plants directly is the Ordinance on Handling the By-products of Animal Origin Not Intended for Human Consumption (OG56/06) that describes both handling the biogas substrate (i.e. animal manure, catering waste, slaughter waste of different types – blood, intestines, cadavers...) and the object in which biogas is produced at.

Including biogas plant parameters in the descriptive part of Spatial Plans will facilitate obtaining of the location and construction permits.

1.1. Market barriers for agricultural biogas projects

Realistic feedstock potential is difficult to estimate as large farms mostly belong to food processing companies (e.g. Agrokor, Vindija, Dukat) that are registered in urban area, i.e. Zagreb, but with farms and processing plants scattered around Croatia. They have shown little interest in providing data on number of cattle with corresponding locations. Those that provided data, asked for confidentiality. On the other hand, Croatian Bureau of Statistics does not publish data on disaggregated level while Croatian Livestock Center publishes data for livestock that is under their surveillance.

A main market barrier for agricultural biogas project is small average size of animal farms. In 2003, in cattle breeding, 96% of milk suppliers had less than 15 cows per farm while only 14 producers had more than 100 milk cows. Pig production shows the same picture – 90% of pig production occurs in about 200 000 small farms. Less than 3 300 (1.5%) producers on family farms have more than 50 000 pigs.

Scattered farms, lack of updated data and structural problems of agriculture are main market barriers for identification of agricultural biogas projects from national policy perspective together with low level of enforcement of environmental laws on farm waste management.

1.2. Market barriers for waste water treatment biogas projects

In general, waste water treatment is one of the activities for which a public company at local level is designated. Those utility companies cover numerous activities – from graveyard maintaining, public lightning to waste water treatment. The main barrier is in their non profit profile. Industries are obliged to treat their waste waters before releasing, although this activity is commonly neglected or poorly executed. Many wastewater treatment plants have been or are being built, but their treatment performance is not always the same as the planned performance. Many plants constructed in the 1980s are frequently over dimensioned since they were based on the developmental and spatial plans, and furthermore, they were designed for the intake of a considerable amount of industrial wastewater, and for higher percentage of population connected to the sewerage system, which has not been achieved with the planned dynamics.

An occasional problem in the system's operation is the inability to fulfil operational requirements related to finances and personnel, which occasionally results in the fragmentation of the municipal sector.

Currently, about 25% of the total amount of municipal wastewater in Croatia is treated; most of that – about 76% is mechanically treated. About 18% undergoes secondary treatment, which represents only around 4.4% of the total amount of municipal wastewater.

Some industrial entities connected to public sewerage systems possess plants for preliminary treatment of wastewater, which should reduce the quality of industrial water to the quality level of municipal wastewater before treatment. Unfortunately, some wastewater is still being discharged into natural recipients without undergoing necessary treatment.

Based on the above mentioned, it is obvious that the existing Croatian wastewater treatment system should be optimized and hence upgraded, naturally with a precondition of ensuring necessary financial funds and increasing the number of expert plant operators.

A private – public waste water treatment plant Zagrebačke otpadne vode (ZOV) for city of Zagreb started to fully operate last year. ZOV is joint investment of WTE Wassertechnik GmbH (WTE) from Essen, RWE Aqua GmbH (RWE Aqua) from Mülheim and city company Vodoprivreda Zagreb d.d. (VZ). The waste treatment plant has both mechanical and biological treatments and states „production of biogas“ as one of its activity. Nevertheless, the project itself has been rather controversial and the efforts to reach the information if they are actually producing biogas failed.

Within CROWATER² project, the Best Available Technologies for several hot-spots will be presented to plant operators and managers, offering solutions to some problems occurring in the operation of the plants.

As a follow-up of this project, it will be possible to use the same concept which would, on the basis of previously collected data and conducted analyses, enable more efficient wastewater treatment on the existing and future wastewater treatment plants.

One of the important elements of the legal basis of water management, as well as of the draft Water Management Strategy, in improving municipal wastewater management is the construction of new and extension of the existing public sewerage systems. Improvement of wastewater treatment systems was also pointed out as one of the priorities in the National Environmental Strategy.

1.3. Market barriers for landfill biogas projects

Currently, Croatia is in the beginning of harmonizing its legislation with the EU legislation regarding waste and waste management. Waste management has been identified as the largest single problem of environmental protection in Croatia. It is necessary not only to harmonize legislative framework with EU demands and standards but also to enforce existing laws. The waste management sector is the main challenge for Croatia that is expected to require significant efforts in harmonization with *acquis*.

A cornerstone document called Strategy on Waste Management of the Republic of Croatia (OG 130/05) was delivered in 2005. It is followed by numerous new legal documents delivered in 2007 out of which Waste Management Plan for 2007-2015 (OG 85/07) is the most important one. The Plan is the core document on waste management in Croatia for the period 2007-2015 having framework set by the Strategy, existing laws and EU direc-

² "Strengthening of public-private partnership in order to improve wastewater management in Croatia", **LIFE 05 TCY/CRO/000108, Project start:** February 2006., **Duration:** 36 months. The project is being implemented with financial support of the European Commission from the [LIFE Third Countries](#) program. CROWATER aims to complete national water and wastewater management procedures administrated by Croatian Waters (national water management agency), technically supported by new "Laboratory for biodegradation analyses of wastewater". Project outputs will contribute to national water protection strategy in order to comply with EU Water Framework Directive towards successful implementation of other EU environmental regulations. Core objectives of the CROWATER project are:

- To build institutional capacity by collaboration between public and private sector for wastewater management, in order to support decision makers, responsible for wastewater treatment plants operation
- To create new approach and methodology for successful management of existing and future wastewater treatment plants
- To contribute to harmonization and standardization of national legal requirements, action plans and documents with EU regulations and practices in the field of wastewater management and treatment according to Urban Wastewater and IPPC Directives

tives. The main task of the Plan is to organize implementation of the main goals of the Strategy which are:

- establishment of integrated system for waste management,
- rehabilitation and closing of existing landfills,
- rehabilitation of “black spots”, locations with high loads of waste on environment,
- development and establishment of regional and county’s centers for waste management with preconditioning of waste before final disposal, and
- establishment of fully informatization of waste management system.

The Government delivers the Plan for the period from 2007 to 2015 that, in accordance with the Law on Waste (OG 178/04 and 111/06) contains:

- types, quantities and origin of waste for which management has to be ensured,
- conditions of waste management for special categories of waste,
- locations (network) of buildings and equipments for recycling and disposal of waste and deadlines for their establishment,
- general technical conditions for buildings and equipment for waste management, and
- estimation and possible sources of means necessary for implementation of waste management goals.

The supervision over the implementation of the Plan is executed by the Ministry of Environmental Protection, Spatial Planning and Civil Engineering (MZOPUG) that is obliged to report on Plan’s dynamics to the Government once per year.

General and technical conditions for buildings and equipment for waste management are to be incorporated in appropriate chapters and not to be elaborated as an independent section. Plans for waste management (on level of a county, city of Zagreb, town and municipality) have to be synchronized with Strategy and Plan. Plan on waste management of a county or city of Zagreb are delivered by county’s assembly for period of 8 years while the designated body of the county is responsible for the monitoring on the Plan’s execution.

Plan on waste management of a town or municipality is delivered by town’s or municipality’s committee for the period of 8 years. The execution of the plan is monitored by designated office.

The following table indicates time frame of development of integrated waste management system:

Table 2: Time frame of development of integrated waste management system

Period	2007	2008	2009	2010	2011	2012	2013	2014	2015
1. Delivering Waste management plans (counties and city of Zagreb)									
2. Establishment of Centres for waste management at county and city of Zagreb level									
3. Monitoring over the implementation of the Plan and annual reporting									

The main idea is to organise waste management from 187 “official” into regional centres for waste management (1-2 by 2010 and 2-3 by 2015) and county centres for waste management (3-7 by 2010 and 7-10 by 2015). This reform is 50% funded by Energy Efficiency and Environmental Protection Fund (Croatia) and the rest is planned to be financed by foreign funds.

The dynamic changes in waste management practice do not necessarily have to be taken as barriers as the restructuring opens new possibilities for biogas. The implementation of the Plan expects the following goals:

- establishment of waste management system for each county according to the regional/county concept,
- increase of separately collected waste share,
- recycling and re-usage of waste,
- pre-treatment of waste before final disposal,
- decreasing the share of biodegradable waste in municipal waste,
- separating fuel from waste,
- decreasing of quantities of waste to be disposed on landfills,
- decreasing of negative impact of waste on the environment, and
- self-sustainable financing of waste management system.

As the real barrier in this matter could be identifying lack of awareness of the responsible persons (regional and local) authorities on biogas plants on landfill gas. Apart of that, there is no domestic producer of the equipment which also could be a barrier for the market entry.

For some reasons, a single landfill gas plant in Croatia, (Jakuševac, Zagreb) that is fully functional and successful over 3 years of operation has not been perceived as a replication example for other landfills.

2. Financial barriers for biogas implementation

Croatia, as a pre-accession country is eligible for Instrument for Pre-accession Assistance (IPA) which is designated for the period 2007 – 2013 and replaces CARDS; PHARE, ISPA and SAPARD programmes. It is established by EU council Directive 1085/2006/EC with 11.468 b€ budget. The main purpose of the programme is to help accession countries (Croatia, Turkey and FYROM) and potential accession countries (Albania, Bosnia and Herzegovina, Montenegro, Serbia) to harmonize their legislation and transposition of *acquis* in order to prepare them for utilization of Structural Funds. IPA is focusing on five main topics: help in transition and establishment of institutions; cross-border cooperation; regional development; human potential development; rural development.

In order to participate in EU Programmes, the Government of Republic of Croatia has to pay membership fee. The programmes that Croatia has signed Memorandum on Compliance are:

- 6th Framework programme for research and technological development
- Intelligent Energy Europe
- Marco Polo
- Fiscallis 2007
- Custom tariffs 2007
- IDABC
- Gender equality
- 7th Framework programme
- PROGRESS
- Europe for Citizens,
- EIP
- ICT
- Civil Protection Financial Instrument
- Culture 2007

The programmes that Croatia participates as third country are LIFE and Youth.

The Third Party Financing is possibility viable through ESCO companies - a company that develops, executes and finances energy efficiency projects on a commercial basis with repayment through savings. Although the main focus is placed on energy efficiency as being the implementing agency for the Energy Efficiency Project Croatia, support to energy efficiency project including RES is not excluded if savings in energy costs and maintenance are used to achieve project investment return. The service includes project development, execution and financing in the manner that Projects include modernization, reconstruction and refurbishment of existing plants and facilities. Areas of business can be di-

vided into public and private sectors, covering buildings, public lighting, industry and energy supply systems.

Public-private partnership is new but recognised concept among local authorities and private investors which greatly depends on the stakeholders involved. If general awareness on biogas among stakeholders will be increased, this could be the most viable concept for biogas plants investment, especially those that are related to feedstock such as waste and sewage sludge that are still under public management.

Access to capital and financial products of commercial banks is limited but this limitation is overridden by loan programmes of Croatian Bank for Reconstruction and Development specially designated for RES projects with favourable interest rates, grace period and pay back time.

Environmental Protection and Energy Efficiency Fund (EPEEF) is established by Law on EPEEF (OG 107/03) as recommended in Law on Environmental Protection (OG 82/94, 128/99) and Law on Energy (OG 68/01). EPEEF's purpose is to ensure additional means for financing of projects, programmes and similar activities in the area of conservation, sustainable utilisation, protection and improvement of environment. The aim is to finance national energy programmes in order to achieve energy efficiency and RES utilisation. In that respect, there is possibility to find national funds for support of biogas project. The barriers could be mentioned in that respect is intensive application documentation and long procedure for realisation of funds.

3. Other related barriers for biogas implementation

3.1. Economical barriers

In general, prices of energy in Croatia are lower than corresponding prices in EU which makes RES utilisation project less profitable business opportunity and decreases the awareness of their necessity in the national energy mix.

The price of natural gas for tariff customers ranged from 1.88 to 2.30 HRK/m³ for households and 1.84 to 2.53 HRK/m³ for entrepreneurs. The pondered average price of natural gas in 2006 was 1.946 HRK/m³ and 2.006 HRK/m³ for households and entrepreneurs, respectively.

In the Republic of Croatia about 10 % of households are connected to one of district heating systems, while the energy supply balance shows that about 10 per cent of the total heat energy spent in households for heating and hot water preparation come from centralized heating systems. As the production cost in most DH companies is greater then selling prices, most of DH companies operate with losses. Losses are result of heavily regulated selling prices and high fuel costs. The following table describes DH prices in Croatia for 2006.

Table 3: Average electricity selling prices in 2006 (VAT excluded)

Year 2006	Average selling price by tariff category (HRK/kWh)	Average selling price with discount (HRK/kWh)
TOTAL SALE	0.5302	0.5302
HV -110 kV	0.3115	0.3115
MV – 35 kV	0.4375	0.4375
MV- 10 kV	0.4544	0.4544
Total MV	0.4519	0.4519
TOTAL HV and MV	0.4265	0.4265
LV- Business (blue)	0.7047	0.7047
LV- Business (white)	0.5887	0.5887
LV-Business (red)	0.5804	0.5804
LV-Business (orange)	0.8452	0.8452
Total LV – Business	0.5944	0.5944
LV- Public lighting	0.4879	0.4879
LV-Households (blue)	0.6624	0.6624
LV-Households (white)	0.5484	0.5484
LV-Households (black)	0.2766	0.2766
LV-Households (orange)	0.8498	0.8498
Total LV-Households	0.5800	0.5800
TOTAL LOW VOLTAGE	0.5815	0.5815
TOTAL TARIFF CUSTOMERS	0.5434	0.5434
ELIGIBLE CUSTOMERS	-	-

Since there are no actual biogas projects, one could not debate on investments and operation and maintenance cost of such an investment. The absence of such information is important barrier for project implementation.

Table 4: Specific heat prices according to DH companies (VAT excluded)

DH Company	Space heating		Domestic hot water		Industrial steam
	households	commercial	households	commercial	all users
HEP Toplinarstvo d.o.o.					
Zagreb	113.03 HRK/MWh	197.41 HRK/MWh	cost is not separated	cost is not separated	112.9 HRK/t
Osijek	108.8 HRK/MWh	150.33 HRK/MWh	no supply	no supply	122.02 HRK/t
Sisak	127.16 HRK/MWh	222.08 HRK/MWh	no supply	no supply	174.56 HRK/t
PT (Zagreb, Samobor, Zaprešić, Velika Gorica)	162.77 HRK/MWh	197.41 HRK/MWh	cost is not separated	cost is not separated	no supply
Toplana d.o.o., Karlovac	5.82 HRK/m ²	21.64 HRK/m ² and 998.67 HRK/MWh	no supply	no supply	no supply
Energo d.o.o., Rijeka	5.38 HRK/m ²	6.97 HRK/m ²	23.49 HRK/m ³	n/a	no supply
Hvidra d.o.o., Split	2.37 HRK/m ²	2.37 HRK/m ²	cost is not separated	cost is not separated	no supply
Toplina d.o.o., Slavonski Brod	2.54 HRK/m ³	4.03 HRK/m ³	21.82 HRK/m ³	21.82 HRK/m ²	no supply
Brod-Plin d.o.o., Slavonski Brod	2.54 HRK/m ³	4.03 HRK/m ³	21.82 HRK/m ³	no supply	no supply
Termoplina d.d., Varaždin	4.75 HRK/m ²	9.5 HRK/m ²	21.72 HRK/household member.	no supply	no supply
Vinkovački vodovod i kanalizacija d.o.o., Vinkovci	5.09 HRK/m ²	6.76 HRK/m ²	no supply	no supply	no supply
Tehno stan d.o.o., Vukovar	5.20 HRK/m ²	0.26 HRK/kWh i 27.06 HRK/kW	20.85 HRK/m ³	no supply	no supply

3.2. Social barriers

Broadly speaking, biomass utilisation in Croatia is well promoted among renewables and many projects are pending for their implementation. However, among different biomass types, biogas was not enjoying special attention. For that reason, the main social barrier for a biogas project would be low level of knowledge, information and awareness of biogas possibilities both in the sense of profitability and positive externalities for the local community and national targets in respect of GHG mitigation and RES. Low level of awareness is crucial social barrier at all levels of society and possible stakeholders.

RES policy is well developed at the highest levels while local and regional levels are mostly not able to follow the stated policies at local level. Recently, local authorities are establishing regional developing agencies and regional energy agencies in order to facilitate utilisation of EU programmes. Unfortunately, majority of those agencies are not well informed on biogas concepts.

Croatia has strong NGOs that are advocating the RES utilisation on the one side and monitoring and reacting on the Governmental activities in the energy field. There is a low level of public awareness regarding the RES and its benefits. NGOs are pro-RES utilisation at a declarative level with often “not in my backyard” attitude when an actual implementation

and/or construction of RES is about to occur. In that respect, there are still informational barriers to overcome but, this time, with a wider information campaign.

Although there are no actual biogas plants in Croatia, the word on low profitable and “bad” biogas plants from Austria and Germany has reached Croatia which increases the reluctance to change or accept new technologies. Mixed information on availability of technology and their prices are bringing confusion among potential biogas producers.

Regarding project preparation procedure, the newly adopted RES-E legal system is still under examination. So far, even projects in highly developed stage (i.e. operating wind farms) were unable to gain eligible producer status and enjoy the feed-in tariff system. The Ministry has foreseen some 6 months to 1 year procedure but it is still early to say if this period was realistic. The main problem occurs in the grid connection and examination of domestic component in the project. Preparation cost could be 50% sub financed by a loan from Croatian bank for Development and Reconstruction in cooperation with the Environmental Protection and Energy Efficiency Fund.

It is fair to state that complicated and long procedure for licences issuing is one of the most common barriers to any kind of project, including RES, in Croatia. The Croatian Government has introduced an action plan - Hitrorez - to reduce the administrative barriers in general and this would affect the RES administration procedures, too.

Another important social barrier is that biogas substrate is usually by-product of some food processing industry to which energy production is not a core business and has little awareness of the possibility for diversifying its business portfolio.

3.3. Legal & Administrative barriers

As before mentioned, there is a clearly described procedure how to obtain eligible RES-E producer status with several issues with lack of transparency but the Ministry is working on its removal. In that sense, procurement process still has the adjective of being uncertain. Other energy forms of biogas such as heat and motor vehicle fuel are recognised by umbrella laws but are not transparently described in the sense of their implementation.

From 1st of July 2008, all electricity consumers that have annual electricity consumption larger than 9 GWh gain the eligible consumer status which allows them to choose their electricity supplier. In that sense, liberalisation of electricity market will be fully enforced.

Good cooperation with local authorities is crucial regarding biogas plant planning as their locations are not clearly described in spatial planning that falls under the local and regional authority's responsibility. Inclusion of biogas plants parameters in the descriptive part of spatial plans will facilitate biogas market development.

Although related to agriculture policy, biogas is managed only by Ministry of Economy, Labour and Entrepreneurship. Due to the poor communication between the Ministries, biogas is not mentioned in the strategic document “IPARD Programme 2007 – 2013 Agriculture and Rural Development Plan” prepared by the Ministry of Agriculture, Forestry and Water Management in December 2007.

Absence of Biomass Action Plan brings overlapping of biomass project where several projects are developing on the basis of the same biomass feedstock which will result in failure of at least one of the projects.

4. Conclusions

Biogas is a complex biomass renewable source which calls for attention of different groups of stakeholders: potential feedstock suppliers (farmers, food processing industries, utility companies), investors, local and regional authorities and developing agencies together with general public that might be affected by biogas plant.

Since biogas project development greatly depends on the feedstock availability, communication and joint actions between Ministry of Agriculture and Rural Development (agricultural biomass) and Ministry of Environmental Protection, Spatial Planning and Civil Engineering (waste) and Ministry of Economy, Labour and Entrepreneurship (RES) becomes crucial for sustainable biogas utilisation and its inclusion in other policies (Kyoto target, rural development, farm waste management etc.). Biogas utilisation demonstrates biomass complexity in general which calls for biomass action plan at national and regional level.

Legal and financial barriers for biogas projects are either in the process of removal or removed. Thus, the main problem remains in public awareness on biogas.

A public awareness campaign specially designed for each stakeholder group could greatly contribute to biogas projects where the campaign should address the following topics:

- Ministries – why there is a necessity to have a coordinated biomass action plan, how biogas can contribute to the national targets on renewables and mitigation of GHG emissions...
- Local/regional authorities – how to incorporate biogas projects in current activities of utility companies; how to make profit and/or save costs in the budget from biogas plants from landfill gas, waste water treatment plants; what are the benefits to the local community of having a biogas plant; possibilities of public-private partnerships in biogas projects; incorporation of biogas plants in spatial planning...
- Food processing industries – how is possible to diversify business portfolio with biogas production, how to save on energy consumption costs, what are the general features of a biogas plant (guidelines on costs of investment, operation and maintenance, feedstock characteristics etc.)...
- Farmers – what is necessary to have a biogas plant, how much feedstock is needed, what are the steps to become a biogas producer, possibility of having a centralised biogas plant, what are the general features of a biogas plant (guidelines on costs of investment, operation and maintenance, feedstock characteristics etc.)...
- NGOs – general information on biogas properties, best practice technologies, examples, externalities on biogas projects...
- Development agencies – general information on biogas properties, best practice technologies, examples, externalities on biogas projects, contacts for further development of biogas projects, basic information on the properties of a biogas investment...

- Existing services/institutions related to agriculture (Croatian Agriculture Extension Service, Croatian Livestock Center...) – introduction of possibilities of biogas project implementations in existing agriculture systems.

Current restructuring of waste management policy in Croatia should be perceived as a window of opportunity to include biogas production in start up investment. The same is true for waste water treatment plans. This places a focus on local and regional authorities and their information on biogas features (i.e. best practice technology, investment).

Biogas technology is novelty at the Croatian market. Foreign equipment producers are present as representative office in Croatia where language barrier makes it difficult to gain full information on the equipment. Most equipment representatives are coming from Austria, Germany and Holland – markets with developed biogas technology. There is significant scepticism towards equipments' efficiency which could be eliminated by more information on biogas technologies – targeted mobilisation campaigns for different stakeholders.