

# Project: BiG>East

(EIE/07/214)

## *Biogas Potential in Bulgaria. Summary Report*

### Deliverable 2.2

Based on Deliverables from WP2



Denitsa Dimitrova ENPRO<sup>1</sup>  
Iva Cheriyska, ENPRO<sup>1</sup>  
Krasin Georgiev, ENPRO<sup>1</sup>  
Svetla Marinova – Garvanska, IP<sup>2</sup>  
Nikola Kolev, IP<sup>2</sup>

<sup>1</sup>**Energoproekt Jsc**  
1407 Sofia, Bulgaria  
51 James Boucher Blvd.

<sup>2</sup>**Institute of Soil Science “Nikola Poushkarov”**  
1369 Sofia, Bulgaria  
7 Shosse Bankya Str.  
P.O.Box 1080

March 2009

With the support of:



The sole responsibility for the content of this publication lies with the authors. It does not represent the opinion of the Community. The European Commission is not responsible for any use that may be made of the information contained therein.

# Contents

<b>1</b>	<b>Introduction.....</b>	<b>3</b>
<b>2</b>	<b>Existing and planned biogas installations in Bulgaria .....</b>	<b>4</b>
<b>3</b>	<b>Utilization of waste material for biogas production in Bulgaria.....</b>	<b>5</b>
<b>4</b>	<b>Feedstock availability in Bulgaria.....</b>	<b>6</b>
<b>5</b>	<b>Agricultural structures in Bulgaria .....</b>	<b>7</b>
<b>6</b>	<b>Opportunities for biomethane injection into the Bulgarian national gas grid .....</b>	<b>9</b>
<b>7</b>	<b>Impacts of biogas production in Bulgaria .....</b>	<b>11</b>
<b>8</b>	<b>Conclusion and Outlook.....</b>	<b>12</b>
	<b>REFERENCES .....</b>	<b>13</b>

# 1 Introduction

Current report was written 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. Data summarized in this report are extracted from documents produced in the frame of Work Package 2 of the Project. Emphasis of this report will be on the biogas potential in Bulgaria, utilizations and related issues in order to facilitate the broader implementation of biogas projects. Supporting countries of the Project are Germany, Austria and Denmark, who have increased number of installed biogas plants and large experience in planning, constructing and maintaining biogas plants.

The biogas production and use in Bulgaria are not developed yet. Therefore, the aim of BiG>East is to promote the possibility of treatment of agricultural waste, sewage sludge and organic municipal waste, which are a serious problem in many regions of Eastern Europe.

The report outlines some biogas projects planned, also projects in stage of development in Bulgaria. Utilization of organic waste for biogas production, feedstock availability and agricultural structures in the country are summarized, too. It is also discussed about the opportunities for biomethane injection into the national gas grid and there are listed the main impacts of the production and use of biogas.

## 2 Existing and planned biogas installations in Bulgaria

Interest in biogas projects in the last few years is growing in Bulgaria. However, there are no operating biogas plants yet and no refuelling stations with biomethane or biomethane mixture with other fuels, too.

In adopted in June 2007 *Renewable and Alternative Energy Sources and Biofuels Act*, there are no regulations in respect to biogas yet. Similarly Bulgarian regulations do not provide specific biogas support instruments as feed-in tariff, quota regulation/certificate mechanisms, tax incentives/investments grants and/or other financial resources. Future development of biogas sector is highly dependant on the willingness of politicians and policy makers that formulate policies and introduce legislations.

Although biogas market in Bulgaria is just at the beginning of its development, the potential of biomass suitable for biogas production is promising. There are already several projects that provide production and utilization of biogas (see Table 1).

**Table 1. Biogas production and utilization in Bulgaria**

Name	Location	Feedstock	Utilization of biogas	Status
Tsarevets farm	Mezdra district	Cattle manure & maize	Electricity	In construction
Dobrich farm	Dobrich district	Animal manure & agricultural waste	Electricity & domestic water	Early planning stage
Montana landfill	Montana	Municipal waste	Purification & burning of biogas	In construction
Sozopol landfill	Sozopol	Municipal waste	Purification & burning of biogas	In construction
Rousse landfill	Rousse	Municipal & industrial waste	-	In construction
Suhodol landfill	Sofia	Municipal waste	CHP	In preparation
Kubratovo WWTP*	Sofia	Sewage sludge	CHP	In preparation

The development of new biogas projects, especially agricultural biogas plants and waste treatment biogas plants, in Bulgaria will largely depend on legislation and policies on the one hand, and on the other hand on the success of the demonstration projects.

---

\* WWTP = Waste Water Treatment Plant

### 3 Utilization of waste material for biogas production in Bulgaria

Generally, Bulgaria has a good infrastructure and an appropriate framework for waste management. However, system for separate collection and recycling of waste in Bulgaria is not yet sufficiently functional. Therefore a large proportion of biodegradable wastes are disposed on landfills. About 85 % of the generated wastes are transported to the landfills and about 52 % of the total waste amount is biodegradable waste.

Landfills and waste management sites, as well as agricultural farms in Bulgaria are very adequate and suitable for co-location of biogas plants, which is a prerequisite for wide development of biogas and by-products market (compost and liquid fertilizer). Facilities for production of biogas could be next to the landfill itself, but also in industrial or agricultural plants. Thereby there would be an opportunity for reducing transport costs. Non-centralized biogas plants are beneficial, as they could be tailored to specific sites and materials, and transportation costs could be minimized.

Table 2 shows the opportunities for biogas production in Bulgaria.

**Table 2. Opportunities for biogas production in Bulgaria**

	Large farm based biogas plants	Small farm based or community biogas plants	Municipal biogas plants for municipal and industrial waste	Landfill gas extraction biogas plant	Biogas plants connected to industry sites	Biogas plants attached to sewerage treatment works
<b>Bulgaria</b>	Limited	Yes	Yes	Yes	Yes	Yes

There is no need to implement sophisticated biogas technologies as biogas cleaning systems or fuel cells. From economic point of view biogas installations with robust and reliable CHP\*\* systems are adequate for Bulgaria.

The selection of a suitable biogas utilization technology is based on the economic conditions. The utilization of the produced biogas largely depends on factors such as feed in tariffs, tipping fees and harvesting costs.

---

\*\* CHP = Combined Heat and Power production

## 4 Feedstock availability in Bulgaria

Feedstock availability for biogas production is difficult to obtain. The overall approach to assessing the biomass resource was first to estimate the quantity of material generated from municipal waste and agricultural practices in the area of eastern European countries. Then the quantity of material that could be recovered from these practices was evaluated taking into account technical and environmental constraints associated with other site factors.

The theoretical potential, based on total biomass production was assessed. The total quantities of crops (maize, rapeseed, soybean, sunflower, etc) were considered as potentially energy crops. The total sum was then reported. This is of course not the real case but this could help identify the potential places for biogas facilities as the areas with the great potential in production of energy crops. Agricultural production and related industry/consumption patterns generate important amounts of organic materials that are to be considered waste, hence their utilization in biogas production is a viable and a political desiderate.

The following classes of organic matters were identified with relevance for biogas production:

**Table 3. Classes of organic matters identified with relevance for biogas production**

Class	Description	Code	Comments
1	energy crops	EC	
2	agricultural waste	AWPP	primary agricultural wastes
3	animal waste	AWSP	secondary agricultural wastes
4	food industry waste	FPW	
5	organic solid waste	SW	
6	sewage sludge	WW	

In Bulgaria the biggest potential for biogas from primary and secondary agricultural wastes is in North East and South Central regions (BG13 and BG22). Regarding municipal solid wastes and waste water the highest potential for biogas production appear to be in the south-western part of Bulgaria where the density of population is high (BG21 and BG22).

Comparison of the biogas potential for six countries from Eastern Europe (Bulgaria, Croatia, Greece, Latvia, Romania and Slovenia) and for every class of organic matter is performed. Bulgaria has the largest potential for biogas production from agricultural wastes derived from secondary production. Bulgaria has big potential for biogas from, sewage sludge, solid municipal waste and wastes from food processing industry also.

In the following table is given an estimation of total potential biogas production, based on organic wastes from agriculture, food industry and sewage sludge. Energy crops are not included.

**Table 4. Estimation of total potential on biogas production in Bulgaria**

Region		Surface	Biogas, m <sup>3</sup> .10 <sup>4</sup>					Total
NUTS***		Ha*10 <sup>3</sup>	AWPP	AWSP	SW	WW	FPW	GWh
BG11	North West	1029	360	27561	4491	156	465	1982
BG12	North Central	1827	720	50188	10422	363	1079	3766
BG13	North-East	1997	990	77135	12511	428	1274	5540
BG21	South-West	2031	420	40706	19430	676	2011	3795
BG22	South Central	2752	760	93947	17610	613	1823	6885
BG23	South East	1465	510	39785	7859	273	814	2954
BG	Bulgaria	11101	3760	329322	72323	2509	7466	24923

Finally, the real potential for biogas (based on biomass potential studies) is assumed to be about 30 % of the total potential biogas production based on literature review.

Region	NUTS	BG11	BG12	BG13	BG21	BG22	BG23	Total
Total	TWh	0,60	1,15	1,65	1,15	2,05	0,90	7,50

## 5 Agricultural structures in Bulgaria

The methodology used to assess the agricultural structure was selected from EUROSTAT – EUROPHARM. This includes the typical sizes of farms, their productivity and the distribution of farms within the country.

In 2004 the arable area was 3.3 million ha (61.8 % of UAA), and about 70 % of it was concentrated in 3 NUTS 2 regions – North-East, North Central and South Central region.

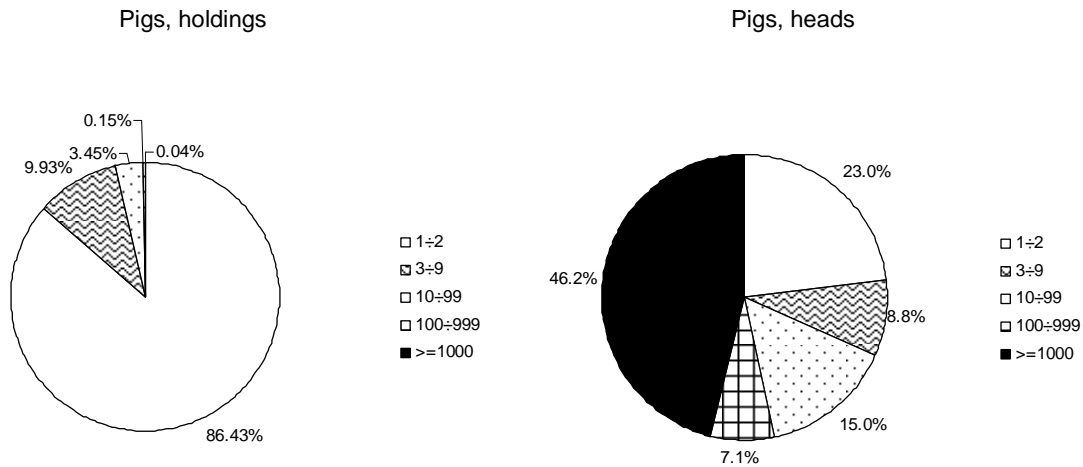
The majority of the total utilized agricultural area (UAA) (about 78 %) is cultivated by holdings managing more than 50 ha (but only 0,8 % of the holdings). Less than 7 % of the UAA is cultivated in 75 % of the holdings which manage less than 1 ha each. There is a tendency for land aggregation - there were 665500 agricultural holdings in Bulgaria in 2004 and 477100 in 2007. This could be either natural process of aggregation (especially due to the market drivers), but also an effect of a special phenomenon (aggregation in structures named “associations” – free tenant structures were different small land owners put together the land under the management of a specialist management company).

Secondary production could be very important for the biogas production. Based on the number (and not on production) of holdings, it could be concluded that in Bulgaria, an important role could play the poultry industry (with 23 %) the pig farming (15 %) and also the cow and goats farming (with 10 % and 15 % respectively).

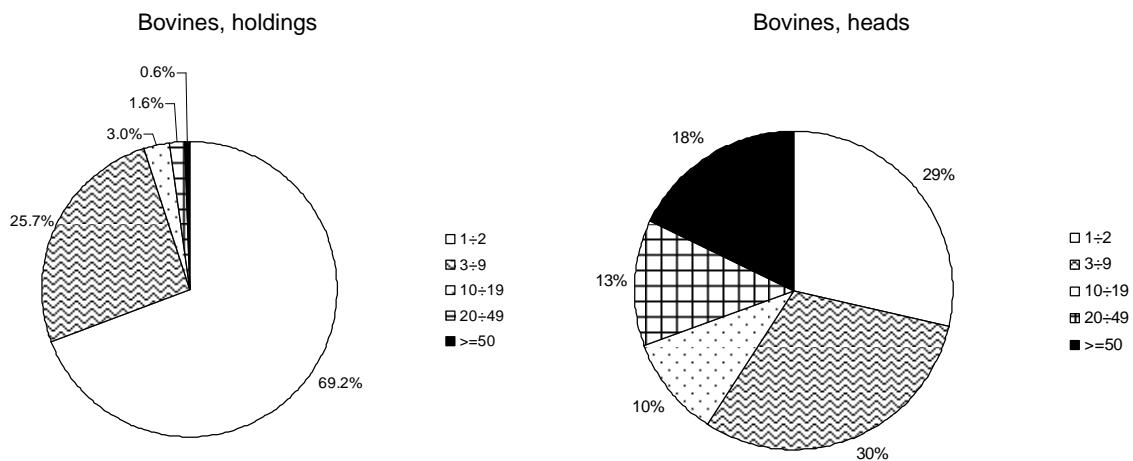
---

\*\*\* NUTS = The Nomenclature of Territorial Units for Statistics

Pig farms have big potential for biogas production. Nearly 50 % of all pigs are grown in 0,04 % of the farms (average number – 5600 heads per holding, 76 holdings). Family type farms with less than 9 pigs are 96 % of all farms and have about 30 % of all animals.



Bovine animals are less concentrated. About 18 % of the animals are in herds with more than 50 heads (957 holdings with average 112 heads per holding). Family type farms with one or two cows are 69 % of all farms and have about 30 % of all animals.



The highest average number of animals per holding breeding grazing livestock is in South East planning region (242 heads per holding with more than 10 ha own lands), followed by North East (193 heads per holding with more than 10 ha own lands). The lowest numbers are for South-West region (73 heads per holding with more than 10 ha own lands).

It could be generalized, that the agricultural structure and its growth in time are favorable for biogas production. The most promising planning regions in Bulgaria are North-East, North Central and South Central. There is a big variety in size, distribution and biomass potential of different farms.



There is also a tendency for increase in the number of animals in an average farm. Therefore each potential site should be considered, depending on the region.

## 6 Opportunities for biomethane injection into the Bulgarian national gas grid

Bulgartransgaz is the only gas transmission operator for the territory of Bulgaria. Bulgartransgaz is member of Gas Infrastructure Europe (GIE). The biggest privately owned gas company in Bulgaria is Overgas Inc. The company provides construction and operation of gas distribution networks and sale of natural gas to end customers. Overgas has major part in 28 companies. From 96 licenses for distribution and delivery of natural gas for the country, subsidiary companies of Overgas have 56 licenses in 50 municipalities. The total length of the gas distribution network is over 1.600 km.

The indexes for quality of natural gas in Bulgaria, according to Bulgarian State Standard, are harmonized with ISO 6976 and are shown in Table 6:

**Table 5. Indexes for the quality of natural gas harmonized with ISO 6976**

Index	Technical requirement
1. Composition of natural gas: <ul style="list-style-type: none"> <li>- methane</li> <li>- ethane</li> <li>- propane, butane and others</li> <li>- heavy hydrocarbons</li> <li>- nitrogen</li> <li>- carbon dioxide</li> <li>- oxygen</li> <li>- hydrogen sulphide</li> <li>- mercaptan sulphur</li> <li>- total sulphur</li> <li>- water and other dissolved solids</li> </ul>	min 92 mol % max 4 mol %  max 2 mol % max 2 mol % max 1 mol % max 0,02 mol % max 2,0 mg/m <sup>3</sup> max 5,6 mg/m <sup>3</sup> max 20 mg/m <sup>3</sup> not allowed
2. Temperature of the gas in the outlet of the gas regulation station	> - 5° C (268° K)
3. Down limit of the calorific value ( <i>when temperature is 20° C and pressure is min 0,101325 MPa</i> )	not less than 8000 +/- 100kcal/m <sup>3</sup> (33,5 ± 0,418) MJ/m <sup>3</sup>
4. Pressure	4.1 for the natural gas transmission grid – up to 5,5 MPa; 4.2 for the natural gas distribution grid – up to 1,6 MPa, in this number for: <ul style="list-style-type: none"> <li>- steel pipes – up to 1,6 MPa;</li> <li>- PE HD pipes – to 1,0 MPa</li> <li>- at the inlet of industrial consumer grid – according to the contract circumstances;</li> <li>- for private premises – 0,01-0,013 MPa</li> </ul>
5. Odor of the natural gas (odor detection threshold)	Odor detection threshold – the natural gas assure perception, when its quantity in the air is ≤ 20 % from the down limit of flash point

Technical requirements to the natural gas grid and equipment are given in the following regulations:

- Regulation No 6 of 25 November 2004 about technical rules and standards for design, construction and usage of objects and equipment for transmission, storage, distribution and supply of natural gas
- Regulation for structure and operation of transmission and distribution gas pipelines and of natural gas equipment, installations and appliances (ordinance No 171, 16 July 2004)

Specific requirements for biomethane injection into the grid are not given.

The law of energy governs the public relationships related to the activities of generation, import and export, transmission, transit transmission, distribution of electric and heat energy and natural gas, trade with electric and heat energy and natural gas, and use of renewable energy resources, as well as the authorities of state bodies in defining of the energy policy, regulation and control functions. According to Article 197 (1) “The transmission company shall be obliged to connect to its network at an interconnection point of its choice, the distribution companies, extraction companies, companies for gas storage.” The conditions and procedure for gas production enterprises access to the natural gas transmission/distribution networks are regulated by “Rules for conditions for access to the natural gas transmission and/or gas distribution networks”, promulgated in SG № 67 of 2 August 2004. According to article 5 (1) from the RULES, transmission- and distribution gas company could not refuse access to the transmission or/and distribution networks for natural gas of a gas extraction company, of the public provider, public suppliers, traders and eligible consumers of natural gas, except for cases, when:

- Provision of access brings to the violation of technical conditions and security of networks;
- Provision of access hinders enterprises to perform their duties for public services;
- Provision of access could cause serious economic and financial difficulties of transmission- and distribution company due to entering into contracts with a clause “take or pay”.

Currently, opportunities for biomethane injection into the Bulgarian national gas grid are not discussed.

## 7 Impacts of biogas production in Bulgaria

Bulgaria exhibits a diverse energy mix with an imported fuels dependency slightly below EU-27 average. Domestic production includes nuclear energy and solid fuels, which are the main fuels for electricity generation.

Since 1988, the Bulgarian energy profile has changed considerably. Between 1988 and 2000, the total primary energy supply (TPES) decreased by more than 40 %. The consumption of oil products fell by 61 % and electricity consumption fell by 32,4 %. In 2004, the most important energy sources were solid fuels (36 %), crude oil (22 %) and nuclear energy (22 %), followed by natural gas (13%). Share of Renewables amounts of 5% from TPES and has been increasing in recent years, although is still below EU average.

The production of biogas as renewable energy source in Bulgaria would be an efficient measure to reduce dependency of fossil energy imports. Also biogas has the potential to reduce methane, also other gas emissions, having an unfavorably impact on the environment.

Bulgaria is one of the poorest countries in water resources in Europe. The annual average amount of water per resident is around 2300 - 2400 m<sup>3</sup> and usable part of it is from 800 to 1000 m<sup>3</sup>/resident. In the years, the water deficit will grow and will become a very serious social, economic and environmental problem for the country, therefore wastewater become extremely important.

At the present moment in the country are built 52 municipal wastewater treatment plants (MWWTP), of which 13 plants purify water only mechanical and 39 have disposal of biological treatment. MWWTP serve 47 towns and 35,3 % of the country's population.

Biogas production could contribute to process wastewater. This reduces wastewater released to the environment and provides renewable energy. Furthermore, biogas could reduce nitrogen leaching from animal manure and guarantee sustainable fertilization of fields. This would have very positive impacts on ground water quality and on biodiversity as whole.

Currently manure in Bulgaria is stored in open storage capacities and used in agriculture inadequate, although in 2006 there is a tendency of slight increase in manure utilization in Bulgaria. According to Executive Environment Agency (MOEW), in 2005 and 2006 the share of emissions of methane, emitted by the agricultural sector occupies 18 %. Good solution for reduction of those emissions would be manure to be used as feedstock for the production of biogas. The resulting by-product (digest) disposes to increasing of nutrients in the soil, which make him suitable for feeding of the poor in nutrients and microorganisms soil. Furthermore, the use of organic fertilizer reduces forming of degradation processes in Bulgaria.

Production of renewable energy, including biogas production, expands the circle of opportunities for detection of jobs and rural development in Bulgaria.

## 8 Conclusion and Outlook

Interest in the production of biogas from organic waste is increasingly strengthened in recent years. However, there are no existing biogas plants in Bulgaria, yet. Currently, potential feedstock for biogas production is used incomplete. Waste is improperly processed or disposed, which increases the risk of environmental pollution. Through treatment of manure with anaerobic digestion in order to produce biogas, it might be reduced the amount of emissions emitted and also the properties of the resulting by-product (organic fertilizer) might be improved. Furthermore, the biogas technologies might be effective way for decrease the energy dependency of Bulgaria.

The future of biogas in Bulgaria is promising, in view of the fact that about 55 % of the generated wastes are biowastes. Our country has the largest potential for biogas production from agricultural wastes, derived from secondary production, in comparison with Croatia, Greece, Latvia, Romania and Slovenia. Bulgaria has big potential for biogas from sewage sludge, solid municipal waste and wastes from food processing industry, too. Agricultural structure and its growth in time are also favorable for biogas production. The most promising planning regions in Bulgaria are North-East, North Central and South Central.

Several biogas projects are under development and it is supposed that the realization of at least one installation will provoke the interest of the community and will facilitate the implementation of new biogas projects.

The main obstacle for preparation of biogas projects in Bulgaria is that there is no existing legislative framework focused on biogas at the moment. There is Renewable and Alternative Energy Sources and Biofuels Act, but it still does not provide any financial incentives and concessions for biogas production.

Other major barrier is that the farmers, industries and society as a whole have low awareness about biogas technologies and environmental, social and economic benefits of their application. Furthermore, there is a lack of sufficient information on relevant ongoing projects and the access to state support, available for funding and co-funding is difficult.

To overcome all problems, concerning the biogas implementation in Bulgaria, it is necessary active involvement of all state institutions; the general public and the non-governmental institutions. Information about Biogas Programmes, coming projects and deliverables from already completed biogas initiatives (seminars and conferences) have to be provided.

It is necessary new, clear and focused legislative; regulative and legal frameworks and also strategy for implementation of biogas technologies to be elaborated. Furthermore, state support for the implementation of biogas projects have to be provided and the access to EU funding opportunities in the field of biogas technologies have to be facilitated.

## REFERENCES

**Assessment of existing biogas installations in Bulgaria, Croatia, Greece, Latvia, Romania and Slovenia, D-2.1, BiG>East, Energoproekt Jsc, Bulgaria; N. Poushkarov Institute of Soil Science, Bulgaria; Centre for Renewable Energy Sources, Greece; Hrvoje Pozar Energy Institute, Croatia; Ekodoma, Latvia; SC Mangus Sol SRL, Romania; Slovenian Energy Restructuring Agency, Slovenia, September 2008;**

**Technical opportunities for the utilization of biogas in Eastern Europe, D-2.6, BiG>East, Finsterwalder Umwelttechnik GmbH & Co. KG, Germany, November 2008;**

**Estimation of the potential feedstock availability in Eastern Europe, D-2.3, BiG>East, SC Mangus Sol SRL, Romania, February 2009;**

**Assessment of the agricultural structure, D-2.4, BiG>East, SC Mangus Sol SRL, Romania, February 2009;**

**Structure of agricultural holdings in Bulgaria`2005, MAF, Agrostistics Directorate;**

**Structure of agricultural holdings in Bulgaria`2007, MAF, Agrostistics Directorate;**

**Statistical yearbook of the Republic of Bulgaria, 2006;**

**Biogas purification and assessment of the natural gas grid in Southern and Eastern Europe, D-2.5, BiG>East, Ing. Gerhard Ahrinz GmbH, July 2008;**

**Impact of biogas production in Bulgaria, Croatia, Greece, Latvia, Romania and Slovenia, D-2.7, BiG>East, WIP Renewable Energies, Germany; Centre for Renewable Energy Sources, Greece; Energoproekt Jsc, Bulgaria; N. Poushkarov Institute of Soil Science, Bulgaria; Hrvoje Pozar Energy Institute, Croatia; Ekodoma, Latvia; SC Mangus Sol SRL, Romania; Slovenian Energy Restructuring Agency, Slovenia, February 2009;**

**Bulgaria's National Greenhouse Gas Inventory Report, 2006;**

**Ministry of Economy and Energy of the Republic of Bulgaria: <http://www.mi.government.bg/> ;**

**Ministry of Environment and Water of Bulgaria: <http://www.moew.government.bg/> ;**

**Executive Environment Agency of Bulgaria: <http://nfp-bg.eionet.eu.int/ncesd/bul/index.html> ;**

**Ministry of Agriculture and Food of the Republic of Bulgaria: <http://www.mzh.government.bg/>**