Project: BiG>East

(EIE/07/214)

Biogas potential in Slovenia

Summary report

Deliverable 2.2; Task 2.8

Based on WP2 deliverables

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Contents

Introduction

This report was written in the frame of the BiG>East project and represents the summary report of the reports made in the work package two of the project, summarising data and findings for Slovenia's biogas potential.

Biogas market is one of the most interesting renewable energy sectors for the farmers in Slovenia. Although there was some interest among farmers for building biogas plants also in the past decades – Austrian example was near enough - there was however a major barrier to it, namely financing. The investment risk was simply too high. After feed-in tariff system was introduced in 2002 things started to evolve. But it was mainly after 2006 when the feed-in tariffs become interesting enough and later on when subsidies for investment into RES installations for farmers were prepared by Ministry of Agriculture that biogas begun its real take-off. However, due to the price categories within the feed-in support system which were in favour of bigger plants (around 1MW). These were also the results.

HSE, Holding of Slovenian Power Plants commissioned a study on biogas potential in Slovenia in 2008. One of the parts is also the potential within Agriculture. In the least aggressive scenario some 45 MW electric power installed would be possible, in the business as usual scenario – compromising food production - around 78 MW. Then there is also almost unexploited sector of food processing industry.

In 2009 new support system is in preparation, with raised tariffs and additional bonuses for specific plant size and feedstock categories which would give better chance to smaller – farm scale installation as well.

1. Existing and planned biogas plants in Slovenia

Exploiting biogas from agriculture and also from landfill gas and wastewater treatment plants is relatively new approach in Slovenia. First installations were on two bigger farms and the interest has increased after the feed-in law was introduced in 2002. Since then the biogas use is promoted by higher price of the produced electricity. Mainly the bigger farms and their investors saw an opportunity for building a biogas plants and the result is that they are planning larger plants, 1 MWe and above. Also almost all potential biogas plants that are currently in preparation or in construction phase are larger than 1 MWe.

Things on the market change, however, last year we were faced (like the whole EU) with high increase of the agricultural prices, especially for maize. Many of the new or potential biogas plant depend on the input from the market and the economy has changed. This is mostly a problem for bigger plants.

Still, energy utilization of biogas from the anaerobic digestion sewage, manure or agricultural waste and landfill gas is already present in Slovenia, although with a negligible impact on energy balance for the time being. Below a map of Slovenia with all existing bio-

gas plant locations in 2008 and a table with their characteristics is shown. Followed by table on planned biogas installations.

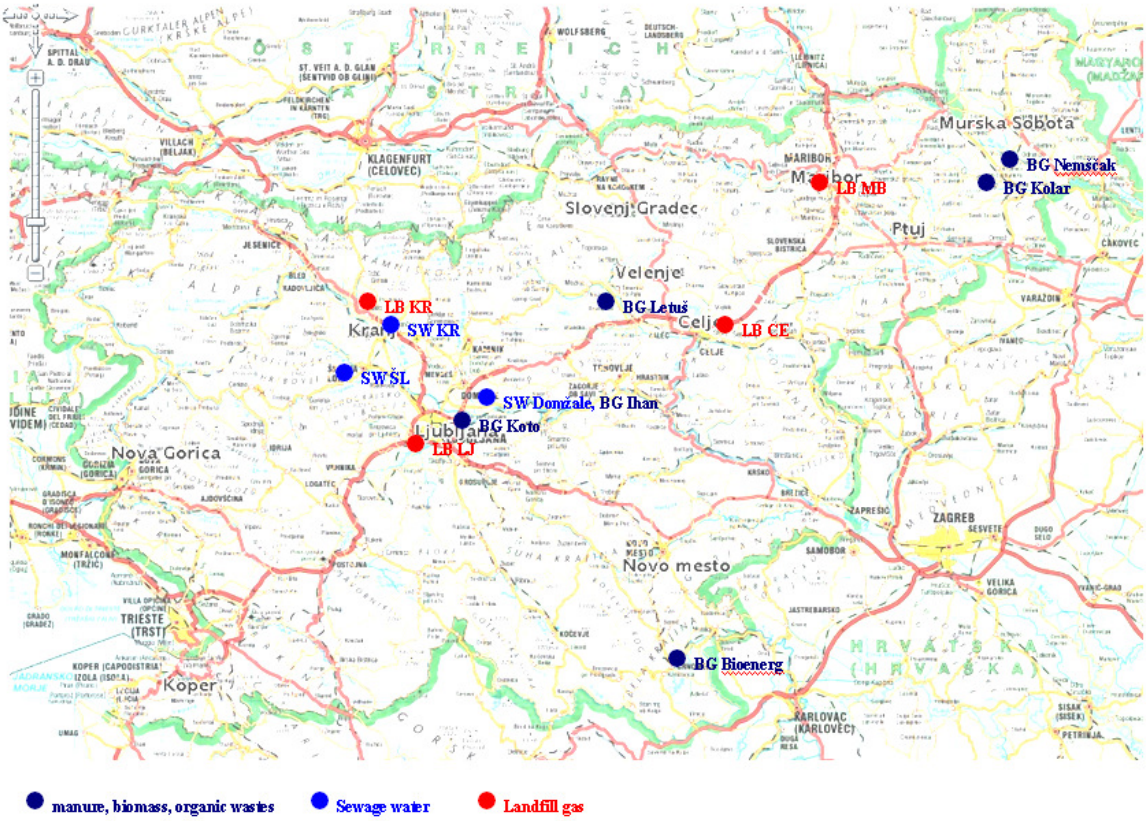

Figure 1.1 Existing biogas plant locations (stand 2008)

Table 1.1 Basic characteristics of existing biogas installations

Name/Sign	Location	Feedstock	Biogas utilisation		Total power (kWe)
			Type	Output	
BG Ihan	Farm Ihan	manure, sludge	electrical power	526	
					526
BG Bioenerg	Bioenerg	organic waste	electrical power	1.460	
BG Koto	Koto d.d.	organic waste	electrical power	526	
					1.986
BG Kolar	Farm Kolar	manure,	electrical	835	

		corn silage	power		
BG Letuš	Farm Letuš	manure, corn silage	electrical power	124	
BG Nemščak	Farm Nemščak (Pan-vita)	manure, corn silage	electrical power	825 + 625	
					2.409
SW ŠL	Škofja Loka	sewage water	electrical power	120	
SW Domžale	Domžale –Kamnik	sewage water	electrical power	250	
SW KR	Kranj	sewage water	electrical power	150	
					520
LG LJ	Barje in Ljubljana	landfill gas	electrical power	2.248	
LG MB	Maribor - Pobrežje	landfill gas	electrical power	625	
LG CE	Bukovžlak (near Celje)	landfill gas	electrical power	469	
LB KR	Tenetiše (near Kranj)	landfill gas	electrical power	469	
					3.811
					9.252

Table 1.2 Basic characteristics of the planned biogas installations

Location	**Feedstock**	**Biogas utilization**		**Total power (kWe)**
		Type	**Output**	
Farm Cvek	manure, corn silage,…	electrical power	2.100	
Ptuj	manure, corn silage,…	electrical power	1.460	
Domžale	manure, corn silage,…	electrical power	1.000	
Ilirska Bistrica	manure, corn silage,…	electrical power	1.100	
Arja vas	manure, corn silage,…	electrical power	1.400	
Pivka	manure, corn silage,…	electrical power	1.400	

Mlajtinci	manure, corn silage,…	electrical power	2.100	
Gea	manure, corn silage,…	electrical power	342	
Motvarjevi	manure, corn silage,…		835	
				11.737
Velenje	landfill gas	electrical power	150	
Nova Gorica	landfill gas	electrical power	625	
				775
				12.512

2. Waste for biogas production in Slovenia

Public waste removal in Slovenia is an activity performed in the public interest mostly by a competent public service. There are over 50 waste removal companies and over 90% are publicly owned.

In 2004, 750.000 ton of waste was brought to nonhazardous (municipal) landfill sites, of which 648.000 ton were collected by the public waste removal scheme. The share of population served by public waste removal services was 94% (1.87 million people). Nowadays, more and more private companies have the permission to collect waste and also companies to recover or reuse waste.

Household waste is collected in standardized containers standing on public land and removed regularly to public landfill sites by the competent public service. However, we are all aware about the potential of organic household wastes for biogas production. Current obstacle is that separate waste collection system is not in place in all major cities and its surroundings. Slovenian households produce yearly more than 600.000 ton of all waste. Quantity is increasing but the relation to waste is slowly changing. They are not only wastes but are also a material for different sources. Waste recovery is designed for beneficial use of waste, comprising first of all recycling, reuse, composting, use of waste in fuelling devices and industrial ovens, and use of waste for fuel generation.

Household organic wastes are collected in brown containers on colleting points. The average amount of municipal waste per capita (total population in 2004) is 371 kg, which means 1 kg of waste per person per day.

Picture below represent the amount of waste (kg per capita) collected in various municipalities.

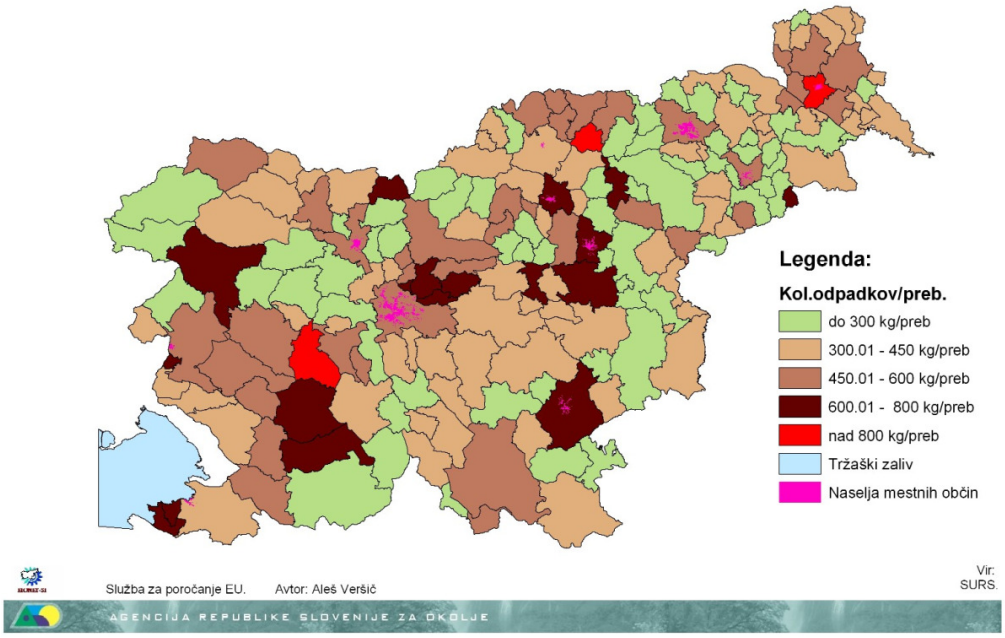

Figure 2.1 Waste per capita collected in Slovenia, Source: ARSO

Appropriate wastes for biogas power plants are organic household waste, edible oil and fat, wastes from animal market… It was collected 8.959 ton of organic household wastes in 2005 and 16.568 ton in 2006, which is 2% of all collected wastes. For example, Komunala Murska Sobota collects organic wastes from households, restaurants, supermarkets and hotels. They collect around 1.200 tons per year. These wastes are sent for composting. Restaurants and hotels pay for the waste removal. There are 7 registered companies that compost organic wastes. These are Letnik Saubermacher, Mecum d.o.o, Eko d.o.o., Center za ravnanje z odpadki Vrnika, Okolje Piran, JKP Grosuplje and Luka Koper INPO d.o.o.. Four of them are collecting wastes with separate waste collecting systems.

Milk production

Wastes from milk production are currently collected in specialized containers and sent to the municipal landfill sites. In some cases this wastes are treated in waste water treatment plants in digesters. Waste water from milk industry is also treated in municipal or their own waste waters treatment plants.

Slaughter houses

There are several slaughter houses in Slovenia and many of them export their wastes abroad (mainly in Italy) others deliver to company Koto d.d.. One of the main activities of the KOTO Company refers to managing animal and other organic by-products. They have a concession contract on the performance of the public utility service of managing slaughterhouse waste and infectious materials of animal origin. This contract comprises the collection of Category 1 and Category 2 animal by-products at collection points throughout the territory of Slovenia, and their disposal to the only rendering plant of the open type in Slovenia. In addition to processing of Category 1 and Category 2 animal by-products, KOTO separately also collects Category 3 animal by-products. They have also a biogas plant where they process these (which allowed) waste.

From so called co-substrates there would be around 3-3.5 MWe potential available according to findings of the above mentioned study (HSE, 2008).

Landfill gas

Currently only three municipal landfills exploit landfill gas for the co-generation of heat and electricity. The biggest landfill area is in Ljubljana, where they have around 3,4 MWe. Second is in Maribor whith 1,3 MWe and Celje also 1,3 MWe. There is also another project where negotiations are still running in Nova Gorica, again 1,3 MWe. Other landfill areas have everything prepared for gas collection and storage but many of them are not yet appropriate because of gas quality for CHP exploitation.

Separating the organic fraction of the waste is in place in modern centres for waste treatment and used in a biogas plant.

According HSE study (2008) we could count on around 7 MWe real biogas potential in this field.

Waste water treatment plants.

There are 6 plants that are using produced biogas from waste waters in CHP units. Total installed capacity of CHP units is around 2 MWe. There is still some potential in plants with high number of PE (person equivalents), in about double of the current size.

3. Feedstock availability in Slovenia

Real feedstock availability is hard to determine since scarcity of data gathered and/or available. There is some estimation possible, however and as we've seen before also some studies on potential made. But since they are from a private institution not all the data are readily accessible.

3.1. Agricultural feedstock

According to the HSE study from 2008, which took into account all the agricultural holdings that applied for a subsidy in 2006 following (realistic) potential was recognised:

From almost 62.000 agricultural holdings about 7600 were seen as suitable for biogas production, accounting to a bit more than 12% of the holdings. In feedstock (source) terms this resulted in e.g. 84.000 LSU in cattle (27%), 29.000 LSU in pigs (59%), 69.000 ha of fields (41%) and 42.000 of permanent meadows (17%).

3.2. Municipal waste

Taking the whole population in the country and the number of tourists we've come to the amount of the highest quantity of organic solid wastes is around 350.000 tons per year in the central region of the country. Other Slovenian regions have also potential for providing solid municipal waste.

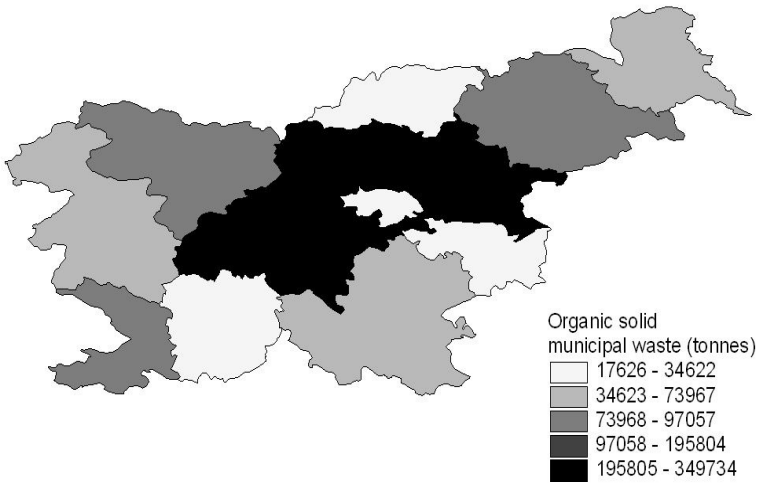

Figure 3.1 Organic municipal waste (tons) distribution in Slovenia

3.3. Sewage sludge

Here data from the waste water treatment plants for year 2006 was taken and the number of people and tourists in the region used. Result is prese3nted in the below figure.

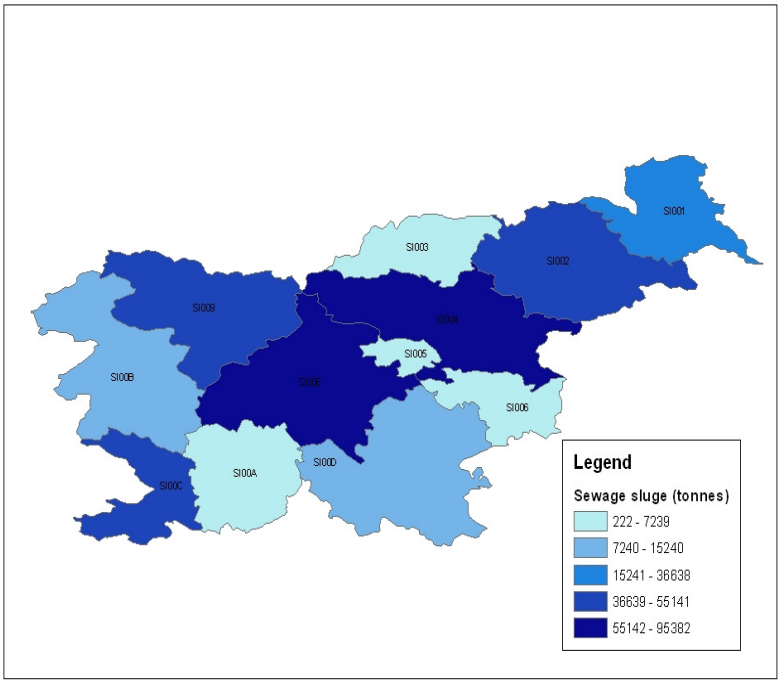

Figure 1.2 Sewage sludge waste (tones) distribution in Slovenia

3.4. Food industry waste

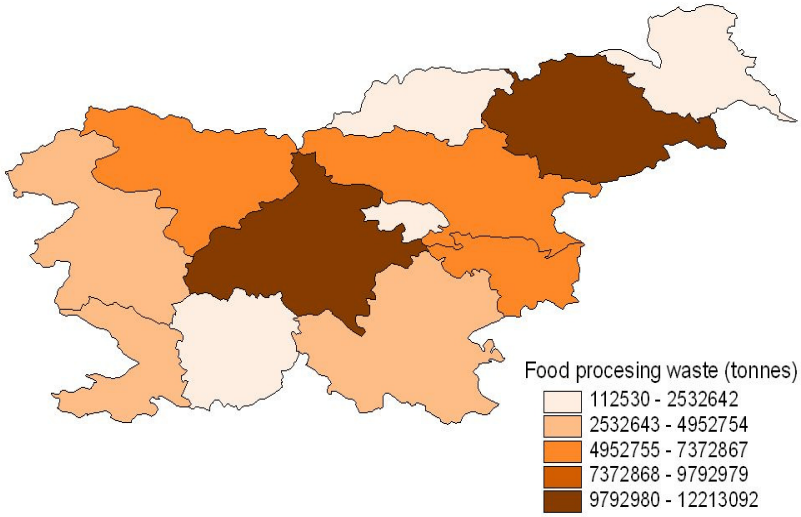

Figure 2 Food waste distribution in Slovenia

Based on the available data (only from waste management) it was possible to conclude that the most suitable area for biogas production is again the central region of Slovenia.

4. Agricultural structures in Slovenia

Taking into consideration the EUROSTAT criteria for classification based on the number of agricultural holdings, using *ArcGis* software, Slovenia suits in class 1 (look fig. 4.1), which means les rural country. Farmers are representing some 6% percent of the population.

The dominating farm surface is between 3-10 hectares with almost two thirds of all agricultural land. According to Agricultural census from 2005 (SURS 2006), in Slovenia there are 77,050 family farms and 133 agricultural enterprises. Average size of family farm is 6.3 ha of utilised agricultural area (UAA), which means that since last census, the size of Slovenian farms slightly improved (average UAA in 2000 was 5.9 ha of agricultural land per holding (SURS 2003)).

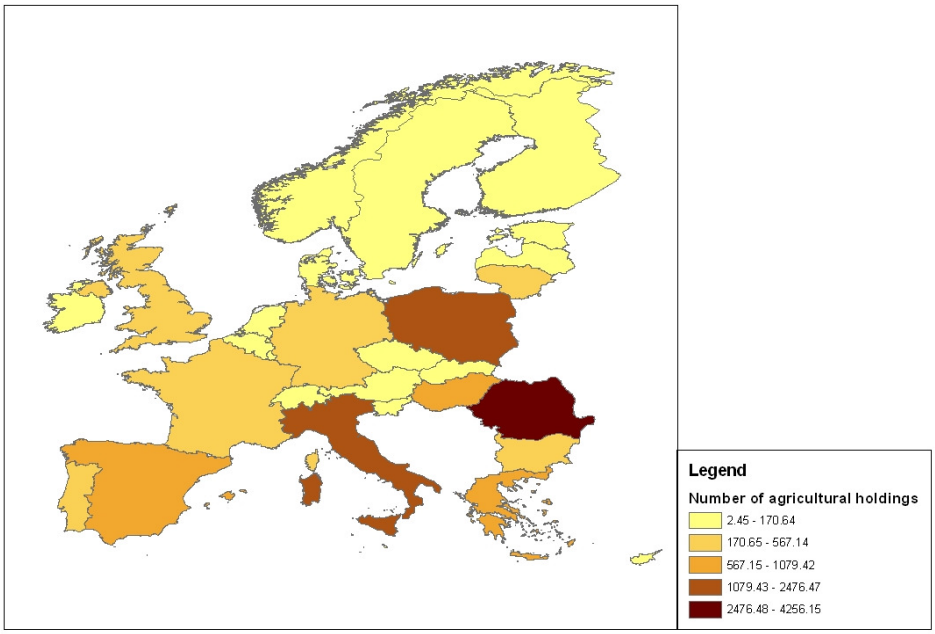

Figure 4.3 Total number of agricultural holdings (*1000) at the European scale (source: Eurostat)

The fragmentation of the agricultural area in Slovenia is quite high. This becomes more obvious when we compare the number of holdings and surface of utilized agricultural area from that region with other like Germany as seen in figure 4.2. Fragmentation is an indicator of the difficulties one could face during a biogas project development. Difficulties related with the fact that, higher the number of agricultural holdings and smaller the production area of the farm being, the access to feedstock will be tougher, due to logistical constrains.

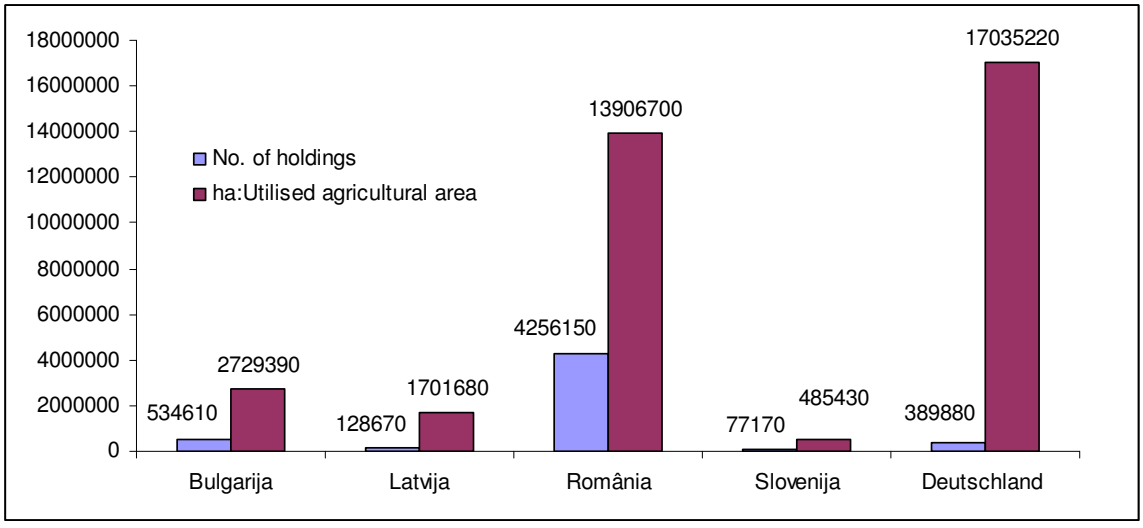

Figure 4.2 Total number of holdings in relation with the utilized agricultural area

Another important indicator of the farm type that could influence the biogas projects is their ownership type. Two types of ownerships over the agricultural land are encountered in countries like Slovenia (SI), Latvia (LV) and Bulgaria (BG) – direct ownership and a leased form. Owned and shared associations on the other hand could be a positive factor for biogas projects. Especially the associations could offer an already existing complex shareholder structure for a future biogas venture.

5. Opportunities for biomethane injection into Slovenian natural gas grid

Natural gas is transported and distributed in the pipeline grid. These grids are categorised according to their nominal pressure into high pressure grids (> 1 bar), medium pressure grids (100 mbar to 1 bar) and low pressure grids (23 mbar).

The feed-in of conditioned biogas into low pressure grids is mostly impractical. The decisive factor is the different volumes of gas consumption between summer and winter. In particular the feed-in into a heavily intermeshed grid is not assured due to the various mixtures and a constant gas quality cannot be guaranteed due to the greatly deviating quality of the biogas.

Significantly better is the situation for feed-in into medium pressure and high pressure grids. With this type of feed-in there are no pressure problems; the feed-in quantity is distributed and then delivered to the customers. These grids, in particular those of the gas transport companies, have also the advantage of biogas conditioning plants do not have to be in the immediate vicinity of the consumer. This allows biogas conditioning plants in rural areas with the appropriate grid connection to produce and feed in large quantities of gas.

5.1. Natural gas grids in Slovenia

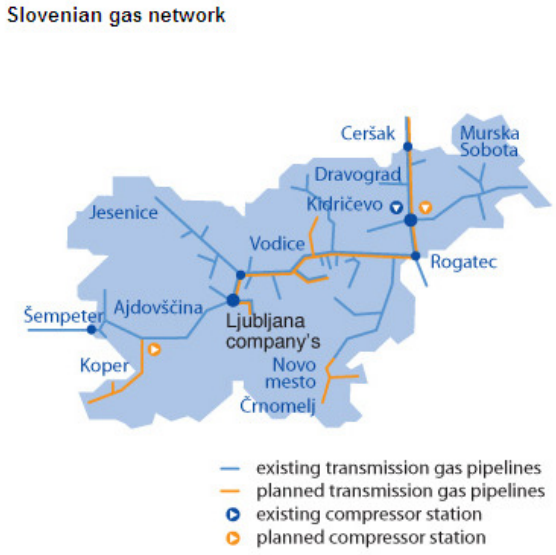

Figure 5.1 Slovenian gas network, Source: Geoplin d.o.o.

Supplier of natural gas in Slovenia is company Geoplin d.o.o. Gas is bought in Russia and Algeria. Geoplin is also in charge of international gas transport to Slovenia and operates national gas pipeline. Company supplies almost all gas distribution companies.

For local distribution of gas various public companies in bigger cities (such as Ljubljana, Maribor, Celje and others) and private companies based on issued concession are in charge.

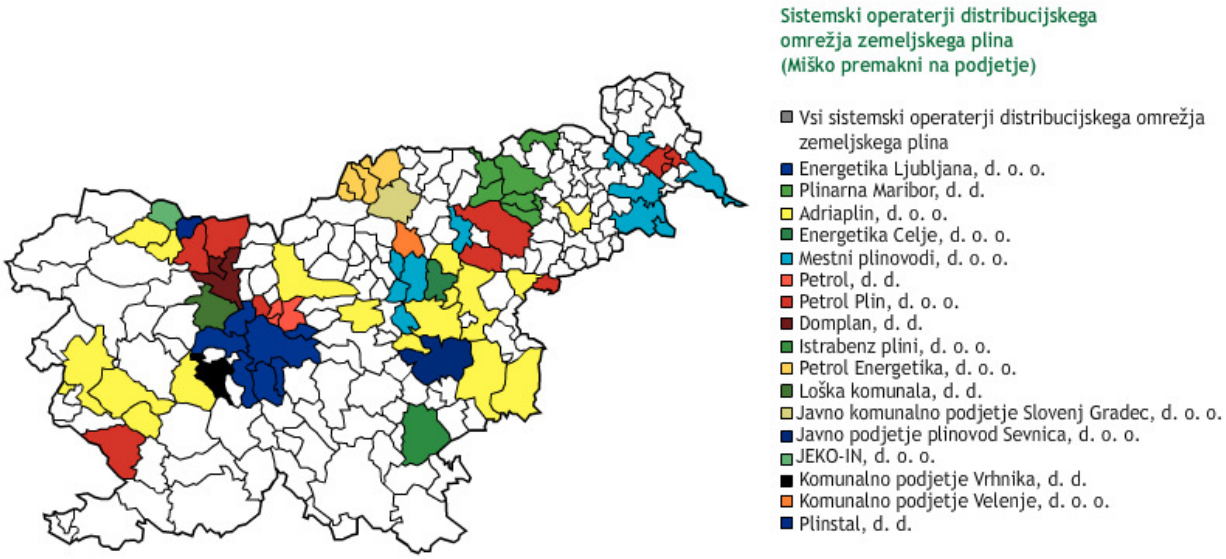

Figure 5.2: Slovenian local distribution, Source: http://www.giz-dzp.si

5.2. Technical requirements for biomethane injection into the natural gas grid

Company Geoplin plinovodi operates the Slovenian gas pipeline transmission system as natural gas system operator. Pressure of the gas in transmission pipeline is 3 bar. When biogas plant decides to connect to the pipeline than this plant is treated as natural gas supplier. Plant operator should contact company Geoplin plinovodi if the injection point is in the transmission pipeline. Otherwise it should contact local distribution company, listed above.

Supply of purified biogas is in the location where special station is build for measuring and controlling gas quality and characteristics. If the requirements are not satisfied than the supply is stopped. Since there are no project is Slovenia we have no experiences yet and also the allocation of the costs should be negotiated and what will be the costs for gas transport.

Characteristic of purified biogas that is supposed to be transported in the existing gas pipeline should meet the following requirements are to be seen in separate report D2.6.

6. Impacts of the biogas production in Slovenia

Impact of the biogas production should be mainly beneficiary although there are also some negative aspects that can be seen, but they are mainly the results of mistakes and could be therefore avoided.

Benefits of the biogas production are quite known. The closed cycle of the biogas production forms an integrate system of resources utilisation, organic waste treatment, nutrient recycling and redistribution. Furthermore renewable energy production creates numerous other energy, environmental and agricultural benefits. Biogas can be used for electricity and heat production and it can also be upgraded into biomethane, which can be than used as a biofuel and/or put into the natural gas grid.

Biogas plants offer additional already known advantages, such as:

- Reduced or removed odour nuisances from digested manure and other biowaste.
- The nutritive substances are more accessible to plants.
- Pathogenic bacteria, viruses and weed seeds are degraded.
- Digested residues, if not suitable for agricultural application, can be prepared as bio-solid pellets and used as secondary fuel.

Furthermore biogas production contributes to the RES energy portfolio, to the lowering of fossil energy dependence of the country (which a over 50% in Slovenia), offers additional possibilities to farmers, etc.

Prospective is therefore good as it seem s to be the most natural way for farmers to deal with manure problem, low income from conventional farming etc. Prerequisites in terms of support are there and will possibly be improved further since an interest group of biogas producers already deals in favour of such development. Furthermore first experience was gathered, lessons learned and there is also an existent market of biogas know-how and equipment.