IEE-Project
FABbiogas

BIOGAS PRODUCTION AND BIOGAS POTENTIALS FROM RESIDUES OF THE EUROPEAN FOOD AND BEVERAGE INDUSTRY

INTERNATIONAL SITUATION

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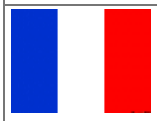
1 Introduction

This report was written in the frame of the IEE project FABbiogas, which is supported by the Intelligent Energy Europe. The aim of this report is to give an overview of the biogas market in six partner countries (Austria, Czech Republic, France, Germany, Italy, Poland), to compare the potential of renewable energy sources from waste from the food and beverage industry (FAB), including the identification of the production of biogas from organic waste, and the untapped potential of organic waste in various industries of food and beverages and to specify non-technological barriers that hinder development and use of renewable energy potential in each partner country. The total land area and population of partner countries are presented in table 1.

Table1. Total area and population of partner countries [1,2,3,4,5,6]

Country	Area (km^2)	Population
 **Austria**	83,855	8,414,638
 **Czech Republic**	78,866	10,513,209
 **France**	640,679	66,616,416
 **Germany**	357,021	80,585,700
 **Italy**	301,338	59,685,227
 **Poland**	312,679	38,186,860

In March 2007, the Heads of States and Governments of the 27 EU Member States adopted a binding target of 20 % renewable energy from final energy consumption by 2020. Combined with the commitment to increase energy efficiency by 20 % until 2020, Europe's political leaders paved the way for a more sustainable energy future for the European Union and for future generations [7]. Factors such as the different starting points, renewable energy potential and economic performance of each country are taken into account in the targets.

The share of renewable energy in total energy production in 2010 and required targets for 2020 for six partner countries are shown in Figure 1.

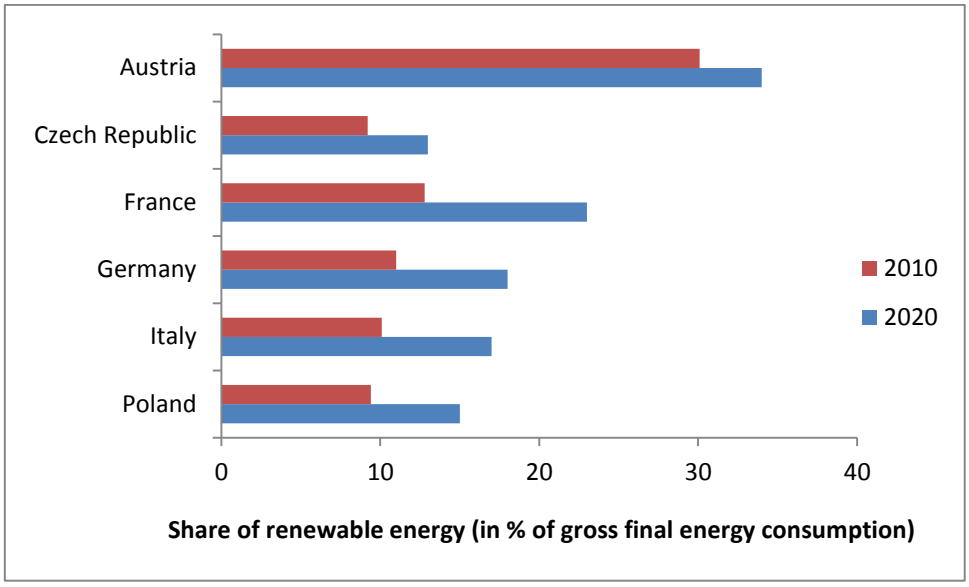


Figure.1. Share of renewable energy in total energy consumption in the partner countries

Biogas is seen to be one of the key technologies both to reach EU member states targets for renewable energies in 2020 and to meet their requirements within the European organic waste management directive.

The European Landfill Directive sets mandatory targets for a three step reduction in biodegradable waste going to landfill. Set against a 1995 baseline, it requires a reduction of 25% by 2010, 50% by 2013 and 65% by 2020. It is necessary to reduce the amount of all types of waste going to landfill. Therefore, it is desirable for the European Union Members to investigate novel solutions based on the use of waste and sub-products from the food industry for renewable energy production.

Biogas plants are believed to be enormously advantageous by obtaining biogas from the organic matter contained in agricultural and food waste which helps the food industry to reduce the environmental impact caused by organic waste.

2 Methodology

The report was prepared on the basis of data obtained from reports of individual partner countries (Austria [1], Czech Republic [2], France [3], Germany [4], Italy [5], Poland [6]). All the necessary data has been collected and presented in the tables or charts to compare the

biogas market in different countries, barriers that hinder implementation of new biogas projects and the largest waste streams.

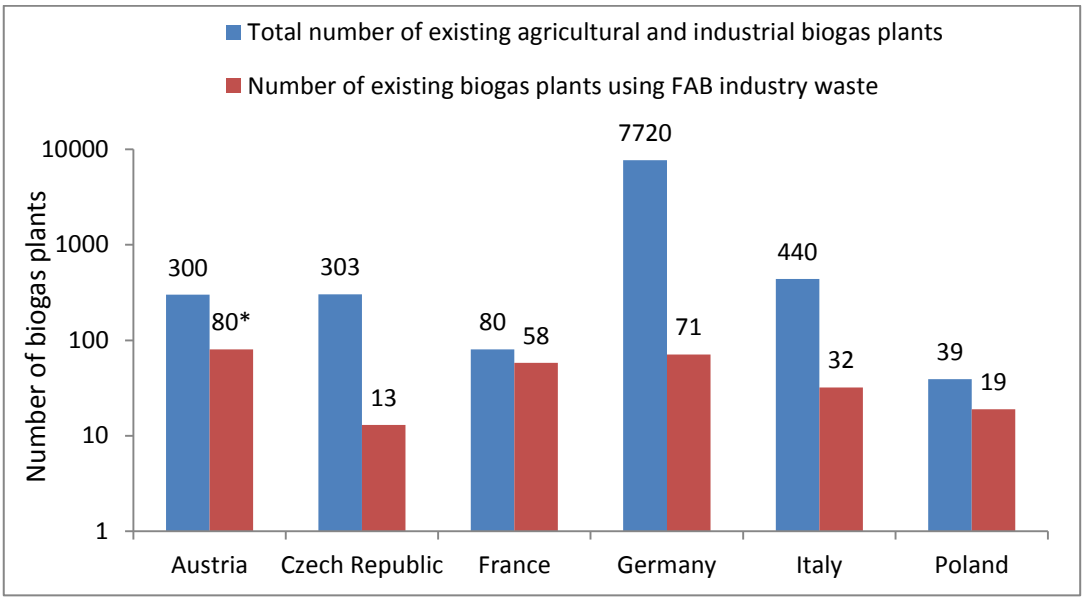
2.1 Biogas plant market in partner countries

The data collected from all six national reports shows that Poland is the third largest country of the six participating in the project and the last in terms of the amount of the existing agricultural and industrial biogas plants, figure 2. Currently there are 39 installations in Poland. Until 2020, according to the Council of Ministers in Poland 2 500 biogas plants with a total capacity of 980 MWel are expected to be built. This seems to be extremely difficult to meet these goals because at the moment collapse in prices of green certificates, a large reduction in wholesale electricity prices, no yellow certificates from the beginning of 2013, and the lack of the RES Act are the main reasons for discouraging of potential investors and the reason for the small number of new biogas plants. It even happens that the above-mentioned reasons are the cause of withholding the start of already constructed objects. The owners just do not want to knowingly expose themselves to some losses. The good news is that over the past two years, more than 20 biogas plants were built, and in total: 19 out of 39 agricultural ones use wastes from industry as a feedstock.

These 39 biogas plants in 2011 consumed 469 000 tons of feedstock. More than half of it, exactly 277 800 tons, was slurry, manure and animal excrements, 123 200 tons-energy crops, and only 68 000 tons was waste from the food processing industry. Last year, however, these proportions, began to change rapidly. Very fast growing consumption of waste from agri-food companies was noticed, and cease to use slurry, manure, animal manure and energy crops. The result is that in the first half of 2013, agricultural biogas plants processed 750 000 tons of substrates, 369 000 tons of which were waste from the food. This means that Poland started to go in a different direction than Germany, where the main raw material used by agricultural biogas plants are energy crops, especially maize. This trend is expected to continue, due to the fact that the corn-based systems are no longer profitable. There are investors who want to bet on the other, cheaper energy crops (e.g. grass), but this is unlikely to change the trend described above, mainly because Polish government proposal of support system for renewable energy. The new system will promote those installations that produce energy cheaply, and in the case of agricultural biogas plants those which have the lowest costs, which are based on the cheapest raw material, i.e. on the waste [8].

France which is the largest of the six partner countries in the project has on its territory only 80 biogas plants, figure 2-3. However, in 2011, the French government has published a

number of new initiatives that ensure solid backing for biogas in France. This backing includes increased support for production of biogas on the basis of waste from cities, industry and agriculture and the use of biogas for electricity production, heating and distribution via the natural gas grid. According to a press release from the industry and energy minister, up to 2020, support for biogas in France will increase to a total of EUR 500 million a year. The French targets are ambitious. By 2020, 270 million cubic metres of biogas are to be distributed via the natural gas grid. Electricity production based on biogas is to be increased fourfold and heating based on biogas is to be increased sevenfold by 2020 [9]. It is worthy of note that as much as over 70 % of mentioned biogas plants in France (58) use Fab industry waste as a substrate.



* - waste biogas plants allowed to use FAB industry waste

Figure 2. Number of biogas plants in partner countries (2010/2011)

In Austria, the installed electrical power of 15 MWel rose to 80 MWel from 2002 to 2007, which was the result of the implementation of the first Eco-power law (feed-in tariffs). There are approximately 300 agricultural and industrial biogas plants in Austria, however, there is no adequate data available concerning waste biogas plants in Austria. Authors of Austrian report identified 80 waste biogas plants using the list of “Approved or registered ABP-plants (animal by-products) according to Reg.(EC) No 1069/2009” received from the “ARGE Kompost & Biogas” (representation of interests of Austrian biogas plant operators) but it is impossible to indicate the number of Austrian biogas plant using only FAB industry waste. Initially, the most commonly used substrate was slurry and small amounts of organic waste, while since 2002, 80 % of biogas plants have been operating on the basis of co-fermentation

of energy crops and manure. Unfortunately, the increase in the prices of energy crops in 2007 caused a significant increase in the cost of maintenance of biogas plants, as well as numerous changes of the Eco-power law have led to a decline of the feed- in tariffs . The consequence was a fewer number of new biogas installations during the last years, as the cost of green energy production was higher than the feed-in tariffs. Furthermore, the amendment of the green electricity act has caused the deterioration of the framework conditions for renewable energy and stagnation of the whole industry in Austria. Higher prices of energy crops, low feed- in tariffs and the insufficient usage of waste heat have led to the struggle of numerous biogas plants for their economic existence [10]. In order to compensate rising costs of raw materials in Austria, subsidies to substrates were granted in 2008, and the amendment to the green electricity act in 2012 was expected to ensure the improvement of framework conditions. In addition, for existing biogas plants an additional maintenance surcharge, a technology bonus (injection of biomethane into natural gas grid) and combined heat and power (CHP) bonus was established.

Due to their favourable subsidisation schemes, the already established biogas markets in Italy, the United Kingdom, the Czech Republic and the Netherlands will continue to be among the most important markets in the next five years.

In Czech Republic, the main trend in the production of renewable energy is withdrawing biogas from municipal landfills, and the use of anaerobic purification step in wastewater treatment plants. When it comes to the development of biogas plants in the Czech Republic, it is dominated by installations based on agricultural residues and dedicated energy crops. The report of the Czech Republic shows that there are currently more than 20 biogas plants, in which biodegradable municipal waste and organic industrial waste are used as substrates. It is planned to build 563 biogas plants, while at the moment there are 303, however, not all of them are put into operation yet. The dynamic development of the biogas market is probably a result of the favourable purchasing price of electric power from agricultural biogas stations and the investment support from EU structural funds, specifically from the Environment, Entrepreneurship and Innovations operational programs and the Countryside Development Program and is also the chief priority of the ECO-energy program established by the Ministry of Industry and Trade.

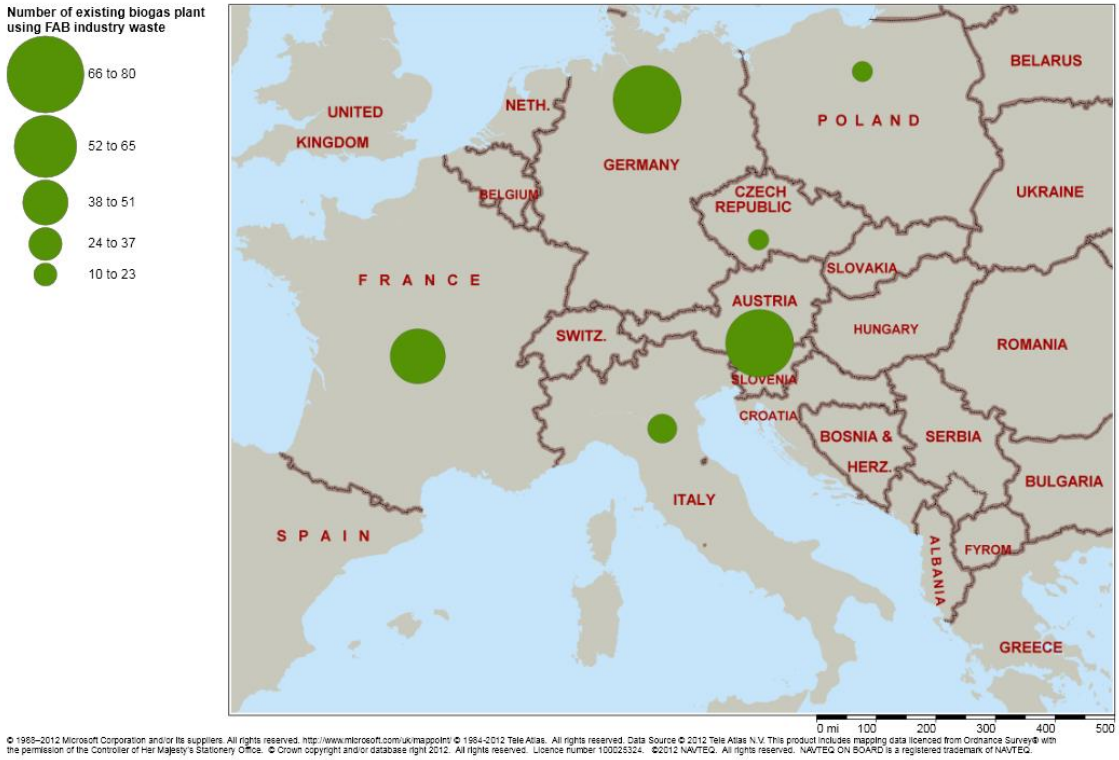


Figure 3. Number of existing biogas plants using FAB industry waste in partner countries

The European Commission set a target of 17% share of energy produced from renewable sources in 2020 for Italy. This EU Directive has been recently transposed into the Italian Legislative Decree n° 28 of 3 March 2011. The new decree defines tools, mechanisms and incentives to reach the European goals. In 2012, there were 855 plants linked to agro activities for a total of 720 MWel installed. The average power installed for the biogas plants is less than 1 MW, most are operated at 999 kWel, the limit for the formerly high feed-in tariff. In 2012 4,620 GWhel. have been generated, about 35 % more than in 2011. The difference is to be attributed to the biogas plants fed with interspecies catch crops, increasing the electricity production from 1.453 GWh to 2.534 GWh. The number of biogas plant using byproducts from the FAB industries is far more limited. In total 79 biogas plants digest FAB waste (5 m tons from industry, 1m ton from slaughterhouses) with 60MWel installed. Regional distribution shows that the plants are mainly located in the northern regions where the industry is located. Only 10 plants are located in the south of Italy including Sicily and Sardinia. About 60 % of the FAB waste plants use co-digestion with animal and agricultural wastes.

Germany is the market leader in biogas technology and is also Europe's biggest biogas producer, figure 2. More than half of the complete European biogas energy production is of German origin. Thanks to generous subsidies, eco-friendly alternatives have become

economically attractive for German power companies and local authorities. Especially the amendment of the EEG in 2004 and the new version in 2009 supported the expansion of biogas plants. In 2012 around 7 515 biogas plants in Germany with an installed electrical power of 3 352 MW had been placed. These supplied around 23 000 GWh of electricity to approximately 6.5 million households. However, the German market has slumped dramatically since early 2012 forcing the German biogas industry to internationalise its business strategies. The German slump is mainly due to the amended Renewable Energy Act in which compensation rates for biogas were reduced significantly with an added tightening of legal conditions. German plants now have to use at least 60 percent of their waste heat and as a consequence the number of plants constructed per year in the country will decrease from around 1 300 in 2011 to 300 in 2012. As presented in the German national report the major inputs for biogas plants are energy crops with 49 % and animal manure and slurry with 43 %. Industrial and agricultural residues only account for 1 % of the total input (in relation to mass). Nevertheless, the number of waste biogas plants continually rises. The authors of the report admit that the current situation in the biogas market in Germany promotes the formation of new installations, but their economic efficiency depends mainly on the quantity and quality of the substrate and the utilization of the biogas and digestate.

As it is clear from the data collected from partner countries, the driving force behind the development of the biogas market is the use of bioenergy is the Renewable Energy Directive (RED) which requires Member States to generate 20 per cent of energy from renewable sources by 2020 and for 10 per cent of transport fuels to be made up of renewable resources.

Biogas production is also increased through various actions supporting and promoting at national and regional level. An important role is played here by Renewable Energy Sources Act, which sets the rate of pay for the production of electricity from biogas from one side of the by-products and wastes, on the other hand from energy crops. The basis for the cost-effectiveness of energy production is a guarantee of its sales and price. The profitability of projects is also highly dependent on the use of thermal energy. Therefore, careful consideration and planning solutions of heat usage plays a significant role in the construction of biogas plants.

3 Waste streams in partner countries

In table 2 and Fig. 4 there were collected data from national reports in order to show dominant streams of waste in each country, the total number of companies form FaB industry

and the total production of waste [in tonnes per year] they generate. In most cases there was also methane potential of those types of waste calculated.

Table 2. Dominant waste streams and their methane potential [1, 2, 3, 4, 5, 6]

Country	Dominant waste streams	Total number of companies in Fab industry branches	Total production of waste [t /year]	Methane production potential [mil. m^3/year]
Austria	• Dairy Industry • Sugar Industry • Brewing Industry • Slaughterhouses	108	1 031 968	74
Czech Republic	• Waste materials from sugar industry • Brewing Industry • Meat industry • Fruit and vegetable industry	2188	1 120 000	80
France	• Beverage industry • Meat industry • Fruit and vegetable industry • Petfood production • Beet-pulp, molasses, other waste of sugar manufacture	13127	11 300 000	680
Germany	• Meat and fish industry • Fruit and vegetable industry • Breweries and malt production • Coffee and tea processing	1767	13 500 000 (t DM/year)	120
Italy	• Oil industry: virgin and exhausted pomace • Alcohol industry: fresh pomace and exhausted • Rice industry: chaff, husks, etc.. • Canning industry: kernels of fresh fruit, dried fruit shells, seeds and • Tomato skins	Lack of data	Lack of data	Lack of data
Poland	• Fruit and vegetable processing • Dairy industry • Meat processing industry • Brewing industry	563	4 023 000	185

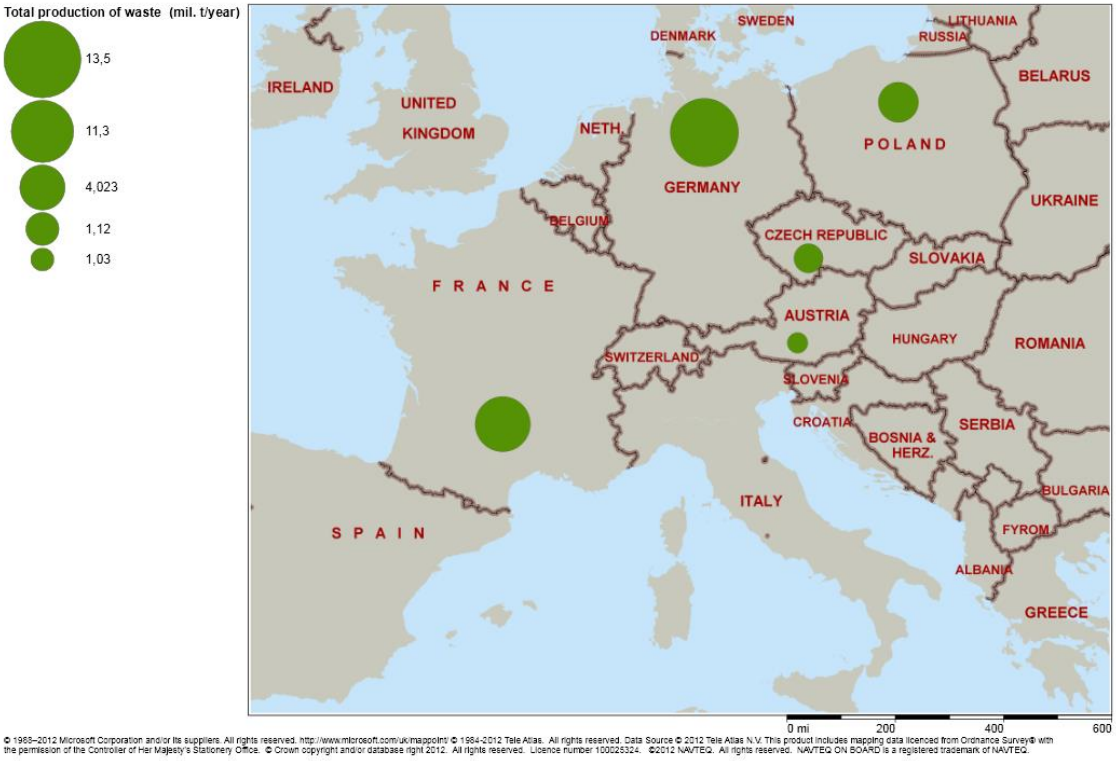


Figure 4. Total production of waste from FAB industry in partner countries

Due to the fact that in Germany it is not possible to publish data from any companies without a specific permission because of the high competition among companies in the same branch, the literature data was taken into consideration in the German national report. According to the report, German industry produces about 13 500 000 tonnes of waste every year. Practically the entire mass of organic industrial waste generated is managed and almost nothing is left unused. As it is clear from the data presented in the above-mentioned report, the largest waste stream as much as 6.072.799 t DM/a comes from fat and oil production, the second in order of the amount of 3.144.201 t DM/a are from sugar and confectionary industry. Significant quantities of waste are generated in Germany by starch production and dairy industry. As the authors have indicated, the greatest potential for waste (390 000 t DM/a), which could be redirected into higher-value utilization is waste from Sugar and confectionary industry. Currently, they are used as feed or used thermally. “Other waste” (100 000 DM t/a) from the production of condiments, sauces, convenience food, and dietary and other foodstuffs are also believed to have high ”redirectable” potential.

Just like in Germany, also in France due to the competition of companies producing food and beverages it is difficult to obtain from them the detailed information on the type of waste

generated and their properties. However, there are data concerning waste published by the NAF (French statistical nomenclature for activities). The table presented in French report shows that waste in France is very diverse in terms of properties (e.g. organic content). The total amount of organic waste generated in France -11 300 000 t/year is similar to that in Germany, figure 5.

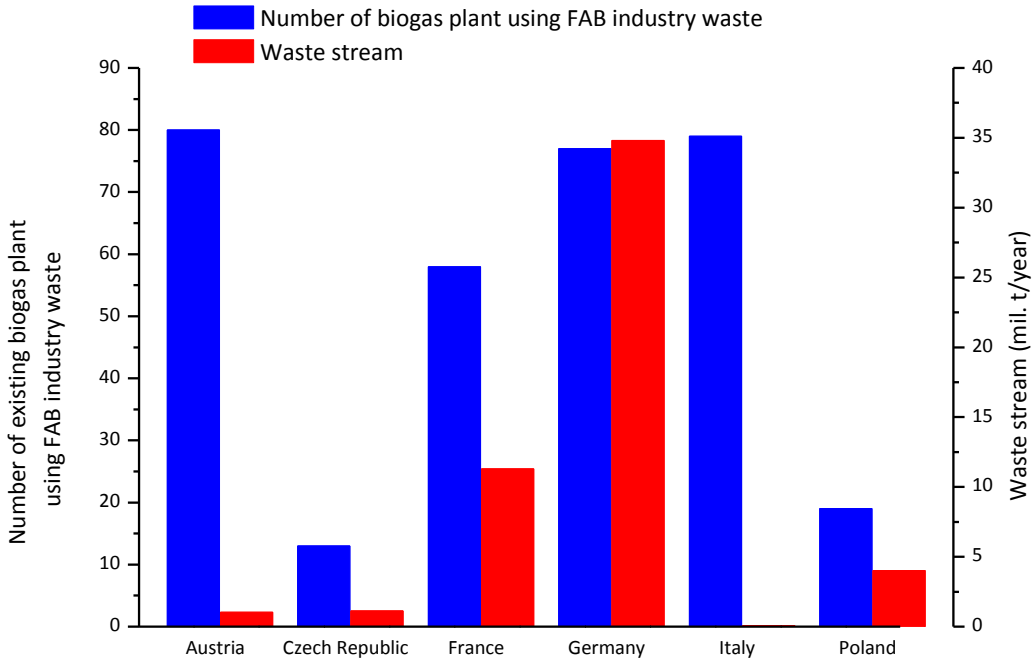


Figure 5. Comparison of waste streams and number of biogas plants using FAB industry waste in partner countries.

In these two countries there is a similar number of biogas plants operating on the basis of waste from food and beverages. However, it seems that in France the number of such installations can rapidly grow, as France has started a food waste program to turn organic waste into methane. Since 2012, France requires companies to recycle their organic waste if they produce more than 120 tons per year. The largest waste streams come from the food industry (15 556 000 t/year), meat processing (2 683 000 t/year) and beverage industry (2 394 000 t/year). According to the NAF there exist 13 127 companies in the Fab industry, mainly: Processing and preserving meat for butchers' shops, Meat processing, Production of ready-to-eat meals, Petfood production companies, table 2, figure 6. A French report presents the results of calculations made by the French Environment and Energy Management Agency ADEME, aiming at estimating the potential available, the stream which could be mobilized for biogas production by 2030. This study mapped out valorisation

average rates (rate of matter valorised as byproducts) and mobilization rates (percentage of matter oriented towards an organic treatment method as dry composting, application to farmland, anaerobic digestion) in France. These calculations show that the mobilisable waste stream at the 2030 horizon is estimated at over 700 GWh, and is located uniformly over the French territory. Detailed information about these calculations can be seen in the French national report, which is available on the project website.

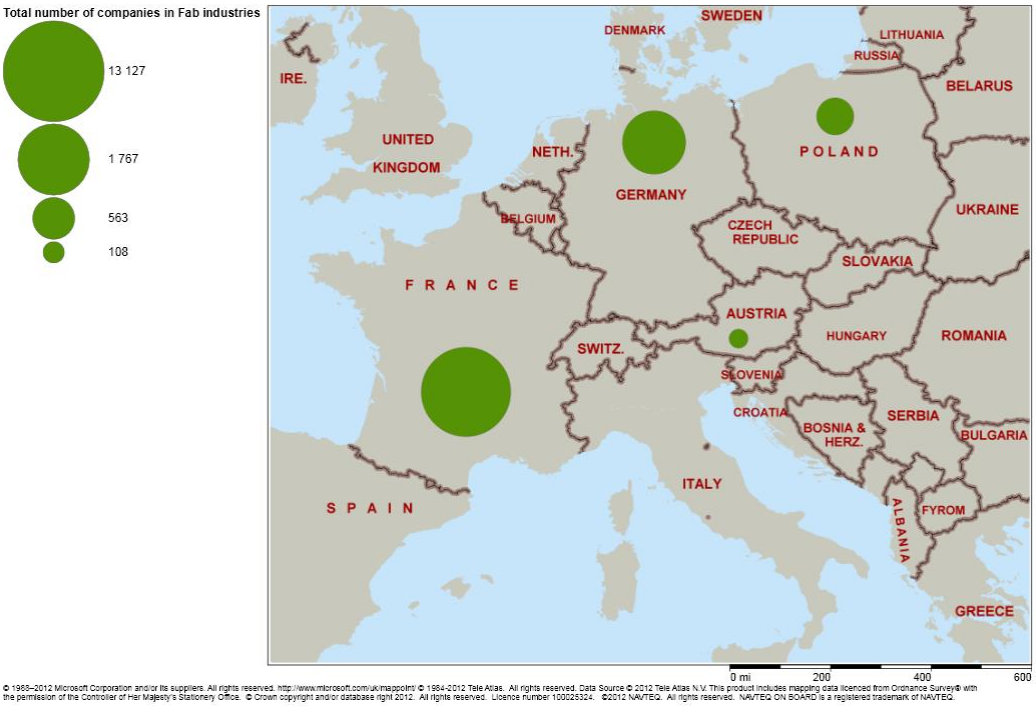


Figure 6. Total number of companies of Fab industry in the partner countries

Directive 1999/31/EC from April 1999 forces also Poland to take up actions aimed at selecting and recycling the organic fraction derived from municipal solid waste. In 2012 Poland began to implement a system of segregation of waste in households. From the point of view of Polish economy, properly conducted biodegradable fraction management is necessary because as a result of compliance with the guidelines of the EU countries, landfills are systematically closed as they do not meet EU requirements. In addition, 1 January 2013 prohibition of storage of untreated waste started to be obligatory. Poland, as a member of the European Union, has been committed to achieve growth in the share of renewables in final energy consumption to 15% in 2020. As presented in table 2 and figures 4-5, Poland has a significant potential for production of biogas from waste, as total waste stream amounts to 4 023 000 t/year. Selected organic fraction of municipal waste can be utilised by composting process or become a valuable substrate for biogas production plant. In Poland, the majority of companies (239) generate from 2 000 - 5 000 Mg / year of waste. In second place with

the amount of 158 are companies that annually produce 500 – 2 000 Mg. Among all these waste streams, waste from the processing of meat and dairy waste are the biggest percentage, figure 7.

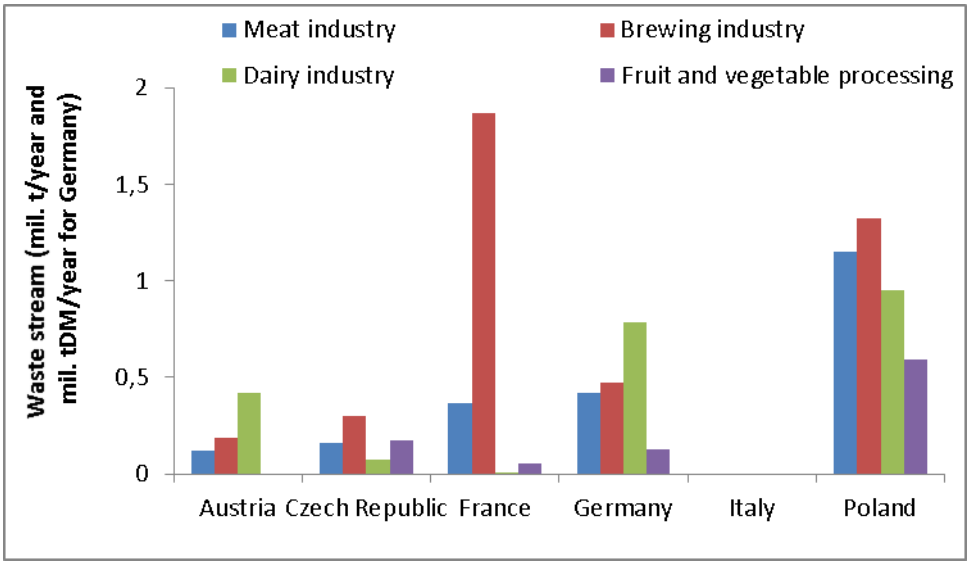


Figure 7. Comparison of the amount of waste streams from four most significant industries in partner countries

Some of this waste is used to produce food (fats, gelatine), feed for animals, and some of this material for the tanning industry. The residue goes to recycling. The potential for biogas production from waste from the meat industry in Poland amounts to 84 574 400 m3/year. The European Union in 1997 banned the use of meat and bone meal in slaughter animal feed. This regulation caused the huge problems with the management of large amounts of waste generated during the slaughter of animals and meat processing, which previously was the raw material for the production of meat and bone meal. Lack of proper management of the waste is a significant environmental hazard, while many presently used forms of disposal are a significant burden for the meat industry. Currently, these problems are faced by all EU member states in varying degrees, mostly by leading countries e.g. Germany and Poland in the meat processing industry.

The Czech national report presents data concerning waste streams from two sources: Waste Management Information System (WMIS) operated by the Waste Management Center: which is a part of the T. G. Masaryk Water Research Institute and the Statistical information of the Czech Statistical Office (CSO) which is based on the results acquired through processing of the Annual Waste Statement. The presented data shows that the largest percentage (80%) of the total number of waste (1 120 000 t/year) are waste materials from primary agricultural and gardening productions. The amount of moist livestock excrements

generated, estimated on the basis of the number of the kept animals (according to CSO) and average production per head is in the Czech Republic more than 27 million tons per year. The potential for processing the waste by methane fermentation process is estimated to be about 30% of the theoretical amount. The report's authors point out that a large percentage of agricultural waste is utilised by other methods, however, agricultural waste and livestock manure in particular, are the most important potential source of substrate for biogas production. The waste from the food industry are another important source of biomass as an appropriate substrate for methane fermentation - about 0.75 tons of this biodegradable waste is produced in the Czech Republic every year. However, up to now only 13 biogas plants use waste from FAB industry as a substrate. The largest stream of organic waste from industry comes from the production of alcoholic and non-alcoholic beverages (except for coffee, tea and cocoa) – 312 335 tonnes and the production and processing of meat, fish and other foodstuffs of animal origin – 154 999 tonnes. The authors of Czech National Report also point out that biodegradable municipal waste also represent a substantial part of the total weight of waste generated, and show significant potential of energy production. These waste constitute 40% of mixed municipal waste. Waste Management Plan of the Czech Republic in response to the requirements of Directive 1999/31/EC enforces a gradual reduction of the amount of biodegradable waste disposal in landfills.

According to the Austrian report, most companies of Fab industry are Breweries (40), dairies (30) and slaughterhouses (20). However, the largest waste stream (240 000 t /year) and also the greatest potential for biogas production comes from sugar mills (28 666 413 m3/year). As it is presented in figure 5, in Austria, the number of biogas plants operating on the basis of waste from Fab industry is similar to those in Germany and France. It should be noted, however, that the amount of waste streams is incomparably smaller. Among the most significant waste streams in Austria there are also residue streams of the Austrian food production: grain residues like husk and pastry (217 000 t/year) and expired food (65,000 t /year). The most important residue streams in drinks / tobacco industry are from beer, wine and fruit juice production (253 000 t /year). However, it can be assumed that the residues of the Austrian food and drinks / tobacco industry are reused as food or as feed. Residues which cannot be used as food or feed are preferably used as substrate in biogas plants or composted. Thermal treatment of residues/waste plays a minor role. All in all 218 900 tons of animal by - products are used as substrate in biogas plants. These are mainly kitchen and food waste, dairy waste, former food of animal origin and small amounts of waste from slaughtering. Hence, the share of industry FAB waste of animal by-products used as substrate for biogas plants is low. These are the dairy wastes (cheese production, butter production) and slaughtering wastes (slaughtering , meat production).

In Italy, the agri-food processing industries that produce waste in quantity and quality suitable for a possible energy use are those related to the processing of products, often typical of certain geographic areas, such as wine and spirits, oil, rice, and, in lesser extent, meat processing industry, dairy industry and canning industry. Residues arising from the pressing of the olives: pomace and vegetation water constitutes an important environmental problem because of the high content of organic substance. They may be employed in installations of anaerobic digestion for production of biogas, but the high acidity limits its use exclusively in co- digestion with other substrates and consequently the limited possibilities for energy recovery has ruled that by-product of this estimate. Another high potential waste comes from wine production. Possible to calculate the average annual amount available nationally of virgin pomace, amounting to about 134,000 tonnes (2.1% of the production of wine grapes); dregs of approximately 294,000 t (4.6%) and stalks, amounting to 96,000 tonnes (1.5%), and then obtain the overall estimate of these differences amounted to about 524,000 t / year. The rice mill industry annually produces significant quantities of waste characterized by a high energy content and for this already widely used for the production of thermal and electric energy at the same processing establishments. The national production of rice, mainly concentrated in the provinces of Novara and Vercelli, Pavia, develops on average on a total area of approximately 225,000 hectares (ISTAT, average 2006 and 2008). The yield per unit is about 6 t / ha, which leads to a total potential production of raw rice amounted to 1,400,000 tonnes. Other significant industry sectors that produce high mounts of high potential wastes are: canning industry (fresh and dried fruit) and tomato processing.

The data collected from the national reports shows that in every country there are different ways of waste management, table 3.

Table 3. Ways of waste management in partner countries

Country	Dominant ways of waste management
Austria	• Feed production • composting • waste used as fertilizers • biogas production
Czech Republic	• feed production • biofuels production • transfer waste to farmers
France	• composting • application to farmland • anaerobic digestion
Germany	• feed production • waste used as fertilizers • biogas production • thermal use
Italy	Lack of data
Poland	• transfer waste to farmers • waste collection by recycling company • incineration of waste • waste used as fertilizers

For example, in Germany, the majority of waste from processing of fruit and vegetables, fat and oil and dairy products or starch are used as feed. Similarly, in Austria, it can be assumed that the residues of the Austrian food and drinks/tobacco industry are reused as food or as feed. Those residues which cannot be used as food or feed are substrates in biogas plants or they are subjected to composting process. In France, however, organic waste are mainly composted, serve as fertilizer or are the substrate for biogas production. In Poland, there are two leading methods of waste management: waste transfer to farmers for feeding animals and paying external recycling company for organic waste collection.

In summary, the two most popular methods of waste management in the partner countries are: feed production and the use of waste as a fertilizer. Uncommonly, waste is used for biogas production or used thermally. Least often waste is collected by recycling company or composted.

3.1 Barriers for biogas plant operators and food and beverage manufacturers in target countries

Even though, there is a favourable legislative framework and state support mechanisms in some partner countries, the biogas market is developing with a slow pace and leaving a considerable part of the existing potential untapped.

In order to identify the barriers for biogas market, surveys among biogas plant operators and FAB producers were conducted in Austria, Czech Republic, Germany, France, Italy and Poland. All survey participants from Fab industry stated that the permitting procedures represent a barrier for biogas market development. Thereby, the main reason for inefficient permitting procedures seems to be lack of knowledge and competence of people responsible for administrative procedures. Along with this, changes in the legislation and unstable governmental policies towards the biogas energy signals instable market and consequently higher risk for investments. Even in the countries which had favourable policy frameworks like Germany or Austria, the governmental support has decreased during the past 18 months. This had an impact on the market development. In Germany there exist a high number of different legislations that are constantly changing and are therefore not adjusted to each other very well. In Austria the legal and technical requirements are high and the administration process lasts minimum 3 months to get the approval for realizing biogas projects.

In France, potential investors expect easier access to bank loans, as banks now consider biogas investments more risky than investments based on solar or wind energy and thus they are reluctant to invest. In addition, the operators of biogas plants in France as one of the major barriers pointed complex administrative procedures and lack of positive experiences.

In Poland, the biggest barrier is no social acceptance for biogas investments. This is probably due to the lack or small amount of well-functioning biogas plant, which would be a good example of how tedious waste can be managed with simultaneous energy production. In addition, the intricate legal procedures, long waiting for permits and lack of proper act promoting renewable energy sources discourage potential investors.

Table 4. Most frequent barriers for plant operators and food and beverage manufacturers

Country	Most frequent barriers for biogas plant operators	Most frequent barriers for food and beverage manufacturers
Austria	• barriers in the approval phase of the biogas plant • financial barriers • barriers/problems during plant operation • lack of competence of bank employees for waste biogas plants	• high price for feed • small amounts of waste • not economically feasible with current legal conditions • odor emissions • not stable material
Czech Republic	• complex legislative • complicated obtaining of permission • public opinion (bad smell, heavy traffic)	• accessibility of sources • legal constraints • price • transport and logistic
France	• more lucrative installations • better access to loans • lighter administrative procedures for new plants • developing co-digestion with other types of wastes	• profitability of the facilities • positive experience feedback • reduction of administrative difficulties
Germany	• rapid changes in the legal framework • the price of the substrate • higher traffic volume • odor emissions and noise • lack of knowledge • missing contact person	• economic aspects • problem with legislation • complex authorization of biogas plant
Italy	Lack of data	Lack of data
Poland	• large number of formal requirements • financial barriers • social acceptance	• lack of knowledge • obtain all permits • financial problems

4 Summary/Conclusions

As the data from the national reports shows, biogas market is growing despite the often unfavourable conditions such as intricate legal procedures, lack of laws supporting renewable sources of energy or lack of competence of the employees of banks and hence the deficiency of financial support for biogas investments. In all countries, however, an increase in the number of biogas installations in recent years is observed. Moreover, in all the partner countries considerable waste streams are generated being ideal substrates for biogas plants. It is satisfactory that more and more industrial organic waste is used in biogas plants replacing the expensive maize silage.

5 References

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