

ESTIMATION OF POSSIBILITIES OF BIOGAS ACQUISITION AND UTILISATION IN THE COMMUNES OF THE LUBLIN REGION

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Summary. The paper presents the results of a study concerning the estimation of possibilities of creation of agricultural biogas installations in the area of communes of the Lublin Region based on waste products from the agricultural and food industry. The study was based on survey questionnaires sent to the communes of the Lublin Province.

Key words: biogas plant, waste management

INTRODUCTION

Energy and energy raw materials are a strategic product with a real influence on almost all elements of correct functioning of economic entities [Rechul 2010]. An effect of increase in the number of implemented programs related with the modernisation of local sources of heat and power is the idea of development of multi-energy companies, conducting activities in the field of electric power, heat and gas generation, transport and distribution and turnover, being established within the area of a town or a commune, and under their patronage [Buczak 2003].

Within the framework of the division of competences of the various organs of state administration and local government the communes are under the obligation of planning and realization of energy requirements within their respective territories, with the aim of guaranteeing continuity and reliability of supply of fuels and energy to the recipients. The commune is responsible for ensuring energy security, and in particular for meeting the requirements for electric power, heat and gas fuels, with rational use of the local potential concerning energy sources and energy from wastes, and for increasing the effectiveness of the use of energy [Rechul 2010]. Biogas installations, being systems for the generation of energy from renewable sources, should constitute important points of the na-

tional map of energy generation. They may be situated at sewage treatment plants, at municipal waste dumps, but also on farms, animal breeding farms, and at food industry plants [Kuczyńska *et al.* 2011].

MATERIAL AND METHOD

Characterisation of the Province of Lublin

The Lublin Province is situated in Central-East Poland. It occupies an area of 25,122 km², which constitutes 8% of the territory of Poland. It is the third largest province in the country. In terms of administrative division the Province is divided into 24 districts, including 20 rural districts and 4 urban districts, and 213 communes. The Lublin Province is an agricultural-industrial region. According to GUS data, in 2008 agricultural lands occupied 1.587.343 ha, which constitutes 63.2% of the area of the province, giving it the first rank in the country [Statistical Yearbook... 2010].

Village dwellers constitute more than one half of the population of the Province – 53.5%. Unfortunately, the agriculture of the Lublin Region is characterised by the traditional model of farming – family farms with small areas. In 2009 there were 268 thousand individual farms in the Lublin Province, with average area of 7.7 ha [Statistical Yearbook... 2010].

So far, within the area of the Lublin Province the contribution of renewable sources in energy production is still marginal, in spite of the increasing tendency over the recent years. Those sources are used mainly for the generation of heat by individual users. Analysing the province resources of the particular renewable sources of energy one can conclude that there are real possibilities of increasing their contribution to the production of energy. Due to the agricultural character of the province and the diversity of agricultural production, biomass has the greatest potential for acquisition and utilisation in the Lublin Region [Program... 2009]. It is especially recommended to use crop plants from dedicated cultivations (e.g. maize, rapeseed etc.) and waste materials for the acquisition of biogas for the production of electric power or heat.

Proper potential of the Lublin Province in terms of acquisition of biomass for the production of biogas is determined by the maximum share of dedicated cultivations of energy crops in the sowing structure. As a preliminary assumption, in the study „Location conditions and investment process for the building of agricultural biogas systems in the Lublin Province” [2009] it was assumed that the share of energy crops in the structure of sowings in the province should not exceed 20%.

Methodological assumptions for the study

Agricultural biogas installations may be of particular importance for the development of the local economy, therefore it is another task for the local government, striving for the economic and social growth of the commune, to promote

the technology of agricultural biogas production among the local owners of large farms and companies active in the areas of agriculture and food industry with the objective of creating an interest in investing in biogas installations [Location conditions... 2009]. The primary objective of the study presented here was at attempt at the estimation of the possibilities of creating agricultural biogas installations in the communes of the Lublin Region based on wastes from the production of the agricultural and food industry.

The study was conducted during the period from April till June, 2011. The questionnaire was sent to 213 communes in the Lublin Province and responses were received from 66 communes, i.e. 31%.

The results of analyses presented in the paper constitute a certain fragment of a broader study on the utilisation of renewable sources of energy in communes. The questionnaire used in the study was an original one, composed of 15 questions, 8 of which were multiple choice questions and 7 were free response questions.

For the purposes of this study we used those questions that concerned the situation of biogas recovery installations and facilities of the agricultural-food industry involved in plant processing and constituting a source of substrates of the biogas installations in the area of the communes.

RESULTS

The first step of the analysis of data from the polls was the calculation of the percentage distribution of responses from the communes to the question concerning the facilities situated within their area and using the technology of biogas recovery (e.g. on waste dumps or at sewage treatment plants) (Tab. 1).

Table 1. Situation of facilities using biogas recovery technology in the communes of the Lublin Region

Category	N	%
Yes	0	0
No	66	100
Total	66	100

The data given in Table 1 indicate none of the communes under analysis had any facilities that would use the technology of biogas recovery from a waste dump or a sewage treatment plant. This is related primarily with the high investment costs and relatively small resources of biogas from objects of that type. The analysis „Evaluation of strategy of development of renewable energy generation and directions of development of biogas utilisation for energy purposes with proposals for actions” [Analysis... 2005] states that biogas installations should be constructed at sewage treatment plants serving towns of over 100 thousand inhabitants.

Not many waste dumps in the Lublin Province have favourable conditions for economically and technically viable generation of biogas. According to the Program of development of alternative sources of energy for the Lublin Province

[2006] the recovery of waste dump gas for energy purposes is determined by the size of the dump (economic viability of biogas acquisition is ensured by waste dumps with area of minimum 10 hectares and depth of about 10 m), and sometimes it also depends on the type of exploitation of the object (natural fermentation is a slow process, lasting for around 20 years and longer). Also very important are the costs of the systems, reservoirs, and biogas purification equipment.

Conditions related with e.g. the availability of substrates for biogas production and access to infrastructure receiving the energy produced have a significant influence on the creation of agricultural biogas installations. Under the conditions of the Lublin Province the greatest chances of development can be seen for biogas installations utilising wastes from the agricultural and food industry. This is related with the costs of raw material acquisition and with the biogas plants playing the role of waste utilisation. The best economic effects can be achieved through the situation of biogas installation in the immediate vicinity of the source of substrates and close to the potential recipients of the heat produced. Therefore the next questions in the questionnaire concerned the existence – in the communes – of objects constituting a potential source of substrates or co-substrates for biogas generation, as well as potential recipients of heat produced in the process of co-digestion. The first of those questions related to distilleries situated in the commune, and the second concerned the situation of sugar refineries. The results are presented in Table 2.

Table 2. Situation of objects constituting a source of substrates for biogas installations in the communes of the Lublin Region

Category	Distilleries		Sugar refineries	
	N	%	N	%
Yes	12	18.2	3	4.5
No	54	81.2	63	95.5
Total	66	100	66	100

As can be seen from the data presented in Table 2, a decisive majority of the communes have no facilities that might cooperate with agricultural biogas installations as a source of substrates and a potential recipients of the heat produced. Only 3 communes have sugar refineries, and 12 have distilleries situated within their area. The possibility of situating biogas installations in the vicinity of distilleries appears to be especially attractive. Stillage is an excellent supplement to typical agricultural substrates (maize silage, rye, grasses), and at the same time a distillery can utilise the heat generated in the course of co-digestion.

DISCUSSION

The Energy Law [Rechul 2010] imposes on communes the obligation of developing the „Assumptions to the plan of heat, electric power and gaseous fuels supplies”, and next plans of energy supply conforming to the adopted assump-

tions. Unfortunately, not many communes in the country have developed their plans of supply in heat, electric power and gaseous fuels, and those that have done it only rarely have properly elaborated issues related local resources of RES (renewable energy sources) [Kostrzewa 2009]. Energy planning in the communes has never been as important as it is now. A plan developed properly must determine the directions for the use of renewable energy sources and advanced energy saving and rationalisation of its use [Wach 2008].

At present the function of biogas installation is to satisfy the demand of local communities for electric power or heat. They can also be a source of fuel for vehicles and agricultural machinery. However, that is not the only advantage resulting from the fact of functioning of installations of that type within a given social-economic environment. Biogas installation permit, first of all, effective waste management, and also have an influence on the need for the creation of new jobs in the commune or region [Rowińska *et al.* 2009].

An important role in the promotion of biogas energy and the possibilities of its utilisation should be played by the local governments, through energy planning in the communes. The evaluation of the possibilities of acquisition and utilisation of biogas in the communes of the Lublin Region should be complemented in the future with information concerning the situation of large-scale animal breeding farms, wastes from which could be a potential substrate for biogas installations.

CONCLUSIONS

The following conclusions have been formulated on the basis of the results of the study and of literature review:

1. At present the level of biogas production in the Lublin Region is low, even though there exist resources of biomass that can be utilised to a greater extent.
2. Knowledge on the availability of raw materials, i.e. substrates for the production of biogas, is a factor facilitating the planning and development of biogas energy in the commune. Analysis of the availability of raw materials for biogas production should be the first action of the investor prior to the start of the investment process consisting in the construction of a biogas installation.
3. Feedback from respondents, concerning the situation of objects constituting a source of substrates for biogas installations in the communes, were received from only 25% of the communes. This may indicate difficulties related with estimation of the local resources of biomass that could be a potential substrate for biogas installations. The limited response of the local governments to the polls may result also from lack of appreciation of the issues of energy generation from renewable sources.
4. A large majority of the 66 communes which took part in the survey does not have any objects (distilleries, sugar refineries) that would produce wastes which could become source of substrates for biogas installations. In 12 communes

there are distilleries, in three sugar refineries, but none of those communes has any installations for the recovery of biogas.

5. Another important factor in the planning of the location of biogas installations is access to energy infrastructure with suitable technical parameters, ensuring the possibility of receiving the products of biogas installations in the form of electric power, heat, or biogas with natural gas parameters.

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OCENA MOŻLIWOŚCI POZYSKANIA I WYKORZYSTANIA BIOGAZU NA TERENIE GMIN LUBELSZCZYZNY

Streszczenie. W pracy przedstawiono wyniki badań dotyczących oceny możliwości tworzenia na terenie gmin Lubelszczyzny biogazowni rolniczych, wykorzystujących odpady z produkcji przemysłu rolno-spożywczego. Biogazownie, jako instalacje służące do wytwarzania energii ze źródeł odnawialnych, winny stanowić ważne punkty na krajowej mapie energetycznej. Opracowanie oparto na wynikach analizy ankiet rozesłanych do gmin województwa lubelskiego.

Słowa kluczowe: biogazownia rolnicza, zagospodarowanie odpadów