

RENEWABLE ENERGY FROM BIOMASS IN FRAME OF A PILOT PROJECT IN HUNGARY

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Abstract

As the results of the research and development work a complex technology will be elaborated to produce a renewable energy resource and an experimental plant will be established. The main objective is the establishment of a possible domestic realisation method of power producing agriculture possessing a sustainable, closed technological cycles with the formation of complex production and connected utilisable technology of renewable energy carriers based on biomass. We strive on the realisation of the production cycle ending with the planned technology. The distillation residue of alcohol production is the additive of biogas production, and the heat surplus of the co-generated biogas utilization, however, can be directed to the security of heat demands of alcohol production. The fermented manure in the biogas industry can be used for reinforcing soil strength toward the production of biomass, whilst the electric power surplus originating can be recuperated in the network. In this way biomass production can be an energy producing process of the multifunctional agriculture with the aim of utilizing the energy.

Keywords: renewable energy, biomass, biogas, experimental biogas factory

Introduction, preliminary

The idea of multifunctional agriculture appeared in the agricultural policy of the EU, which aims the growth of the ratio of the production of non-food materials and non-food industrial basic materials apart from the food production function, for economical reasons. Among these functions is the utilisation of the energy of biomass as well.

The renewable resources now cover only 1% of the primary energy demand of the world, however, there has been a significant rise in the need for the renewable energy carriers in the developed industrial countries because of the reasons of environmental protection, and thus, the biomass is getting a greater and greater part.

The utilisation of the energy carriers based on biomass is in tight connection with the priority of the environmental protection and rural development policy of the EU agriculture. The release of carbon dioxide and other climate gases can be reduced with partial replacement of fossil energy carriers with bio-fuels. Hungary has also joined the “Kyoto” pact and has undertaken to reduce the release of „greenhouse gases” by 8% by 2010 compared to the level of the average release in 1985-‘87. Taking into consideration the natural resources of our country, biomass can be our determining renewable energy source in the future.

Several applied and practical solutions exist all over the world towards the cultivation and utilisation of dedicated energy crops. Direct burning and low efficiency are common in the practice of biomass based energy production. The proportion of the production and utilisation of bio-fuels is small. Only 30% of the energy accumulated in the rape remains in the produced bio-diesel, which is utilisable in commercial diesel engines.

The thin manure, which is produced in great quantity, however, is a source of risk in animal husbandry, which could be utilised in biogas plants according to the practice accepted by the EU. In

biogas plants based on thin manure various by-products, wastes, or dedicated energy crops can be used to increase the biogas output.

The previously formed biogas workshops in the developed economic countries were, first of all established for destructing organic waste matter, and the economic renewable energy produce was secondary purpose only. For today, however, the workshop capacity (size) and the economically maintainable running projected on the investment expenses have become, nonetheless, a determining parameter in terms of the bioreactors to be established for the purpose of biogas production, which is strongly technology dependent, though.

The Szolnok College Technical and Agricultural Faculty also joined in the projects concentrating on the solution of the great problem of pig manure treatment in Hungary.

Presentation of the project

Our objectives have been derived from the alteration of the basic function of agricultural production, the increase in the need for the renewable sources of energy, the unresolved environmental problems of thin manure appearing together with the specialized animal husbandry, as well as the low efficiency of biomass energy utilisation.

The main objective of the project is: the establishment of a possible domestic realisation method of power producing agriculture possessing sustainable, closed technological cycles with the development of complex production and utilisation technology of renewable energy carriers based on biomass.

The renewable energy carriers to be produced as the result of the planned technological process are bio-ethanol and biogas, which originate from the biomass utilisation of the whole plants or from the waste of the main technological process. The plant species applied in the research can be cultivated as well in the backward regions possessing weak arable land conditions in our country, thus there may be significant influence on the spreading of realizable complex technology even on the improvement of the close-up of certain small regions.

The activity of R & D within the frame of the project focuses on the research activity related to the renewable energy production based on the biomass producing basic plants, the applied research activity focusing on the maximisation of biogas quantity and alcohol obtainable from biomass, and the research aiming the optimum of the utilisable possibility of connected heat and electrical energy as bio-energy carriers, but there are its applied research attractions to the realisable works of the designed experimental establishment as well.

A consortium of two enterprises and four higher institution research workshops has applied for the realisation of the project.

The technological process of the designed connected electrical and heat energy can be seen in *Figure 1*.

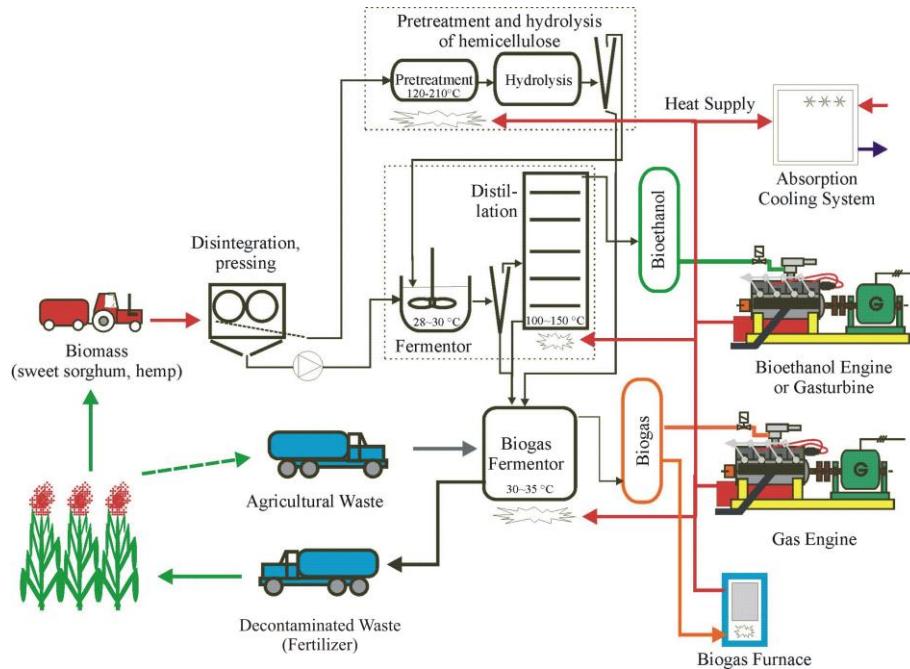


Figure 1 The planned cogeneration process

We strive on the realisation of the production cycle ending with the planned technology. The distillation residue of alcohol production is the additive of biogas production, and the heat surplus of the co-generated biogas utilisation, however, can be directed to the security of heat demands of alcohol production. The fermented manure in the biogas industry can be used for reinforcing soil strength towards the production of biomass, whilst the electric power surplus originating can be recuperated in the network. In this way biomass production can be an energy producing process of the multifunctional agriculture with the aim of utilising the energy.

The novelty of our application lies in its complexity, as well as with the plants chosen to realising the established objective, the possibilities of the complete range utilisation of the plants, the production of connected, co-generated energy, the production of a “high class” bio-fuel, the influence of regional development and economy of the application results accomplishing the objectives of the basic- and applied research and experiments, along with its examination.

We wish to establish a connected energy producing workshop based on an existing distillery. In the case of winning this tender we want to establish the joint institution at the site of building upon an existing distillery. On establishing the biogas plant the higher haulages of low concentration biomass are a crucial planning aspect. The higher haulages support also the small size plants.

Implementation of the test biogas plant agrees with alcohol producing technology of the small size plant in size and costs. In the great-size plant biogas producing technology the flexible technology (canvas awning or awning covered gas store) that is used at the biogas storage units would be applied to the fermentors as well. After the amortisation instead of hardly neutral or recyclable, costly, solid facilities we want to implement a cheaper solution that fits better to the small-size plant and waste processing.

The biomass potential available in the environment of the bioreactors to be established for the purpose of biogas production is extremely variable and might as well be immensely and differently compounded as per workshops. The completion of increased scale experiments representing the industrial circumstances is justified in every case before the establishment of workshops in order to

determine the formula yielding the maximum biogas output and the optimum industrial technological parameters.

The foregoing results of the project

Our faculty has been appointed to carry out technological experiments of biogas production and mechanical preparation of biomass varieties on the basis of the earlier results.

The controlling, measuring and changing of the technological parameters need special laboratory instrument system. We need to develop special laboratory instruments for our technological experiments. We had possibility to improve a newly half automat fermentor line. We can contribute to preparatory work reducing the risk of realisation, to the work serving as the base for the establishment of domestic biogas workshops with laboratories including the formed experimental fermentor system.

In the frame of this tender we have decided on the applicable plant species and types in the all period of connected bio-ethanol and biogas production. We have made biogas technological experiments for increasing the by-products of the distillery. Moreover, the applicable recipes and the technological parameters have been found.

Researchers of Budapest University of Technology and Economics make experiments with ethanol and biogas to produce and utilize thermo and electrical energy. It has been found to burn ethanol in internal combustion engines or in turbines presumably we use higher-concentrated alcohol. The distillery has to be transformed for utilisation of thermal surplus of the biogas-based thermo-and electricity producing institutions. The plans of the demonstration experimental biogas factory are being made and the complex establishment will be built this year. *Figure 2* shows the function sketch of the planned biogas factory.

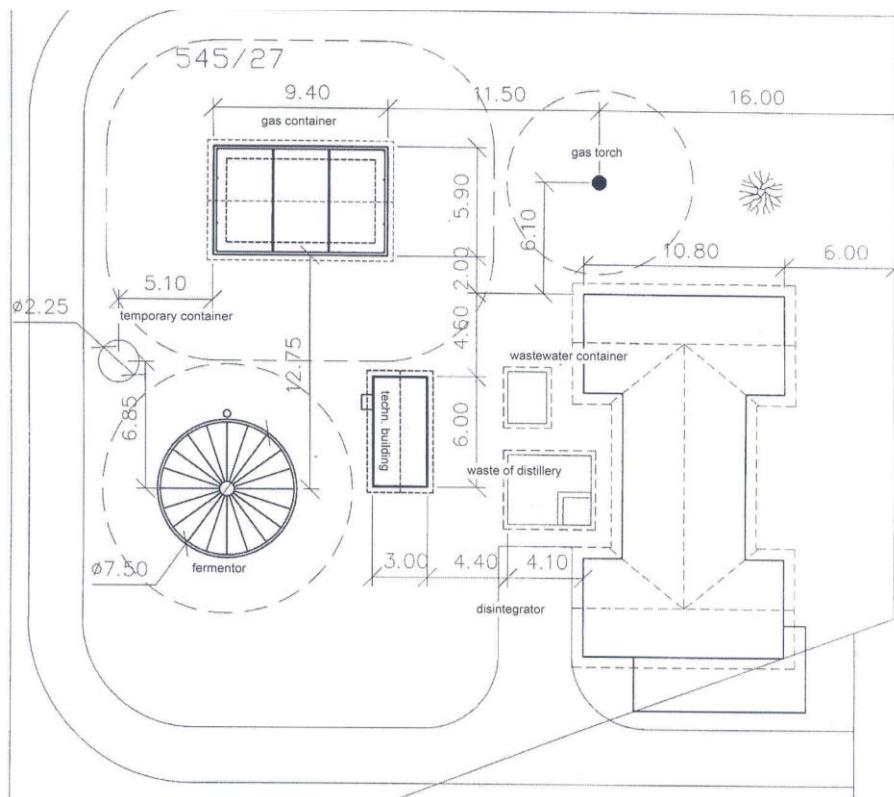


Figure 2 Main sketch of the experimental biogas workshop

The basic idea of our project to be realised at the experimental institution was renewable energy production based on closed cycle biomass.

Distillation residue with distilled biomass is put in the biogas fermentor. Hot steam needed for distillation is guaranteed with combustion of biogas developing in the fermentor. The distilled hot stillage heats the mezophyl fermentor via heat changer.

Conclusions

We can establish on the basis of the results of our project that the suitable resolution for Hungary can be adaptation of biomass based on complete renewable energy production model.

The objective in the future is to form and adapt the experimental model in the given region where competitive market food cannot be produced instead of leaving it uncultivated. The planned model can be characterised with its input and output, as well as with the relationship amidst.

The characteristics of biomass varieties for energetics as well as the social, economic and environment characteristics of small regions form the planned input of the model. While that of its output are formed by the produce-able and utilizable energy quantity with the realisable technology.

The model differing from many other models and realisation, beyond the energy production and starting from the local needs extends over the utilization of renewable energy as well. Distinctly from other model according to our model it is necessary to produce and utilize the renewable energy fitted to given small region.

The primary objective was to dispose the waste in the near past in the establishments producing biomass energy for renewable energy production, or where arborescent vegetation was burned up. And the secondary viewpoint was the rational economical renewable energy production and utilization. Economic viewpoints of energy production have come into prominence at the new energy production establishments.

According to our approach, the materially based economic analyses influenced by the market conditions do not satisfy the requirements of the mid- and long term planning objective on their own.

All in all, it can be ascertained that biomass energy production has been of material value and technology centred. Increasing the closing up chances of the lagging small regions belongs to the partial objectives of the model to be worked out by us, thus the model formation rests on the local social, economic and environmental circumstances. It uses the energy sources that are locally and potentially available, and it concentrates on the supply of the energy need originating locally.

References

1. Kalmár I. – Nagy I.: Kapcsolt bioetanol és biogáz-előállítási „Jedlik Ányos” projekt. In: Energiagazdálkodás. 2006. 47. évf. 1. szám. p 22-24
2. Kalmár, I – Nagy, V – Kalmárné, Vass E: Laboratory development in technological experiments on enhancing biogas output. Napjaink környezeti problémái – globálisról lokálisig (Pannon Egyetem), Keszthely 2006. november, CD kiadvány
3. Kalmárné Vass E. – Kalmár I. – Nagy V.: Üzemi körülményeket is reprezentáló kísérleti eszközrendszer továbbfejlesztése biogázelőállításhoz. MTA AMB XXXI. Kutatási és Fejlesztési Tanácskozás, Gödöllő 2007. január 23., 3. kötet p 118-122, CD kiadvány