UNIVERSITY AND INDUSTRY COOPERATION FOR ZOOTECHNICAL WASTE MANAGEMENT OPTIMISATION

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The aim of this work is to present a method for exploiting the zootechnical waste from cattle breeding in order to obtain energy and fertilizer. The process taken into account is the biological-anaerobic treatment in digester. ALPI BIOGAS, Competence Center for biogas in Southtyrol, is based on a network of public and private companies that can significantly develop the energy generation from biomass at small scale.

Keywords: waste management, zootechnical waste, bioenergy.

1. Introduction

After the entrance into the European Union, Romania must comply with all the EU legislation and the zootechnical sector will have to take it into account. The aim of this work is to present a method for exploiting the zootechnical waste from cattle breeding in order to obtain energy and fertilizer. The process taken into account is the biological-anaerobic treatment in digester. The zootechnical liquid waste has a high pollutant concentration that creates problems for its treatment with conventional methods. This waste contains nutrients (N and P) and about 10% of dry matter with about 75%-85% of volatile solids (VS). For this reason this zootechnical waste has been used for years in agriculture as amendment, but the new EU legislation requests some limits for pollutants which can be applied at land. The anaerobic digestion is the more used treatment for the liquid zootechnical waste because it allows recovering biogas with an interesting methane content. This paper will also present considerations regarding an Italian experience of university–industry cooperation within the ALPI BIOGAS project.

2. Methods

The paper is developed in two parts. The first one concerns the analysis of the competences that allowed the implementation of a network of public and

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private organisms in Italy in order to promote the use of anaerobic digestion also at small scale.

The second part concerns the assessment of the potential of this sector in Romania in comparison with the Italian scenario.

3. ALPI BIOGAS: structure, activities, implemented projects

The consortium ALPI BIOGAS was founded in September 2007, within the framework of the area program of the European Union "Applied Spatial Management ASM", administrated by the department of innovation, the research and development of the "Provincia di Bolzano".

The consortium has the objective to join scientific, managing and technical experiences on local scale with the purpose of creating a group able to solve the open questions connected to the diffusion of the biogas-technology in Trentino-Alto Adige and over the whole national territory.

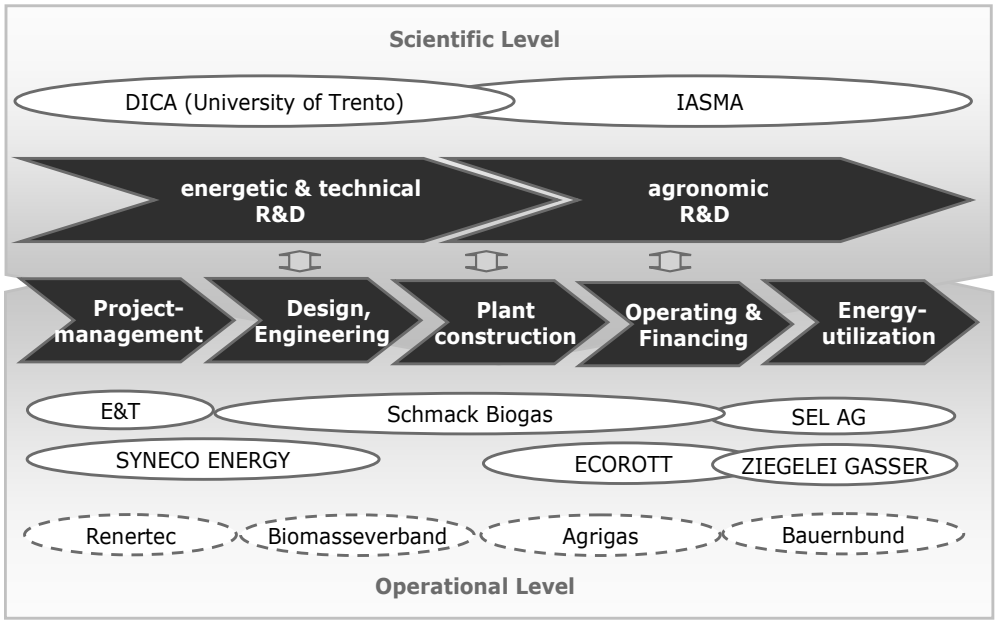

Fig. 1. Scheme of the ALPI BIOGAS organization.

It was paid great attention by SYNECO Srl, the head society of the center, to the formation of a vertical corporation that involve all the company actors of the system. Therefore, the project counts on the participation of:

- a general contractor leader in the sector of biogas (Schmack Biogas Srl)
- an energy production and distributing agency (SEL SpA)

- two significant users, like Ziegelei Gasser Srl (bricks production) and ECOROTT (compost management)
- a consulting and education agency, E&T Srl

From a scientific point of view the ALPI BIOGAS project relies on the participation of the Istituto Agrario di S. Michele A/A, the University of Trento (DICA) and other research and development institutes, known on international scale. Finally, also the biomass consortium for Alto Adige, the countrymen Union and the RENERTEC (removable energy center) support the ALPI BIOGAS project.

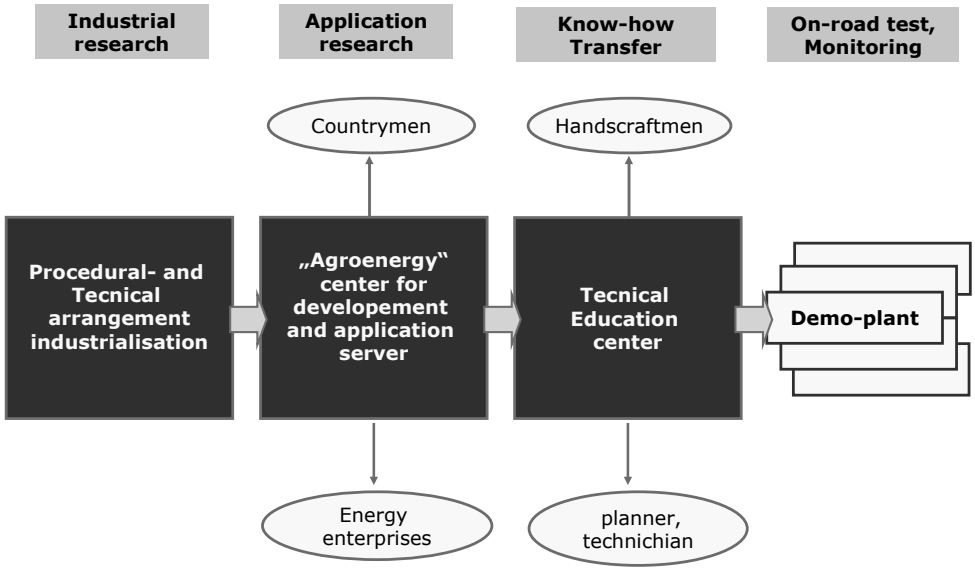

Fig. 2. Scheme of the activity of ALPI BIOGAS consortium.

From the beginning of summer 2007, when the preliminary activity program of the consortium started, the experience of the partners has allowed to indicate five important themes on which research and development are focused: compact optimized plant for the alpine contest, biomass pre-treatment, refuse post-treatment for sustainability balance of agronomic nutrients, integrated management of refuse in industry and the biomethane feed-in to natural gas net.

The work program for each project managed by ALPI BIOGAS plans the building and the real-time monitoring of a demonstration-plant. Finally, the business plan of the center has been approved for at least 5 years and can rely on a

budget of about 10 M€, which comprises the expenses both for the initial investments and for the staff.

3.1 Post-treatment of Refuse

In areas of high zootechnical activity, the amount of sewage on land is often too large. In these cases, in order to obtain a full environmental sustainability (adequate nutrient-loop, Fig 3) it is necessary to treat the sewage to reduce the nutrients (above all N) or to concentrate it for the fertilizer production to be sold. Nevertheless, this procedure is very expensive and often not economically sustainable. The insertion of a biogas plant before of the treatment allows to obtain a good profitability of the total process.

In base of the characterisation [1,2] of the refuse obtained from anaerobic digestion of zootechnical waste (see figure 4), the DICA of the University of Trento performed the preliminary study on the Best Available Technology (BAT) for the treatment of separated liquid fraction [3], considering, besides the traditionally systems (fig. 5), also innovative processes like SHARON-ANAMMOX (fig. 6) and fitodepuration (fig. 7).

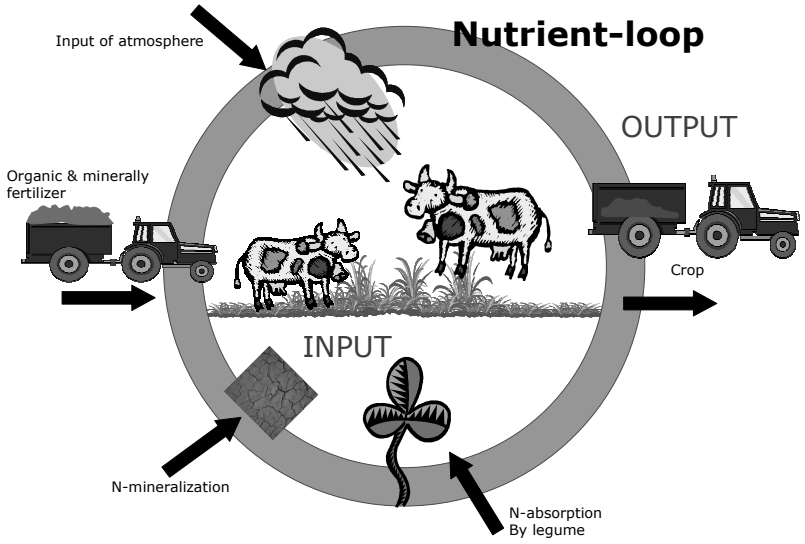

Fig. 3. Scheme of the loop of the agronomic nutrients.

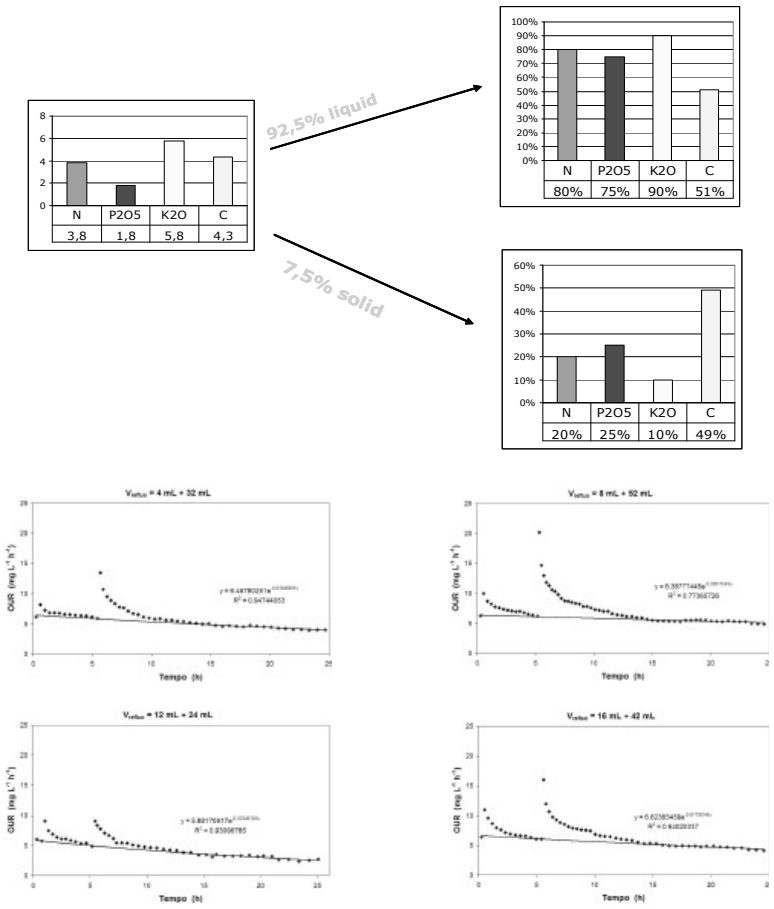

Fig. 4. Characterisation of liquid and solid phases of refuse.

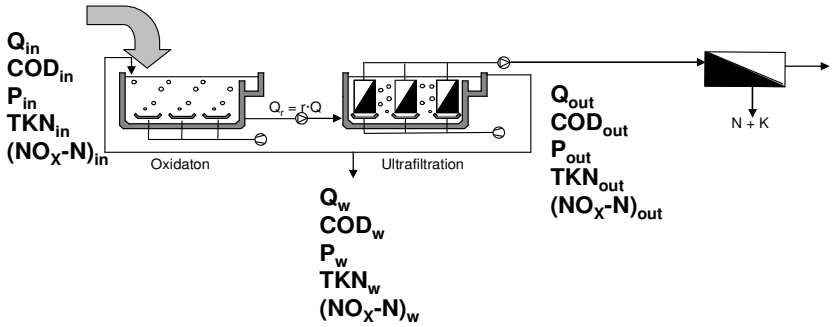

Fig. 5. Scheme of MBR system and inverse osmosis process for the production of fertilizers

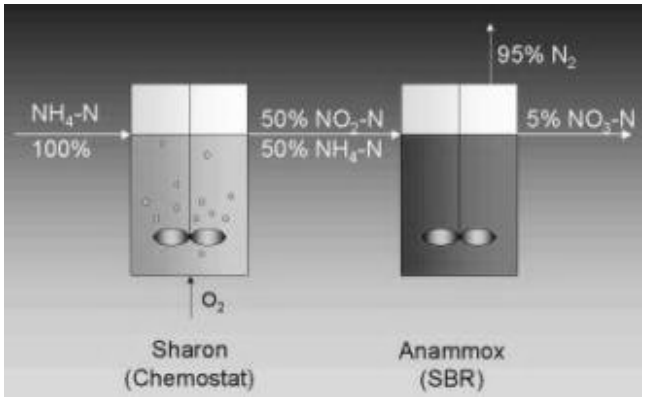

Fig. 6. Sharon- annamox process.

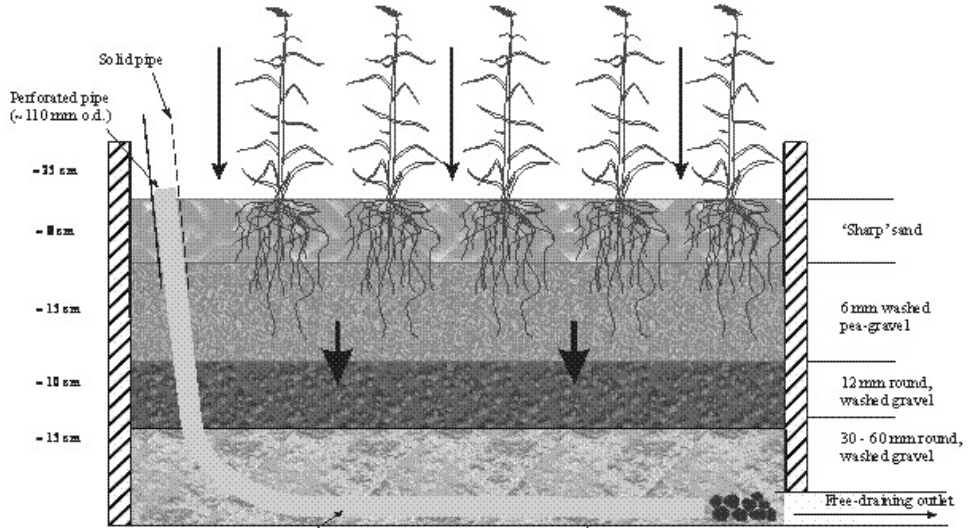

Fig. 7. Fitodepuration plants.

3.2. Biomethane feed-in to natural gas net

The state of the art for the valorisation of the biogas obtained by the anaerobic digestion sees the production of electric energy and heat using CHP-unit with maximum rate of 42%. For small scale plants (< 500 kW_{el}) the electrical rate is equal to about 35 %. In order to avoid not very efficient and rational conversion (heat far from users), a plant feeding in directely biomethane in natural gas net (see figure 8) seems to be needed.

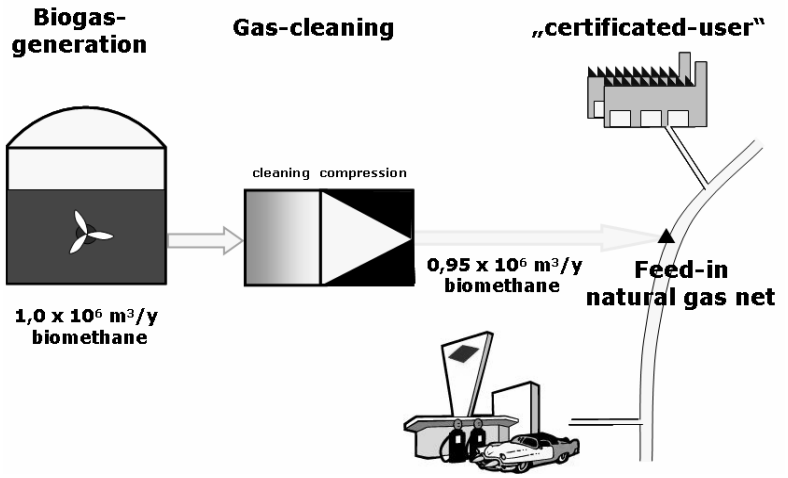

Fig. 8. Directly utilization of biomethane.

3.3. Compact optimized plant for the alpine contest

The technology of biogas is optimized on plant of medium-great scale (>500 kW_{el}), but these have little sustainability for alpine contests. For this reason, the most important objective of the Alpi biogas consortium is the development of a small dimension plant model for the country sector with height reliability and standardisation.

3.4. Pre-treatment of biomasses

In the field of the agro-refuse recovery it exists a great potential for anaerobic digestion. However often the refuse, which contain an high organic matter, must be pre-treated. For this reason, the DICA will plan one or more plants which use different technologies for each specific type of biomass.

3.5. Integrated management of refuse in industry

As a valid alternative to the agronomic recovery, the refuse can be directly used in the production cycle of different materials; for example, in a plant integrated with the bricks production. In this case, the energy derived from the biogas combustion will cover the heat and electrical requirement of the brick production and also the refuse of this biological process will be used in the mix for bricks.

4. The Romanian-scenario

A centralization of cattle breed is expected in Romania as a consequence of an expected industrialization of the zootechnical sector after the entrance into the EU. For this reason the development of expertise for small digesters management can be considered a priority. The potential of biogas generation from the zootechnical waste is interesting and can be classified as energy from biomass. Depending on the biodegradability of the treated zootechnical waste, the quantity of the produced biogas varies from 0.25-0.40 m^3/kg_{VS}, equivalent to 0.75 m^3_{CH4}/d from a mature cattle.

5. Conclusions

We have illustrated the activity of ALPI BIOGAS, a consortium which is based on a network of public and private companies and that can significantly develop the energy generation from biomass at small scale.

Considering the Romanian-scenario, we can suggest that the Italian experience could be replicated in Romania, in order to improve the known-how transfer of biogas technology.

We think that the activation of the first initiatives in this sector should be sustained with adequate incentives.

Acknowledgements

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