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Biogas in Brazil

Due to negative experiences in the past, biogas technology could not establish itself in Brazil. Currently though, there is a revival of agricultural biogas plants there. Biogas production from animal residues is especially suited for the southern regions, where swine and poultry farms are concentrated. Generally the Brazilian plants are small and simple units, which cannot be compared to those in Germany. Vinasse, a fluid residue from alcohol production with high potassium content, is generally used as fertilizer on sugar cane fields. Using vinasse as a substrate for biogas production would be very recommendable, but is seldom done due to lacking general political conditions and technology.

Brazil is the fifth largest country in the world and with its acreage of 8.5 Mio. km^2 it covers almost the half of the South-American continent. In 2007 the country provided 46 % of its energy by renewables, mainly from sugar cane and its derivates (ethanol, bagasse, vinasse), hydropower and wood [1]. Alarmed by energy shortages in the past, the Brazilian Government tries to ensure an economical power supply all over the country. The biogas technology can contribute to this considerably.

History of agricultural biogas plants in Brazil

Already in the 1970s and 1980s the interest for biogas in Brazil was raised, especially for swine farmers. Agendas from the government tried to reduce the dependencies of small and rural farms from mineral fertilizers and energy. As well they tried to decrease the damaging effects of animal farming to the environment and to raise the income of the farmers. But these expectations were not fulfilled and the biggest part of the plants was abandoned [2].

Reasons for this failure were

- the lack of know-how about design and function of the biogas plants
- high costs for construction and maintenance of the plants
- deficient know-how about land use systems, their nutrient demands and the balance
- missing information about the nutrients in the digestate
- rising costs caused by the need of purchasing new machines for transportation and application of the digestate
- missing methods for conditioning of the gas
- no adapted technology and due to this short durability of the used aggregates
- wrong dimensions, designs and use of the plants
- availability of cheap electric energy and liquid gas

Currently the Brazilian electric energy supply is based to 77 % on the hydro power, which is susceptible to fluctuations (*Fig. 1*) [1]. In 2001 the phenomenon of the "Apagoes", the cut off of the electrical power in a large scale appeared in Brazilian cities due to acute energy crisis. Therefore the biogas plants once more got attention. But when the danger of the "Apagoes" was over, the projects to build biogas plants were cut off, and those that were already started to build were abandoned. In the last years, with the implementation of the emission trading, the biogas plants appeared again [4].

Today, 30 years after the failed experiments to implement agricultural biogas plants, this technology offers the Brazilian farms a perspective again. Reasons for this are the ability of new materials, the raised dependency on energy, because of higher automation at the bigger farms as well as the rising prices for conventional energies. The possibility to generate income from emission trading affects this [3]. Especially in poultry farming this technology will gain

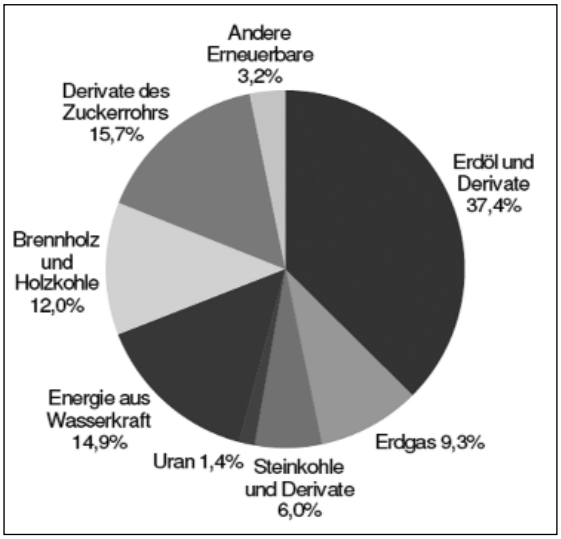

Bild.1: Internes Energieangebot in Brasilien (eigene Darstellung, nach [1])

Fig.1: Internal energy supply of Brazil (own diagram, according to [1])

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more attention, hence a law, having become effective in 2001, forbids the use of poultry manure as feedstuff for ruminants. Therefore the poultry farmer cannot sell the manure anymore and have to search for other ways of treating it [5].

To make this technology useable for Brazil, new improved and more efficient technologies need to be provided. Furthermore legal conditions and programs including financing opportunities should make the biogas technology available to small and average farms. Though know-how should not be the limiting factor, a long-termed assistance program for farmers that want to operate a biogas plant need to be established. Supplementary regulatory frameworks and programs with the objective of promotion of related businesses should be introduced. So the supply of the farms with an appropriate technology can be assured [5].

Fig.3: Biogas plant with solar-driven pump for circulation of the substrate

Presence and perspectiveslooks

Currently there are 3000 agricultural biogas plants being operated in Brazil. Most of them are in the temperate zone of the south, where the swine and poultry farms are mostly located. The Brazilian biogas plants are small and simple constructed units, with a low power. The automation and the controlling of the process affecting parameters is not comparable to those in Germany [6].

In Brazil biogas from agricultural residues is mainly produced in animal husbandry and here basically in swine farming (90 % of the agricultural biogas plants). Since the breeding of swine and poultry are heat consuming sectors, biogas production is a good option for these farms. The heat of the co-generation unit or the combustion of the gas can be used for heating the stables as well as heating process water or for drying grain. At present some companies for providing the technology are established. But still a serious problem is the delivering of the engines [7].

A further important potential for using agro-industrial residues is the so far little investigated and noticed potential of the vinasse. Vinasse is a corrosive, high-grade contaminated fluid residue from ethanol production. For the production of one litre ethanol 10 to 15 litres vinasse are produced [8]. Vinasse has a huge content of organic dry matter, potassium, calcium and little parts of phosphorous and nitrogen. Due to its high biochemical oxygen demand and low pH-value, vinasse may not come to the hydrologic cycle in higher contents. The use of the vinasse as a fertilizer on sugar cane fields is state of art in Brazil [9]. A further reasonable use of it could be the fermentation in UASB-reactors [10]. The biogas production from vinasse could be advantageous, since it is produced in huge amounts in distilleries and may be collected there directly. Since the bio-ethanol industry still depends on fossil fuel for its motor pool, this fuel could be replaced by biogas [9].

This system has already been tested by few sugar cane factories in the federal state Sao Paolo, and the biogas was used for driving the own fleet. But at the end of the 1990s this system was given up as a result of low and subsidised diesel costs and problems in providing spare parts [9].

The anaerobic treatment of vinasse delivers a valuably fertilizer and the biogas delivers energy. Additionally the vinasse changes by digestion, concerning plant availability of the nutrients, pH-value and environmental compatibility in a positive manner. The technology is technically mature useable in the model, although there are some uncertainties like the corrosive effect of the gas and equipping and on the engine, stability of the anaerobic digestion that is influenced by the quality and quantity of the vinasse. These potential problems could be of negative impact for the future commercialization of the technology. These problems first can be solved and evaluated with starting up a pilot plant [11].

Hopefully Brazil will be able to transfer the theoretical know-how into a practical application soon and give regulatory frameworks, so that the big potential of the vinasse will be used in the future.

Fig.2: Biogas plant from the Embrapa in Concórdia-SC

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