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Agricultural Biogas Plants

Collecting labour data and full cost principle analysis

The analysis of costs and collecting of labour data of biogas production plants in two different real existing plants are shown. The sampling of full costs gives some hints for interested farmers and helps them to save money.

The production of energy by a biogas plant on farms is still growing. This is based on the ecological interest and the negative aspect of the public to nuclear power plants. The financial supporting of the government helps that the regenerative energy as wind, water, sun and biogas are on discussion. Although the production of biogas is supported by the government. From this point of view agricultural companies and farmers invest more and more in such a plant. The collecting of labour data is a basis to get the full costs principle calculations of this energy enterprise.

Material and methods

The data was collected on two real existing farms.

Farm I: The biogas plant was built in 1997 and is still in progress. The biogas production is based on pig manure, food waste and green litter. The yearly input is about 8200 tons. 50 % of the material is imported. The fermenting parlours are built by concrete. Two are lying and two are standing types (1200 m^3). The gas parlour is 400 m^3 big and the volume of the parlours at the end of the pipe is 1200 m^3. The plant is working mesophile. The production of electricity is 400 kW per hour. This is done by two generators with a power output of 150 and 250 kW per hour.

Farm II: The farm was built in 1999. As substrates are used liquid pig manure and solid turkey manure. Per year 3500 m^3 pig manure and 400 tons of turkey manure are available. The gas dome has a volume of 90 m^3. The fermenting parlour takes 480 m^3 of volume. The end of the pipe is 850 m^3 big divided in three pots. The methan gas is burnt in a BHKW with 44 kW_{el} and 60 kW_{therm}.

Due to the lack of comprehensive and comparable data related to the investment sums required for agricultural biogas installations a methodically structured blueprint of investment costs based on DIN 276 is to be developed and deployed for the different types of installations.

The results of the total costs are shown in *table 1*. The data collecting of labour input is done according to [1].

Results and Discussion

In table 1 the total costs of farm I and farm II are shown and discussed. The main data of the biogas plants are presented. To make sure that the two plants are discussed on an equal level it is useful to show the absolute score as well as the score by produced energy in kWh_{BHKW}. After all we can remain that the total costs resumed by the biogas plant - at each farm - is negative. The negative result on farm II is related to the produced electric energy lower as the negative result on farm I.

Table 1: Results of costing for the exemplary biogas plants I and II

		Plant I		Plant II	
		€	€/kWh_{BHKW}	€	€/kWh_{BHKW}
1	total performance	269056.46	0.135	56797.37	0.165
2	total direct costs	26814.70	0.015	6782.54	0.020
3	performance without direct costs	242241.76	0.120	50014.83	0.145
4	working costs	29112.96	0.015	5598.65	0.015
5	building costs construction	48899.92	0.025	3549.10	0.010
6	building costs technical plants	215409.26	0.105	29931.82	0.085
7	building costs outside area	84984.68	0.040	16915.54	0.050
8	other costs	7828.49	0.005	1063.49	0.005
9	total costs	413050.01	0.205	63841.14	0.185
10	**loss plant BHKW (no promotion)**	**143962.87**	**0.070**	**7043.77**	**0.020**
11	promotion	51206.80	0.025	2294.06	0.005
12	**loss plant BHKW (with promotion)**	**92756.07**	**0.045**	**4749.71**	**0.015**

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The negative result is on farm I three times higher than on farm II, even if the different financial supports of the farms are added. Farm I works more efficient in the use of fossil oil consumption. They use 0.025 l oil per kW. 0.057 l is the result on farm II. The labour costs on the biogas plant are 7 to 8 % on basis total costs. Even if the workload is 5,2 h per day on farm I. The building costs and the costs of technical equipment paid by farm I refuse 0.13 € /kWh $_{BHKW}$ in farm II the level is 0.095 €/kWh $_{BHKW}$.

In case of labour costs the two agricultural enterprises had nearly the same input per kWh$_{BHKW}$. But there was found a difference in the way how the work is done. The results are shown in *table 2*. Farm II is working at the heat and power unit 16% of the total. Even 13% takes the time concerning the gas storage and the fermentation parlour. Farm I does this work in totally 9 % of the total. In terms of handling the substrates Farm II needs 34% of the time. This is four times more than Farm I. Farm I uses 10 % of the time for administration. This is involved by the import of co-substrates. From this point of view you can explain why 55% of the whole labour needed on farm I, is used for mixing etc. of the co-substrates.

In discussion with the literature it is shown that over all the input of labour is nowhere measured. The generalisation of 1h per day is in reality not found. Even in case of full costs principle calculation we find no enterprise which works in an economic way. The benefit of the biogas enterprises belong to the case of money you can get for using co-substrates (17 to 25 € per ton).

Table 2: Percentage of work times for the biogas plant I and II

Activity	Plant I % of daily work	Plant II % of daily work
BHWK	5	16
Fermentation parlour and gas-storage	4	13
Base handling (Fermenter)	8	34
Tank (filling up/emptying out)	18	8
Administration	10	2
Others		
a) Mixing co-substrates	55	
b) Public relations		27
Total	100	100
Remark: - values are rounded		

Conclusions

Of two farms the economic results of a biogas plant are shown. Using a blueprint checklist of investment costs based on DIN 276 and find out the labour input a full cost principle calculation is done.

Based on the process technological and economic analyses of the two agricultural enterprises surveyed it is possible to prove that the generation resp. production of electric and thermal energy on the basis of natural manure cannot be realized in an economically way.

To run the enterprise in an economic way the invest costs and the labour input has to bee degreased.

Literature

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