APPLIED PLANT RESEARCH
WAGENINGEN UR

Feasibility study anaerobic digestion as heath and electricity production for glasshouse horticulture

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Introduction

The cost of energy in horticulture is considerable. Energy contributes 20% to 33% of the various costs in the production of the six most important horticultural products and in all cases is one of the three greatest costs. Energy costs still increase. Growers are looking for biogas production as a solution for this problem. Heath and power cogeneration installation (HPC) running on biogas will be one of it.

Case study

The case:

Table 1. Input figures of the case.

Glasshouses	3 ha
Heating requirement	35.9 m3 natural gas/m2 /y (34 TJ/y)
Heath HPC	1,36 mWe
HPC runtime	7900 hours per year
Digester and HPC:	€ 2.600.000,–
Output HPC:	35 % el., 55 % heath
Price corn:	€ 37,- / 1000 kg
Costs removing sludge	€ 15,- / 1000 kg
Price natural gas	€ 0,25 / m3
Feeding	100 % corn

Questions

What is more profitable: natural gas or biogas of a digestion?
The following sub-questions for application of biomass digestion in horticulture have been asked:

1.Which techniques are suitable most?
2.Which biomass is as feeding most suitable?
3.What are the costs and turnovers of digestion?
4.What costs 1 kWh electricity produced with gas of digestion or with the natural gas driven HPC?

Most suitable technique and feeding

For the glasshouse horticulture a number of points are important:

- The digestion process must be constantly and reliable, because the glasshouse cropping is not possible without warmth.
- The prices of soil for glasshouses € 50 – 60 /m2
- So the organic material for the digestion must be invoked of other areas.
- The smoke gases of the HPC must be safe, to be able dose CO2 in the glasshouse.
- The legislation around the removing of sludge is strict.

Soil use and transport indicate in the direction of a combination of efficient digestion with a feeding with high CH4 production by m3 feeding. A constant gas production and legislation around removing of sludge plead for a feeding with a constant composition.
The stability of a mesophilic digestion with energy rich corns or energy beets seems to be the best choice.

Results

In this case there are the following results:

- Volume digestion unit: 7.600 m3
- Input of corn: 36.000 ton a year = 1.500 van rides
- Sludge: 23.400 ton a year = 1.000 van rides

Table 2. Partitioning yearly electricity production costs.

HPC biogas of the digestion			HPC natural gas		
El-production	10.079	mWh	El-production	10.722	mWh
Yearly costs	k€	€/kWh	Yearly costs	k €	€/kWh
Digester	282	0,028			
HPC	140	0,014	HPC	140	0,013
Biomass	1.329	0,132	Natural gas	946	0,088
Sludge	350	0,035			
Total costs	2.102	0,209	Total costs	1.086	0,101
Heath saving	237	0,024	Heath saving	266	0,025
Balance	1.865	0,185	Balance	819	0,076
MEP subsidy	1.040	0,097	MEP subsidy	82	0,008
Costs - MEP	825	0,082	Costs - MEP	737	0,069

[1] MEP = Environmental friendly Electricity production

Table 3. Break-even prices of several production costs.

	With MEP	Without MEP
Price corn per 1000 kg	€ 33,25	€ 6,50
Removing costs sludge	€ 9,25	
Price natural gas per m3	€ 0,29	€ 0,59

Conclusions

1.Technically feasible
2.Tailor-made solutions
3.Economical risks because of uncertainties of:
- high investments
- the MEP-subsidy
- the price of corn for digestion
- the costs of removing the sludge
- legislation
- the price of natural gas

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