Impact of competition claims for food and energy on German biogas production

P. Weiland
Johann Heinrich von Thünen-Institute (vTI)
Federal Research Institute for Rural Areas, Forestry and Fisheries
Braunschweig/Germany
Contents

- Introduction
- Plant construction
- Substrates for biogas production
- LCA of biogas production
- Gas grid injection act
- Amendment of the EEG (actual draft)
Biogas plants in Germany

Number of plants


0 500 1000 1500 2000 2500 3000 3500 4000

100 120 139 159 186 274 370 450 617 850 1050 1300 1600 1750 2050 2700 3500 3750
Compensation for electricity 2007 (EEG)

- 2007 EEG Compensation
- CHP-Bonus
- Technology bonus
- Biomass bonus
- Basic fee

- < 150 kW: 10.99 Euro-Ct/kWhel
- > 150-500 kW: 9.46 Euro-Ct/kWhel
- > 500 KW-5 MW: 8.51 Euro-Ct/kWhel
- > 5-20 MW: 8.03 Euro-Ct/kWhel
Substrate application in agricultural biogas plants (2005-2007)

- 83% Energy crops and manure
- 15% Energy crops
- 2% Manure

More than 90% of new biogas plants use silage maize.
2/3 of the biogas plants have more than 50 % energy crops in the input.
Growing substrate costs since 2006

**Silage maize without transport and ensiling**


Cost increase: 83 %
Specific investment costs for biogas plants

Spec. investment costs €/kW_{el}

Source: DZ-Bank
Profit of a 500 kW biogas plant with silage maize (7,750 h/a, $\eta_{el}=37\%$, no heat utilization)

<table>
<thead>
<tr>
<th>Silage maize [EUR/ton]</th>
<th>Investment costs [EUR/kW$_{el}$]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>18.00</td>
<td>155,500</td>
</tr>
<tr>
<td>20.00</td>
<td>135,800</td>
</tr>
<tr>
<td>22.00</td>
<td>116,000</td>
</tr>
<tr>
<td>24.00</td>
<td>96,200</td>
</tr>
<tr>
<td>26.00</td>
<td>76,500</td>
</tr>
<tr>
<td>28.00</td>
<td>56,700</td>
</tr>
<tr>
<td>30.00</td>
<td>36,900</td>
</tr>
</tbody>
</table>

Source: DZ Bank
Reduction of the greenhouse effect by biogas production

Source: Pehnt, IFEU 2007
LCA of biogas plants (1)

- In most of the applications biogas production result in reduction of greenhouse gases.
- The best ecological effect can be achieved by anaerobic treatment of manure.
- For biogas production with energy crops up to 60% of the relevant ecological effects are caused by crop production (e.g. fuels consumption for sewing, fertilization, harvesting, transport).
- Energy crops with a high biomass yield per area should be used to reduce the ecological effect of this module.
Without gas-tight covering of the storage tank biogas production can have a negative climate effect (methane losses: 2-10 %).

The utilization of the heat from the CHP is important for a positive ecological effect.

Biogas upgrading and gas injection with conventional upgrading technologies can enhance the greenhouse gas emissions.

The lowest methane losses can be achieved by using mono ethanol amine scrubbing (MEA: 0.1%) for biogas upgrading.
On 12 March 2008 the German Federal Cabinet has decided a new gas injection act in order to promote the injection of biomethane (BNG) into the gas grid.

The aim of the act is to substitute at least 10 % of the natural gas consumption up to 2030 by biogas.

This act regulates the priority of connections to the grid for suppliers of upgraded biogas.

A considerable part of the costs for gas injection have to be paid by the grid operators and not by the biogas producers.
Gas grid operators must connect biogas plants to the grid (obligatory connection).

50% of the costs for the grid connection must be paid by the grid operator.

The grid operator is responsible for the odorization, the control of the gas quality and the compression to the grid pressure and has to cover all these costs.

The gas can be supplied by the biogas plant at various pressures according the different upgrading processes.
The gas transport customer will receive a fee from the gas grid operator to the amount of 0,7 €-Cent/kWh because gas grid operator saves costs for long distance transport.

The methane losses by upgrading must be lower than 1 % within the next 3 years, and afterwards maximally 0,5 %.

The injected gas must be feed-out within 12 month with a flexibility of 25 %.
The basic fee is enhanced by 1 ct/kWh$_{el}$ for biogas plants with a capacity lower than 150 kW (11.67 ct/kWh$_{el}$).

The biomass bonus is enhanced from 6 ct/kWh$_{el}$ to 8 ct/kWh$_{el}$ for biogas plants up to 500 kW.

A manure bonus of 2 ct/kWh$_{el}$ is paid for biogas plants with a capacity lower than 150 kW$_{el}$ if at least 30 vol-% manure is used for biogas production.

The CHP-bonus is enhanced from 2 ct/kWh$_{el}$ to 3 ct/kWh$_{el}$.

The technology bonus of 2 ct/kWh$_{el}$ is cancelled for dry fermentation and will be paid for biogas upgrading if the methane losses are maximum 0.5 vol-%.

The total fee (not only the basic fee) will be reduced by 1 % per year.
Outlook

- A competition between food and biogas production does not exist, because only 2% (350,000 ha) of the agricultural land is used for energy crops.
- The increased costs for energy crops are the result of the high world market prices (increased demand in USA, India, China, Brasilia).
- The share of small biogas plants which use manure, intermediate crops and organic wastes increases.
- The number of large biogas plants with gas injection into grid increases.
- Without using the heat from CHP most of the biogas plants cannot make a profit in future.
Many thanks for your attention!