Industrial application of anaerobic digestion

Günther Bochmann
Industrial application of AD

- Degradation of organic compounds
  - waste water
  - Pasteous or solid products

- Energy production
  - Electricity
  - Heat/saturated steam
  - Biomethane

- Production of fertiliser
  - Feedstock
  - Legislation
Digestions systems

- Sludge bed systems
- CSTR
- Plug flow fermenter
Industries

- Slaughterhouse / meat processing industry
- Dairy
- Brewery
- Olive processing
- Sugar factory (sugar beet pulp)
- Distilleries (bioethanol, rum, schnapps)
- Potato processing
- Winery
- Juice factory
<table>
<thead>
<tr>
<th>Country</th>
<th>Dominant waste streams</th>
<th>Total production of waste [t/year]</th>
<th>Methane production potential [mil. m³/year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Dairy Industry</td>
<td>1 095 901</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Sugar Industry</td>
<td></td>
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<tr>
<td></td>
<td>Brewing Industry</td>
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<tr>
<td></td>
<td>Slaughterhouses</td>
<td></td>
<td></td>
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<tr>
<td>Czech Republic</td>
<td>Waste materials from sugar industry</td>
<td>1 120 000</td>
<td>80</td>
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<tr>
<td></td>
<td>Brewing Industry</td>
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<td></td>
<td>Meat industry</td>
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<td></td>
<td>Fruit and vegetable industry</td>
<td></td>
<td></td>
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<tr>
<td>France</td>
<td>Beverage industry</td>
<td>11 300 000</td>
<td>680</td>
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<tr>
<td></td>
<td>Meat industry</td>
<td></td>
<td></td>
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<td></td>
<td>Fruit and vegetable industry</td>
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<tr>
<td></td>
<td>Petfood production</td>
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<tr>
<td></td>
<td>Beet-pulp, molasses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>Meat and fish industry</td>
<td>13 500 000 (t DM/year)</td>
<td>120</td>
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<tr>
<td></td>
<td>Fruit and vegetable industry</td>
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<td></td>
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<tr>
<td></td>
<td>Breweries and malt production</td>
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<tr>
<td></td>
<td>Coffee and tea processing</td>
<td></td>
<td></td>
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<tr>
<td>Poland</td>
<td>Fruit and vegetable processing</td>
<td>4 023 000</td>
<td>185</td>
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<tr>
<td></td>
<td>Dairy industry</td>
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<tr>
<td></td>
<td>Meat processing industry</td>
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<td></td>
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<tr>
<td></td>
<td>Brewing industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>In total</strong></td>
<td></td>
<td>31 038 901</td>
<td>1 141</td>
</tr>
</tbody>
</table>
Dairy Berglandmilch/Austria

Feedstock
- 360 t/d
- Whey
- Waste water

Gas production
- 5,500 m³/d

Energy utilisation
- 7,900 kWh/d electricity
- 9,900 kWh/d heat

Specification
- liquid treatment
Brewery Gösser Göss/Austria

Feedstock
- Brewers spent grains 17kt/a
- Yeast
- Kieselghur

Gas production
- ~2,000,000 Nm³

Energy utilisation
- Electricity production
- Gas to brewery

Specification
- Preacidification
- Digestate utilisation
## Biogas potential

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Gas yield [m³ biogas/kg FM]</th>
<th>Gas potential [m³ CH₄/a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewers spent grain</td>
<td>120</td>
<td>240.000</td>
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<tr>
<td>Malt dust</td>
<td>600</td>
<td>9.000</td>
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<tr>
<td>Residual yeast</td>
<td>60</td>
<td>13.800</td>
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<tr>
<td>Abwasser</td>
<td>0.35</td>
<td>28.000</td>
</tr>
</tbody>
</table>

~250.000 – 300.000 m³ biogas/a
or 1.5 – 1.8 Mio. kWh/a in a 100.000 hl brewery

Quelle: Pesta 2005
Substitution of energy in a brewery

26.8 kWh/hl SB
~85%

9.9 kWh/hl SB
~70%

17.9 kWh/hl SB
Abbatoir in Upper Austria/Austria

Feedstock (150-200 t/week)
- Blood
- Rumen content
- fat

Energy production
- 5 GWh electricity
- 4 GWh heat

Energy utilisation
- Electricity production
- Utilisation of thermal energy

Specification
- High nitrogen content
- Additionnally use of geothermal energy
Sugar factory Magyar Cukor Kaposvár/Hungary

Feedstock
- Sugar beet pulp
- Energy crops (seasonal)

Gas production
- 160,000 m³/d

Energy utilisation
- Biomethane
- Process energy

Specification
- Gas upgrading
- Gas injection

© Planungsbüro - BPE Dr. Prendl
Panvita Ekoteh Nemscak
Murska Sobota / SLO

Feedstock
- Pig manure
- Energy crops (seasonal)
- Slaughterhouse waste
- Flotation waste

Gas production
- 17,000 m³/d

Energy utilisation
- Electricity production
- Heating stables / 50,000 pigs

Specification
Stahlbush Oregon/USA

Feedstock
- Vegetable waste
- Potatoes, pumpkins and maize waste
- Grass

Gas production
- 17,000 m³/d

Energy utilisation
- Electricity
- Heat production

Specification
- Pumpkin seeds drying
- Digester type
Feedstock
- Slaughterhouse waste
- Pig manure
- Food and market waste

Gas production
- 14,500 m³/d

Energy utilisation
- Electricity 1.0 MW
- Heat production 1.3 MW

Specification
- Heating stables
- Pretreatment
Conclusion

- Utilisation of various organic residues
- Substitution of fossil fuels
- Increasing of fuel efficiency by CHP units
- Reduction of transport costs
- Successful implementation in several industries
- Greening of industrial processes
- Specific plants and knowledge required
Questions?

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