Country Report Germany

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## Summary of AD plants in Germany

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>5000</td>
</tr>
<tr>
<td>Industrial wastewater treatment</td>
<td>174</td>
</tr>
<tr>
<td>Sewage sludge treatment</td>
<td>?</td>
</tr>
<tr>
<td>Municipal biowaste treatment</td>
<td>74</td>
</tr>
<tr>
<td>Landfills</td>
<td>1645 (out of operation for biowaste)</td>
</tr>
</tbody>
</table>
Number of agricultural biogas plants
Electric capacity of agricultural biogas plants

Installed electric capacity [MW]

- EEG (1)
- EEG (2)
- EEG (3)

Cultivation of energy crops for biogas

Cultivation of renewable resources in Germany

Cultivation area in hectares

In 2010* (figures given in 1,000 ha)

Industrial use

- Fibre plants: 1
- Medical plants and vegetable dyes: 10
- Sugar-rich crops: 10
- Starch-rich crop: 160
- Oil crops: 136

Energy use

- Crops for solid biofuels: 4
- Sugar and starch for bioethanol: 240
- Crops for biogas: 650
- Rapeseed for biodiesel/vegetable oil: 940

*forecast

Source: FNR
Biogas upgrading plants

Actual situation
- 35 upgrading plants are in operation
- 10 upgrading plants are in construction
- 80 upgrading plants should be in operation at the end of 2011
- Main treatment capacity 500-800 Nm³/h

Aim for 2020
- 1000-1400 upgrading plants of mean capacity
- Around 120 plants per year up to 2020
- Total injection capacity 6 bill. m³ per year
- According the actual development only 20 - 40 % of the aim can be achieved up to 2020
Increase of the biomethane upgrading capacity

![Graph showing the increase of biomethane capacity from 2008 to 2020. The x-axis represents the years (2008 to 2020), and the y-axis represents the biometane capacity in TWh/a. The graph includes a linear and an aim trend line.]
Applied technologies for biogas upgrading

- Pressure Swing Adsorption: 13
- Chemical Scrubbing: 4
- Pressurized Water Scrubbing: 1
- Membrane Technology: 9
- No Information: 1

German Energy-Agency (dena)
September 2010
Feed-in capacities according the applied upgrading technology

- 300 Nm³/h; 1%
- 4700 Nm³/h; 17%
- 6750 Nm³/h; 25%
- 6540 Nm³/h; 24%
- 8900 Nm³/h; 33%

- Pressurized Water Scrubbing
- Pressure Swing Adsorption
- Chemical Scrubbing
- Membrane Technology
- No Information

German Energy-Agency (dena)
September 2010
Bottlenecks for the future market of biomethane

- The production costs for biomethane are too expensive compared to natural gas:
  - Biomethane: 6-8 Cent/kWh
  - Natural gas: 2-3 Cent/kWh

- The legislative regulations are not optimized for biomethane injection:
  - The gas must be used in CHP-plants in order to achieve a fixed compensation (EEG).
  - The use of biomethane for only heat production is not supported by the regulations.
  - The use of biomethane as vehicle fuels is tax-free only up to 2016.
Necessary measures to increase the biomethane production

- The biomass-bonus of 7 Cent/kWh$_{el}$ should not be limited to plant capacities of $\leq$ 500 kW.
- The use of biomethane in heating systems with a condensation boiler should get a fixed compensation.
- The addition of biomethane to natural gas should result in a reduced tax for vehicle fuel.
- The sale of gas driven vehicles should be supported by the Government in order to increase the market for gas vehicles (2010: 90,000 gas vehicles).
Challenges of ordinances

**Amendment of the Gas Network Access Ordinance (18.08.2010)**

- The grid access costs are split between the grid operator and the biomethane supplier in the ratio 75%/25% (previous: 50%/50%).
- The grid operator is owner of the grid access and covers the costs of maintenance and operation.
- For grid access with a connecting pipeline of < 1 km, the biomethane supplier has to pay maximum 250,000 €.
- The grid operator has to provide a grid access availability of 96%.
Strategies for increasing biogas production

- Decoupling of the manure bonus from the biomass-bonus in order increase the co-fermentation of manure and wastes.
- Uniform compensation of biogas independent on the biogas plant size.
- Increased application of biogas for producing heat, cold and vehicle fuel.
- Simplification of the regulations of Renewable Energy Act.
Enhancement of the process efficiency

- Technologies to reduce the energy losses during ensiling and storage (compacting, ensiling additives).
- Technologies for disintegration of substrates to increase the bioavailability (enzymes, physical methods).
- Feed-in technologies for solid substrates in order to achieve a better homogeneity in the fermenter.
- Membrane reactor for higher conversion rates.
- New stirrer types to reduce the energy input for mixing.
Technologies for increasing the electric efficiency of CHP by using the surplus heat for electricity production (ORC, exhaust turbo generator).

Development of biogas upgrading technologies for raw gas capacities of $\leq 250$ Nm$^3$/h (amine washing process).

New membrane types for biogas upgrading.

Optimization of technologies for digestate upgrading.

Development and test of new measuring devices for process control.
Energy crops for biogas

- Test of conventional and new energy crops at different climate and soil conditions.
- Development of high yield crops with low input.
- Test of wild crops for biogas production.
- Reduction of GHG during cultivation of energy crops.
Many thanks for your attention!