Experience with grid injection in Germany

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Biogas plants in Germany

- 4,500 biogas plants
- 1,650 MW_{el}
- Only < 30% of new biogas plants use the entire surplus heat

- Electric power is the main aim of Germany’s biogas producers due to the high EEG-compensation.
- Grid injection is a good approach to increase the rate of heat utilization.
- Missing legislative regulations have hindered the injection of biogas into the natural gas grid.

Number of biogas injection plants in Germany

- Number of plants
- Expected
Requirements for biomethane production and injection

- Privileged access to the gas grid.
- Standardization of the gas quality
- Standardized measurement requirements for grid access with calibritable analyzers.
- Practicable rules for balancing of biogas injection and take-out.
- Support for green electricity, green vehicle fuel and green heat supply.

Gas Grid Access Ordinance (GasNZV)

- The access to the gas grid is privileged for upgraded biogas (connection pipe < 10 km).
- The gas grid operator has to finance 50% of the gas grid connection costs.
- The biomethane producer has to fulfill the standardized quality requirements for biomethane (DVGW G 260, DVGW G262) which are independent of local gas quality.
- The grid operator has to adjust the gas quality to be injected (Wobbe-Index, pressure, odorization).
- Feed-in and take-out is balanced on a yearly basis with 25% flexibility.
- The grid operator has to pay 0.7 Cent/kWh for avoided grid costs.
Objectives of the German Government

- Substitution of 6 bill. m³ natural gas by biomethane up to 2020. Today 3.6 % of this target is fulfilled by 35 running injection plants.
- Around 1,300 biogas upgrading plants of medium size with an investment of 10 bill. Euro are necessary to reach the objective of the Government.
- In 2030 biomethane should cover 10 bill. m³ of current natural gas consumption.

Gas injection plants in Germany (1/2010)

- 35 plants are in operation and 35 under development and construction.
- The plants which have been erected cover the entire area of Germany.
- The actual feed-in capacity is 25,000 Nm³/h.

Quelle: dena 11/2009
Gas quality for grid injection

- **Exchange Gas**
  Exchange gas must have the same quality standards as conventional natural gas. It can be mixed with natural gas in each ratio.

- **Accessory Gas**
  Accessory gas composition is not equivalent to that of natural gas, and can be injected into the grid only beneath a certain threshold.

Gas quality standard in Germany

- The quality of natural gas in Germany vary with the geography. Therefore, the quality standard of exchange gases depends on the region of its origin.

- **Natural Gas L**
  Low-quality gas which contains roughly 89 % of flammable gases (primary methane). To adjust the biomethane quality air must added sometimes.

- **Natural Gas H**
  High-quality gas which contains about 97 % flammable gases (methane, ethane, propane, butane). To adjust the biomethane quality LPG must be added in some applications. This makes gas injection more expensive.
Most of the upgraded and injected biogas is used in CHP in order to receive the compensation for electricity and heat according the Renewable Energy Sources Act (EEG).

Only three plants (Bottrop, Jameln, Dannenberg) produce pure biomethane for the direct utilization in a local filling station.

A little part of biogas is used as vehicle fuel in form of an admixing product in combination with natural gas.

Biomethane as an admixing product is offered by some gas suppliers as “green gas” with admixing quotas ranging from 5 to 20 %. Customers can fulfill the requirements of the Renewable Heat Law by using an admixing product with 20 % biomethane.

### Application of upgrade technologies (1/2010)

<table>
<thead>
<tr>
<th></th>
<th>PSA</th>
<th>PWS</th>
<th>MEA</th>
<th>Genosorb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of plants</td>
<td>13</td>
<td>9</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Percent [%]</td>
<td>41</td>
<td>28</td>
<td>22</td>
<td>9</td>
</tr>
</tbody>
</table>
Feed-in capacities according the different upgrade technologies (1/2010)

<table>
<thead>
<tr>
<th></th>
<th>PWS</th>
<th>PSA</th>
<th>MEA</th>
<th>Genosorb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity [Nm³/h]</td>
<td>8,608</td>
<td>7.075</td>
<td>4.175</td>
<td>1,305</td>
</tr>
<tr>
<td>Percent [%]</td>
<td>41</td>
<td>33</td>
<td>20</td>
<td>6</td>
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</tbody>
</table>

Biomethane feed-in capacity of 34 upgrading plants in operation and construction
### The biggest grid injection plant in Germany

**Biogas park Güstrow**

<table>
<thead>
<tr>
<th>Upgrading process</th>
<th>PWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up of operation</td>
<td>2009</td>
</tr>
<tr>
<td>Feed-in capacity [Nm3/h]</td>
<td>5,400</td>
</tr>
<tr>
<td>Pressure level [bar]</td>
<td>25</td>
</tr>
<tr>
<td>Substrate input [tons/a]</td>
<td>450,000</td>
</tr>
<tr>
<td>Investment [Mill €]</td>
<td>100</td>
</tr>
</tbody>
</table>

**Methane slip**

<table>
<thead>
<tr>
<th>Upgrading process</th>
<th>PSA</th>
<th>PWS</th>
<th>Genosorb</th>
<th>MEA/DEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane slip [%]</td>
<td>2 - 5</td>
<td>2 - 3</td>
<td>2 - 4</td>
<td>&gt; 0,1</td>
</tr>
</tbody>
</table>

- The methane slip is limited to 1 % up to 2011 and later 0,5 %.
- The biomass bonus (EEG) can be received only if the slip is ≤ 0,5 %.
- Only MEA/DEA washing processes fulfills this threshold value without post-treatment of the off-gas.
Biomethane sales and trade in Germany

- The transport and sales of the injected biomethane from its production site to the end customer is usually coordinated by a biogas trading company.
- The company buys biogas quantities from various producers and delivers it to different end customers.
- The trading company makes an entry contract with the grid operator and an exit contract with the end customer.
- The amounts of biomethane fed into the natural gas network must be documented along the value chain.

Interest of VW on biomethane

- VW has created a new trademark for biogas: SunGas.
- VW operates a first filling station.
- The Passat TSI EcoFuel is the most efficient gas car.
Summary

- Germany has started biogas injection at the end of 2006 but is now the leading country in the world.
- More than 1,000 injection plants must be built within the next 10 years to fulfill the aims of the Government.
- Most of the injected gas is used in CHP plants for achieving a fixed compensation for electricity and heat (EEG).
- Biomethane in combination with natural gas is offered by gas suppliers in admixing quotas between 5 to 20 %.
- The transport and sales of injected biomethane is usually coordinated by a gas trading company.
- The amounts of biomethane fed into the gas network must be documented along the whole value chain.

Many thanks for your attention!
For achieving the best-possible impact on the conservation of the climate, the legislation supports the utilization of injected biomethane for combined heat and power generation.

The EEG covers therefore CHP plants that use virtual biomethane transported by the natural gas grid.

The EEG gives plants generating power from renewable resources priority to the public power grids.

The feed-in tariffs for electricity are guaranteed for 20 years from commissioning.

The compensation is dependent on the substrate type, the CHP and the gas conditioning capacity and the degree of heat utilization.