Experience with grid injection in Germany

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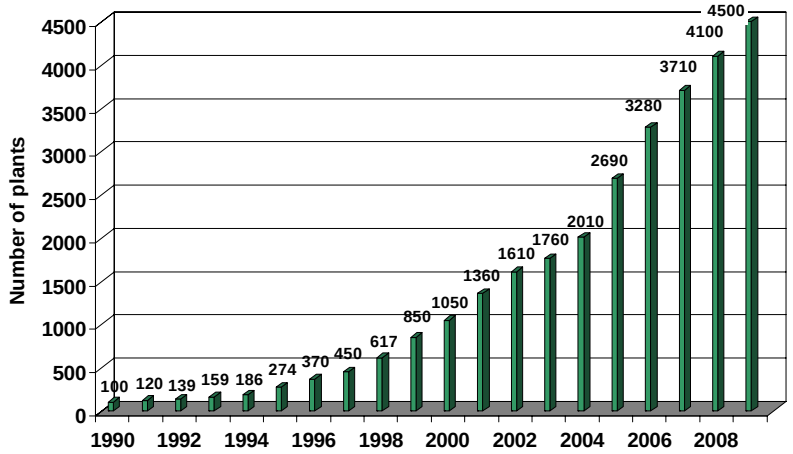
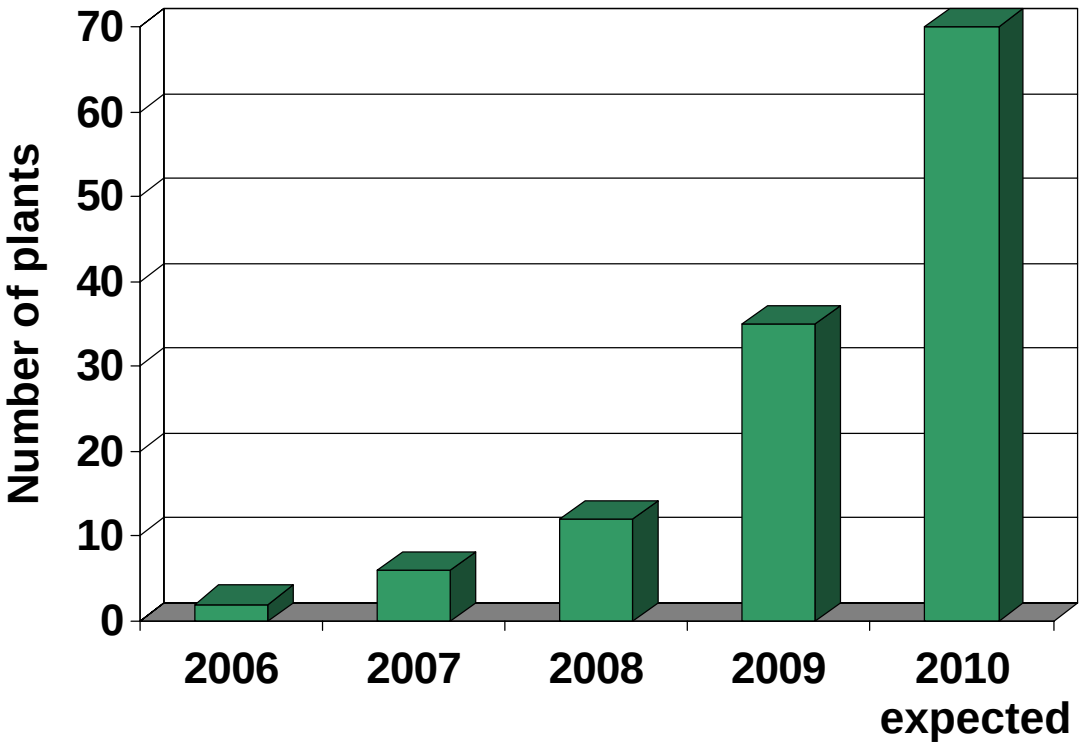
Biogas plants in Germany



- 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



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.**

Gasinjection plants in Germany (1/2010)

Quelle: dena 11/2009

- **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.**

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.

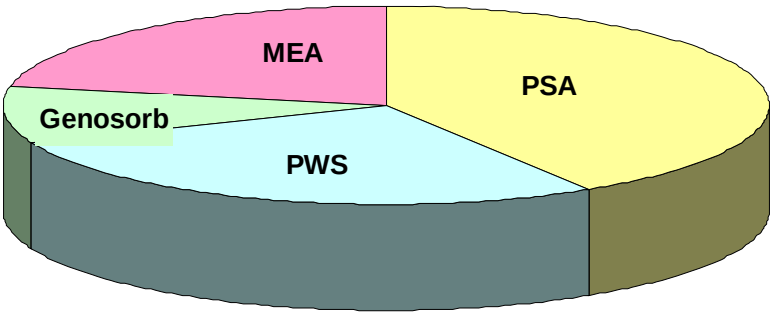
- ***Natural Gas H***

  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.

Utilization of upgraded biogas in Germany

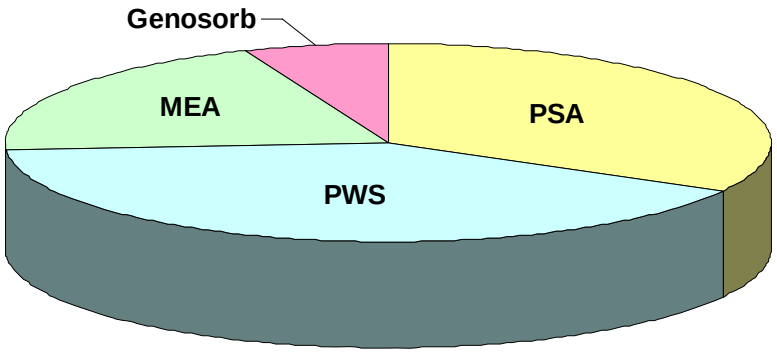
- **Most of the upgraded and injected biogas is used in CHP in order to receive the compensation for electricity and heat according the Renewable Energy Sources Act (EEG).**
- **Only three plants (Bottrop, Jameln, Dannenberg) produce pure biomethane for the direct utilization in a local filling station.**
- **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)



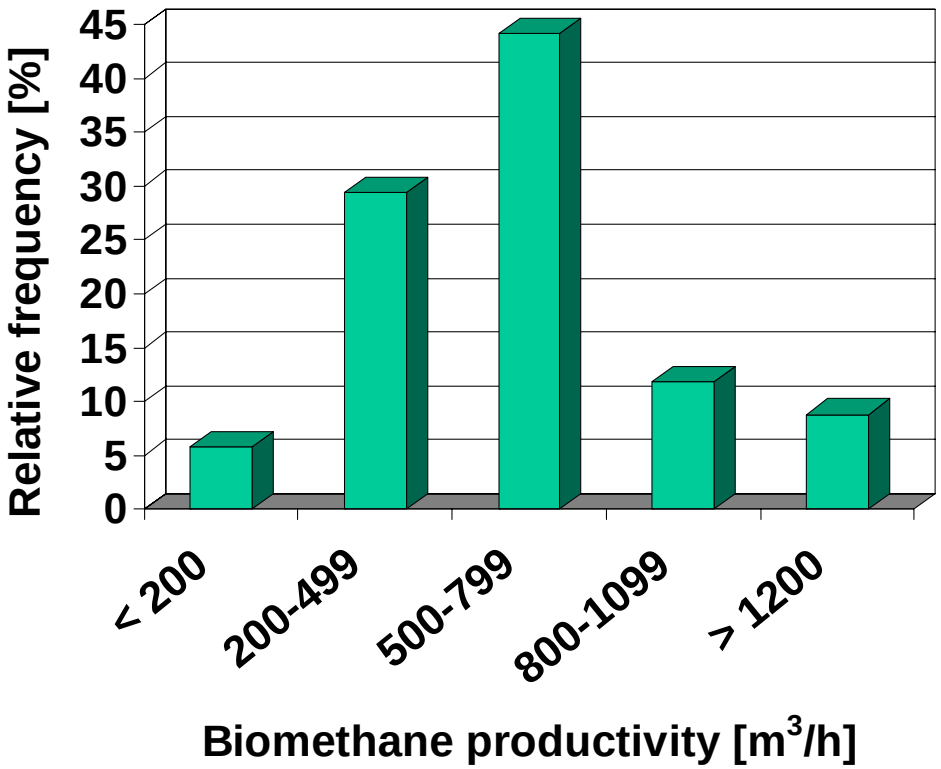
	PSA	PWS	MEA	Genosorb
Number of plants	13	9	7	3
Percent [%]	41	28	22	9

Feed-in capacities according the different upgrade technologies (1/2010)



	PWS	PSA	MEA	Genosorb
Capacity [Nm³/h]	8,608	7.075	4.175	1,305
Percent [%]	41	33	20	6

Biomethane feed-in capacity of 34 upgrading plants in operation and construction



The biggest grid injection plant in Germany

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

Biogas park Güstrow

Methane slip

Upgrading process	PSA	PWS	Geno-sorb	MEA/DEA
Methane slip [%]	2 - 5	2 - 3	2 - 4	> 0,1

- 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.**

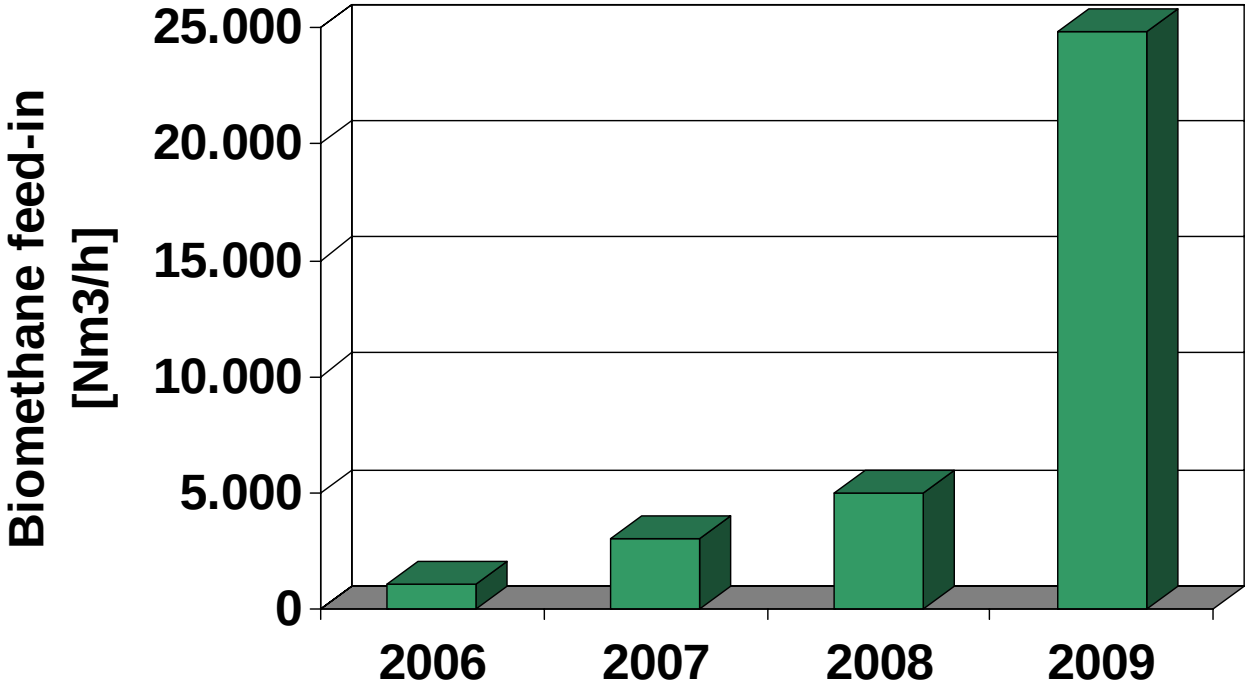
Summary

- 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!



Biomethane feed-in in Germany



Renewable Energy Sources Act (EEG)

- 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.