



## **Power Generation from Biogas – Energy Provider Perspective**

Global Biogas Congress  
Brussels, 29th November 2011

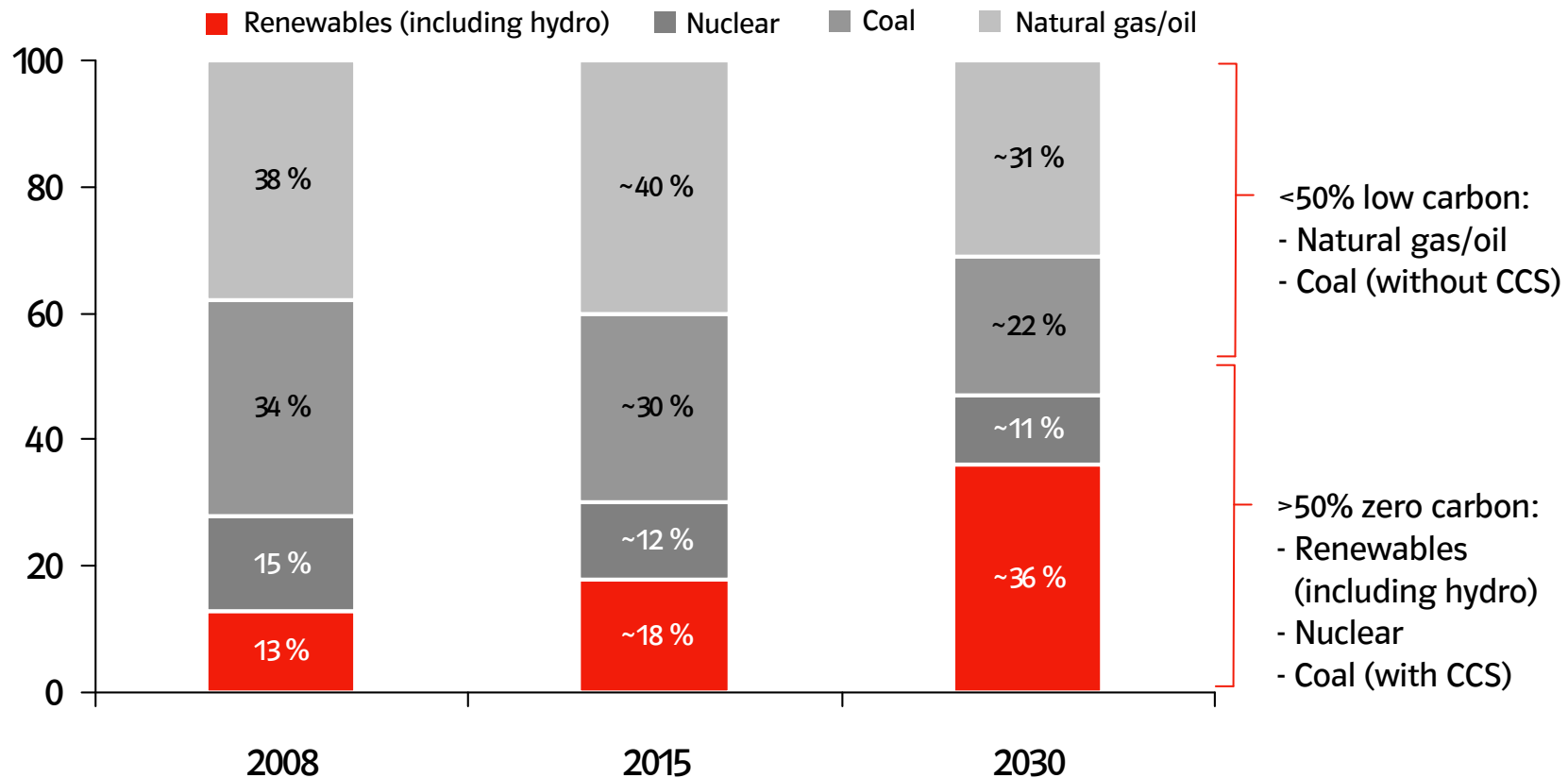
Dr. Christian Böse

## Content:

- Who is E.ON Bioerdgas?
- Development of Biogas-Production in Europe
- Biogas in Germany
- Most efficient use of biogas
- Biomethane injection as an attractive option for utility energy procurement and GHG abatement

## Energy-Mix 2030: Increasing Share of Renewables at E.ON

### E.ON Production Portfolio: (2008 – 2030)<sup>1</sup>



<sup>1</sup>Figures based on attributable generation capacity..

## Our targets:

- Support reaching the political objectives of German Government and EU regarding shares of bioenergy in 2020 and 2030.
- Provide an increasing share of biomethane in the overall consumption of natural gas.
- Implement most efficient technologies for reducing green house gas emissions (at least 60% compared to natural gas).
- Provide additional income and work opportunities in rural areas.
- Leadership in the sustainable production of biomethane:
  - Cross-compliance and good agricultural practice for biomass production,
  - Lowest GHG emissions in biomethane production,
  - Sound integration of biomethane production into the local economic, agricultural and social framework.



## E.ON biomethane projects in Germany

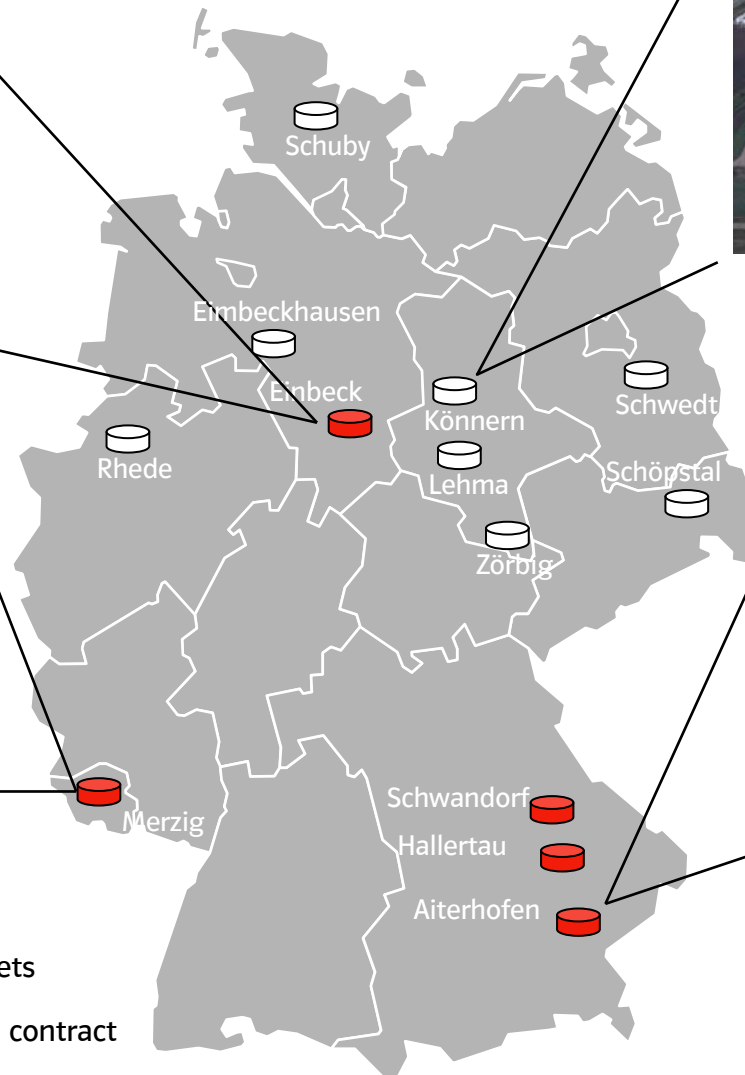


**Einbeck:**  
50 GWh/a  
in operation since 09/2009



**Merzig:**  
50 GWh/a  
in operation since 05/2011

-  E.ON assets
-  long term contract



**Könnern:**  
150 GWh/a  
in operation since 09/2009



**Aiterhofen:**  
90 GWh/a  
in operation since 09/2009

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## Biogas production: two approaches

### Local Biogas Utilisation

**biogas**  
(local CHPs)

CHP



biogas plant

- few locations with full heat utilisation

### Biogas Feeding into the Gas Network

**biomethane**  
(purification + feeding in)

biomethane

upgrading

gas pipe

electricity (CHP)

heat

fuel

**NEW**

- optimised heat utilisation
- new products
- demand from customers

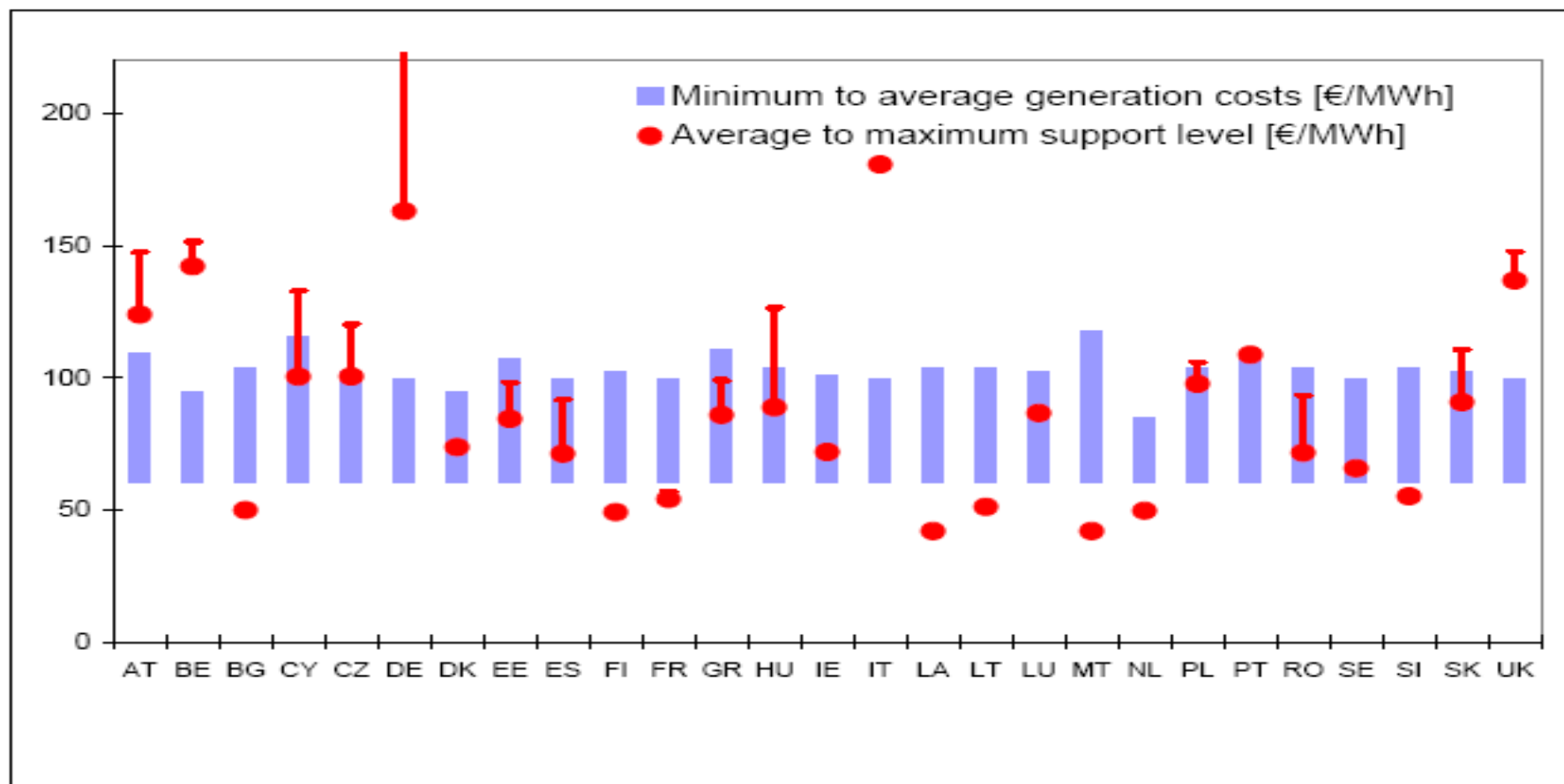
# Significant differences in Biomass/Biogas Support between Member States

## Support Schemes for Energetic Use of Biomass

	Italy	UK	Netherlands	Spain	Czech. Rep.	Slowakia	Austria	Belgium	France	Poland	Portugal	Bulgaria	Germany	Romanian	Sweden	Hungary	Greece	Ireland	Danmark	Finland
Support for capacities >20MW <sub>e</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Investment Support	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Tax exemptions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CHP Support	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Duration of Support	15	20	12	15	20	15	15	10	15	0	25	15	20	15	15	10	20	15	10	0
Co-firing Support	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

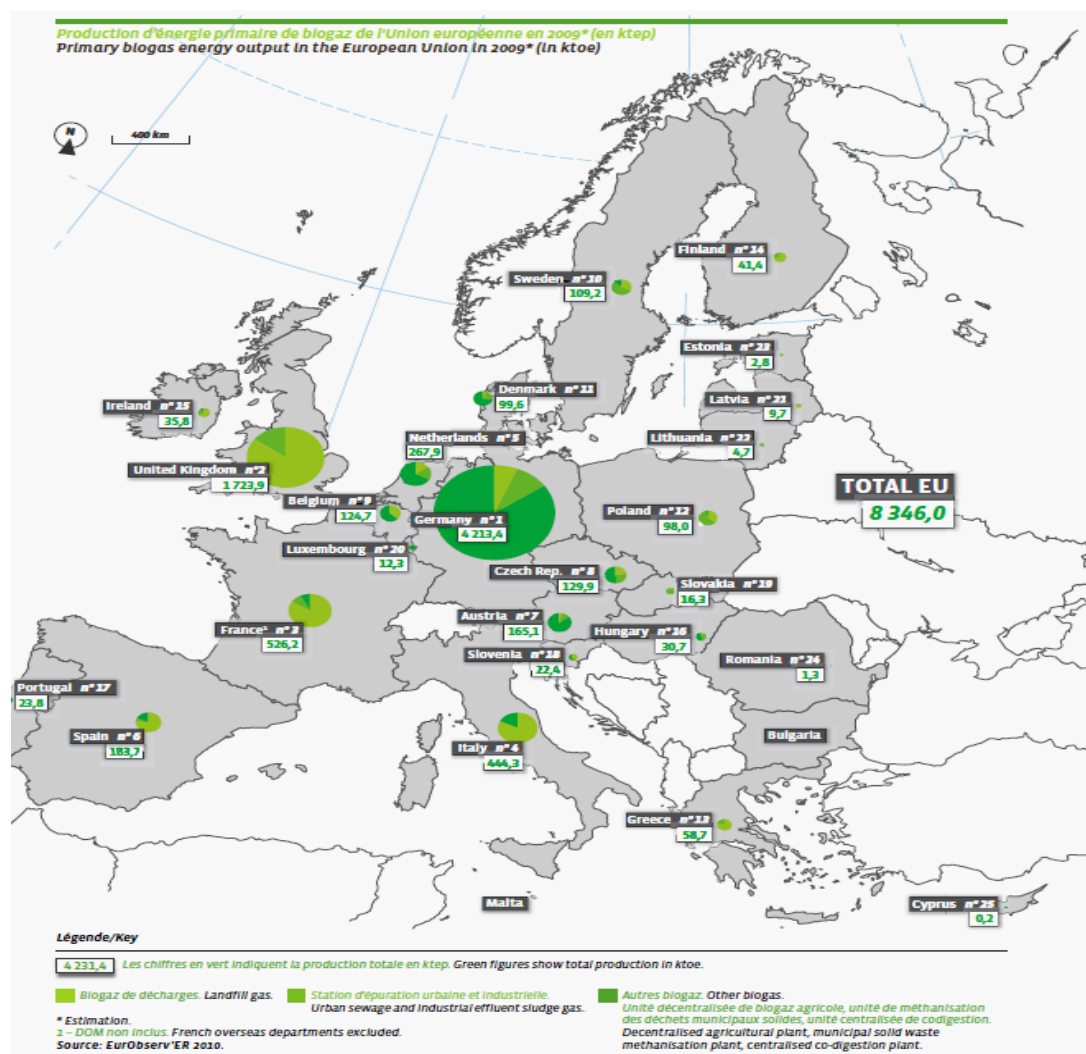


**Figure 3: Price ranges (average to maximum support) for direct support of biogas electricity in EU27 (average tariffs are indicative) compared to long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.**

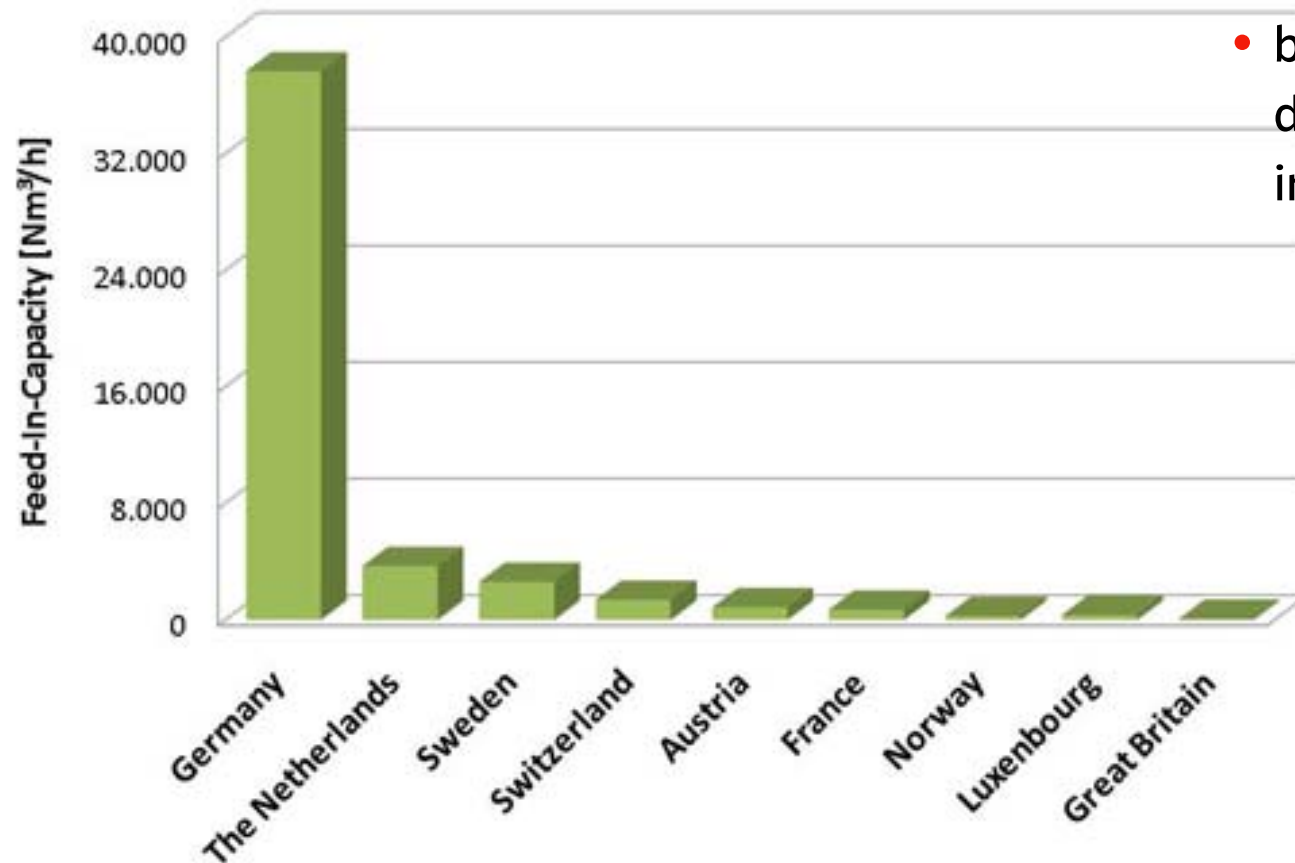


Source: OPTRES, 2007 in COMMISSION STAFF WORKING DOCUMENT  
 „The support of electricity from renewable energy sources“, Brussels, 23.1.2008  
 SEC(2008) 57

## Status of Biogas-Production in EU 2009 in ktoe



## Biomethane Production in Europe



- biomethane projects depend on national incentive schemes

*German Energy-Agency (dena)  
August 2011*

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## Biogas- Plants in Germany / Livestock Density

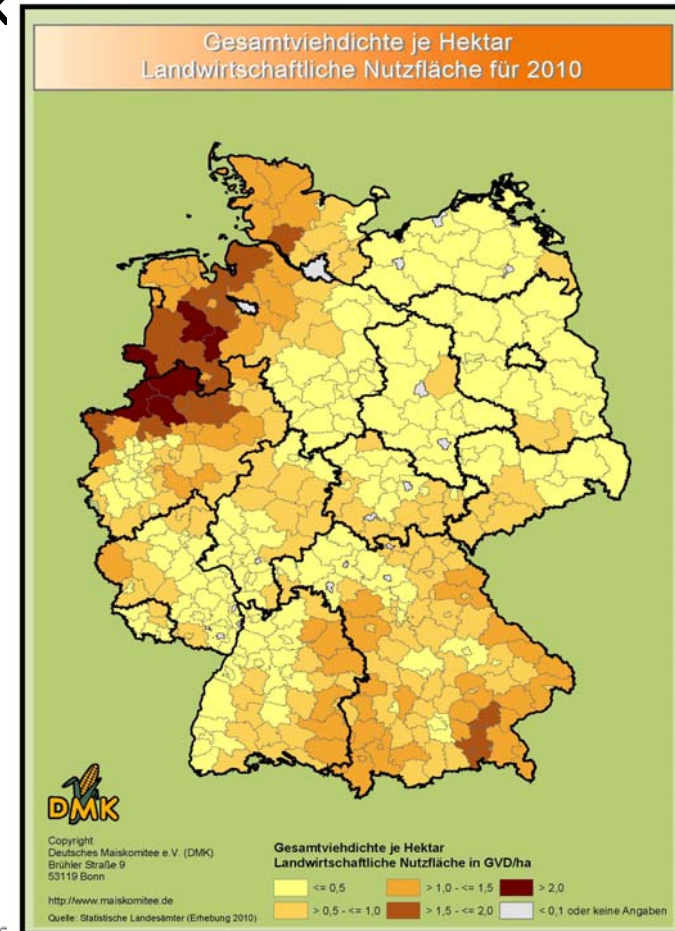
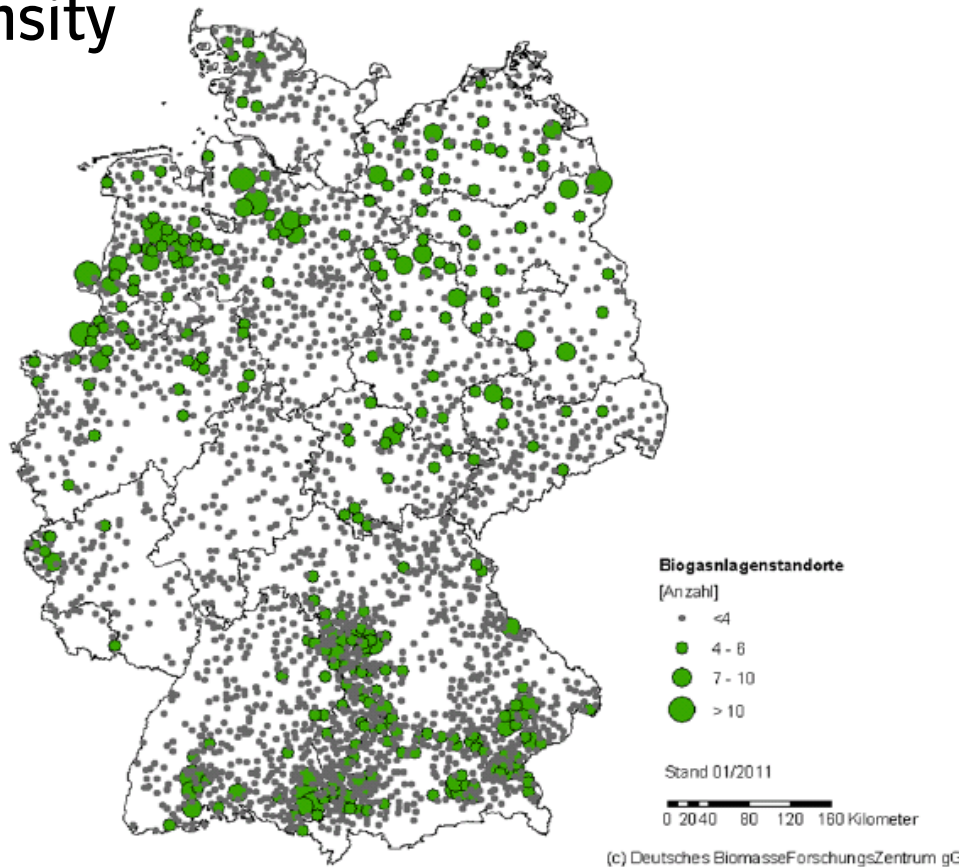
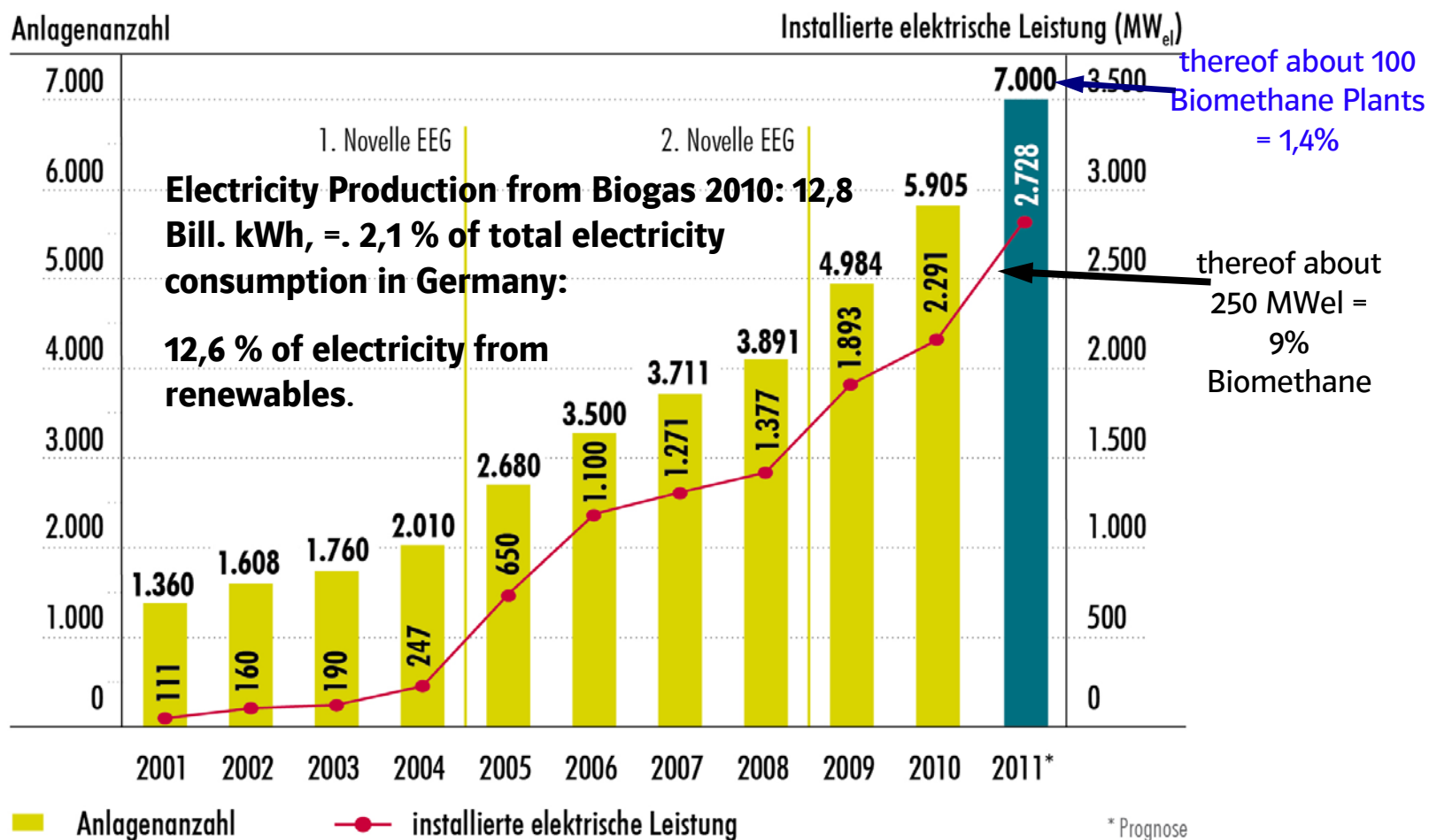


Abb. 3-4: Verteilung der in Betrieb befindlichen Biogasanlagen in Deutschland; Bezugsebene: Postleitzahl Stand 01/2011; Biogasdatenbank DBFZ) [1],[37],[42],[43],[46]

Source: DBFZ

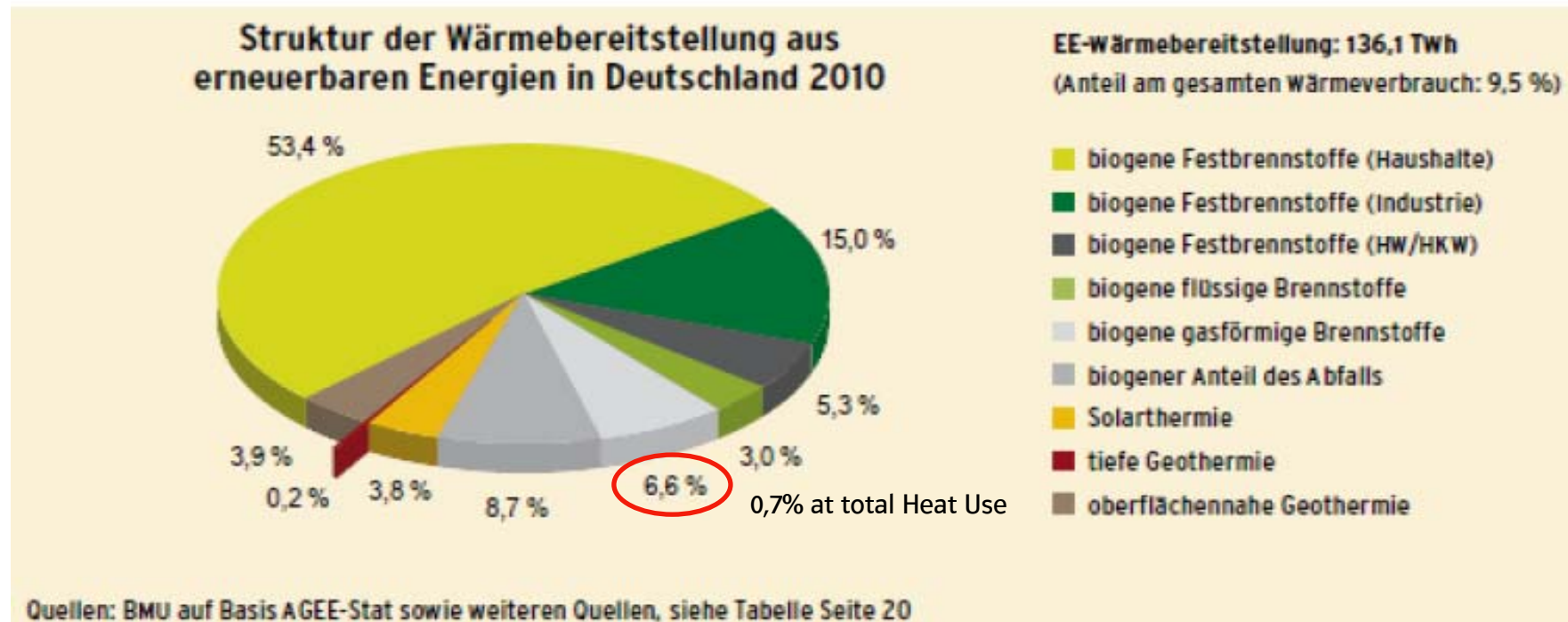
Source: DMK

## Case Study Germany: Development of Biogas Production



Source: Fachverband Biogas, FNR

## Case Study Germany: Share of Biogas in Renewable Heat



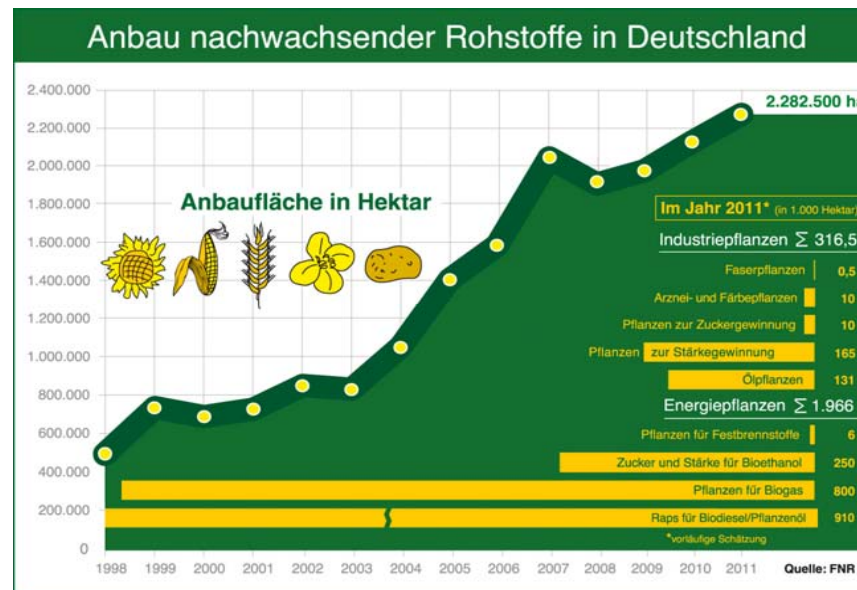
Source DBFZ



## Feedstocks



- Most biogas plants in Germany run on energy crops and manure,
- Range of energy crops is broadening
- Potential of organic bio-waste is limited and requires additional technical installation for feedstock treatment prior to the biogas production,
- Use of non-agricultural raw materials in specialized biogas plants,





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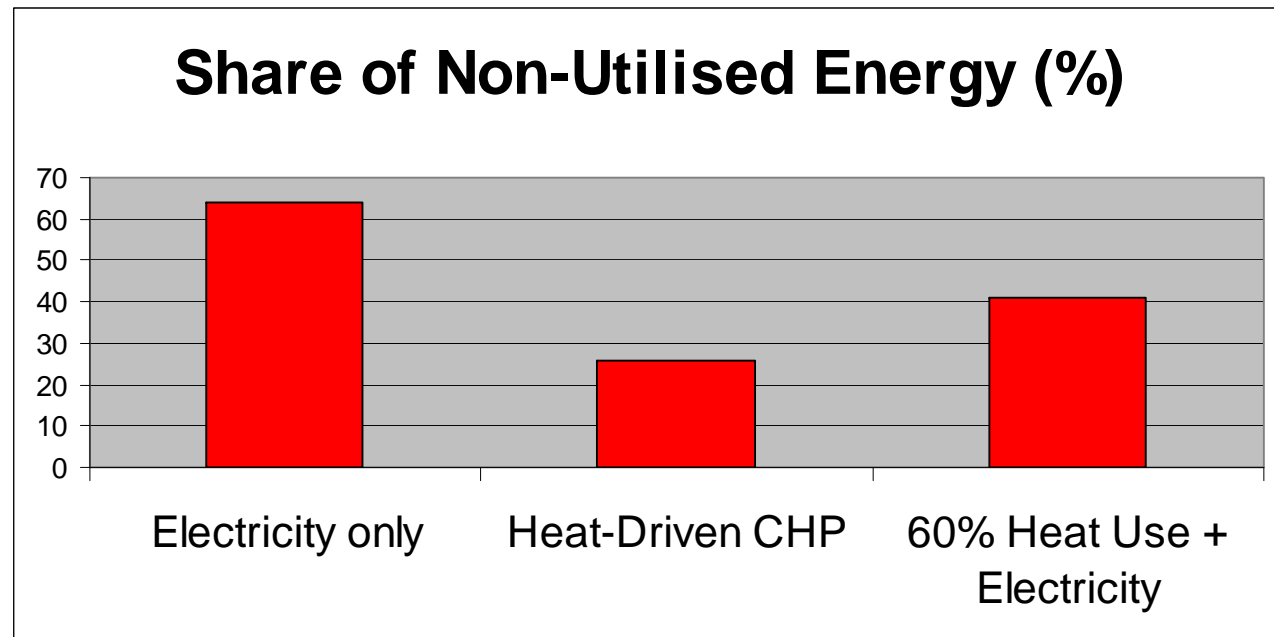
## Efficiency of Biogas Utilisation

The degree of Heat-Use decides on the efficiency of the biogas plant.

This is true for:

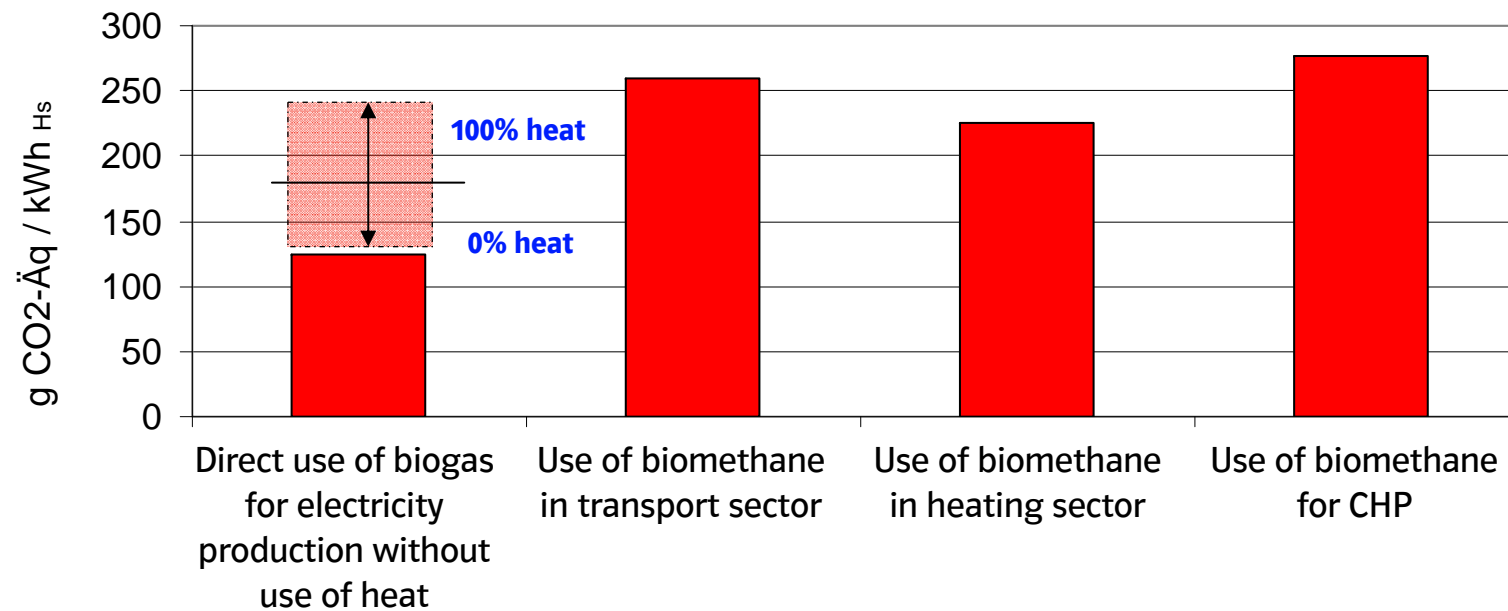
Energy efficiency,

Economic efficiency,



Efficiency in Climate gas reduction.

## CO<sub>2</sub>-Reduction for different ways of biogas use



Source: Own compilation based on Data from Wuppertal-Institut and IFEU

## Biomethane: The most efficient bio fuel

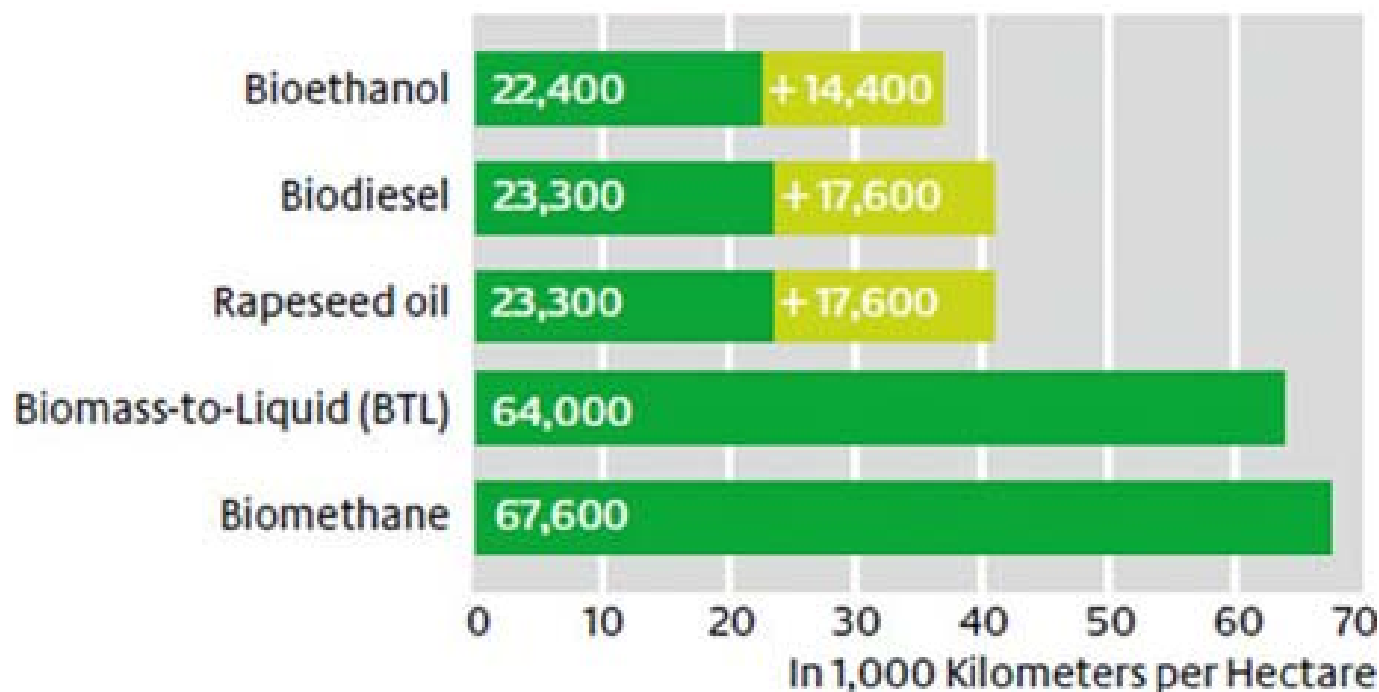


Figure: Yield of biofuels  
in km per hectare

■ Biomethane from  
byproducts (mash,  
straw/mulch)

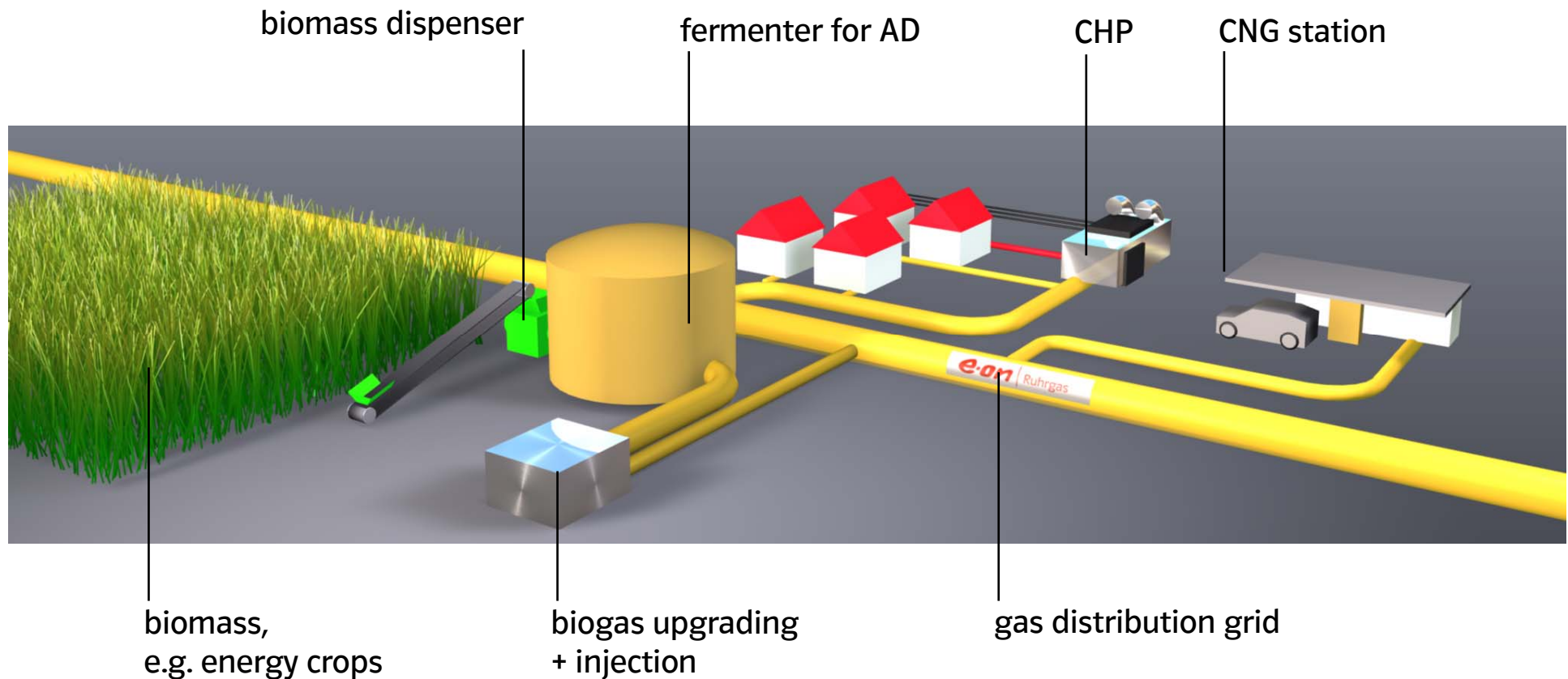
Source: FNR 2008 [www.biogaspartner.de](http://www.biogaspartner.de)

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## Elements of the biomethane chain

Separation of biomethane production and consumption using the gas grid as storage



## Biomethane plant Aiterhofen



- Annual biomethane production:  
 $90 \text{ GWh}_{\text{HS}}/\text{a}$
- Substrates: 80,000 t/a  
(energy crops, mainly maize)
- Biogas production and upgrading built by Schmack Biogas
- Upgrading by PSA
- Commissioning 09/2009

## Main Advantages of Biomethane (I)

- The Gas Grid Access of Biomethane was facilitated in 2008 by the Gas Grid Access Ordinance which stipulates that biomethane plants take precedence when it comes to being connected to the gas grid. Plant operators and grid operators must each bear half of the costs associated with the grid connection.
- Biomethane can be used for:
  - Biomethane for power generation (in cogeneration mode)
  - Biomethane for admixing products (in blends with natural gas)
  - Biomethane for transport application as biofuel.
- Biomethane is a dispatchable and storable energy source (unlike wind and solar power).



## Main Advantages of Biomethane (II)

- Biomethane is available year-round (24/7); AD plants run in base load.
- Anaerobic digestion of energy crops has highest energy yields per ha; and it is based on a broad mixture of input materials:
  - dilute organic waste, solid organic waste, wet crops, dry corn
  - root, stem, leaves and fruit
- Anaerobic digestion of local energy crops has a closed cycle of matter: minerals from biomass return as fertiliser to the fields
- Biomethane has the best eco-balance of all existing bioenergies

## Contacts:

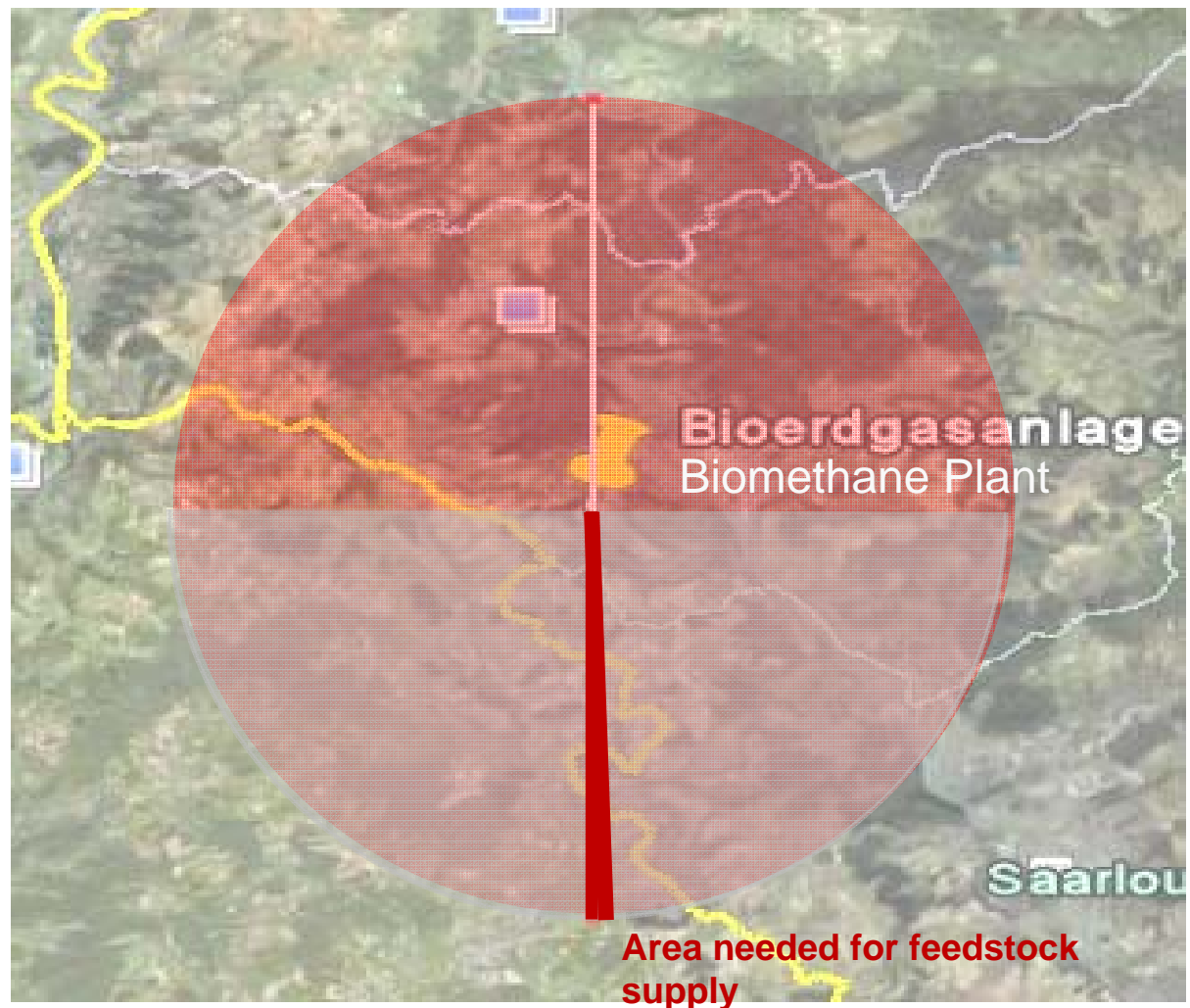
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## Cropping Area needed for Feedstock Production (Einbeck Size: 5 MW; 45 GWh/a)

- Feedstock grown in a radius of 15 km around the plant location
- Total Area: 70.700 ha, thereof about. 35.000 ha agricultural area
- Area needed for feedstock supply about 1.000 ha (ca. 1,5% of overall area; ca. 3% of agr. area)
- About 70 farmers supplying feedstock





## Allocation of Harvest Area Einbeck 2009

