



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Big>East Mobilisation Campaign



20 October 2009, Athens, Greece

Current situation and outlook on biogas market in Germany

Michael Köttner, Chairman

GERBIO

German Society for Sustainable
Biogas and Bioenergy Utilisation



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Situation in Germany

- **Overview**
- Feedstock & Market Perspectives
- Technology options: Energy Crops and Residues
- Economics: feasibility, yields, costs & benefits



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

GERBIO ...

... German Association, created in 2001

... promotes the sustainable generation and use of energy made out of biomass.

... Fields of Work



BIOGAS



Plant Oil



Wood Gas



Liquid & Solid Manure and Digestate treatment



Decentralized Wastewater Management



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Activities of GERBIO related to Biogas technology

- Know-How transfer (international workshops, study tours, training)
- Support of small scale installations
- Contacts to experts in planning, design and construction
- Contacts to specialized companies
- Networking with members in different regions nationally and internationally

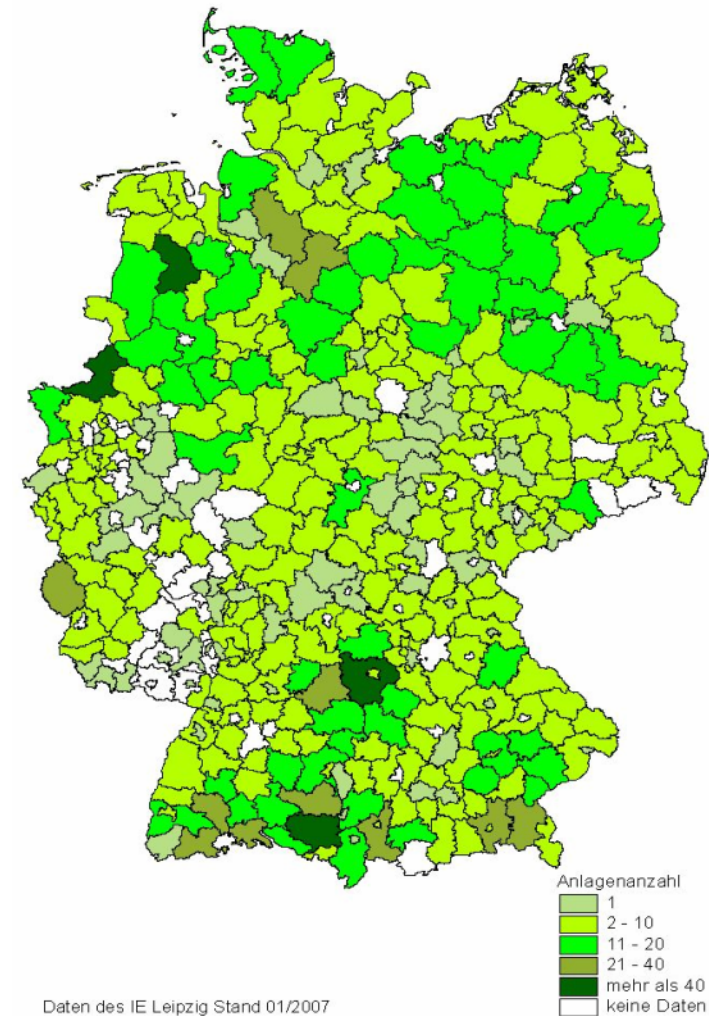
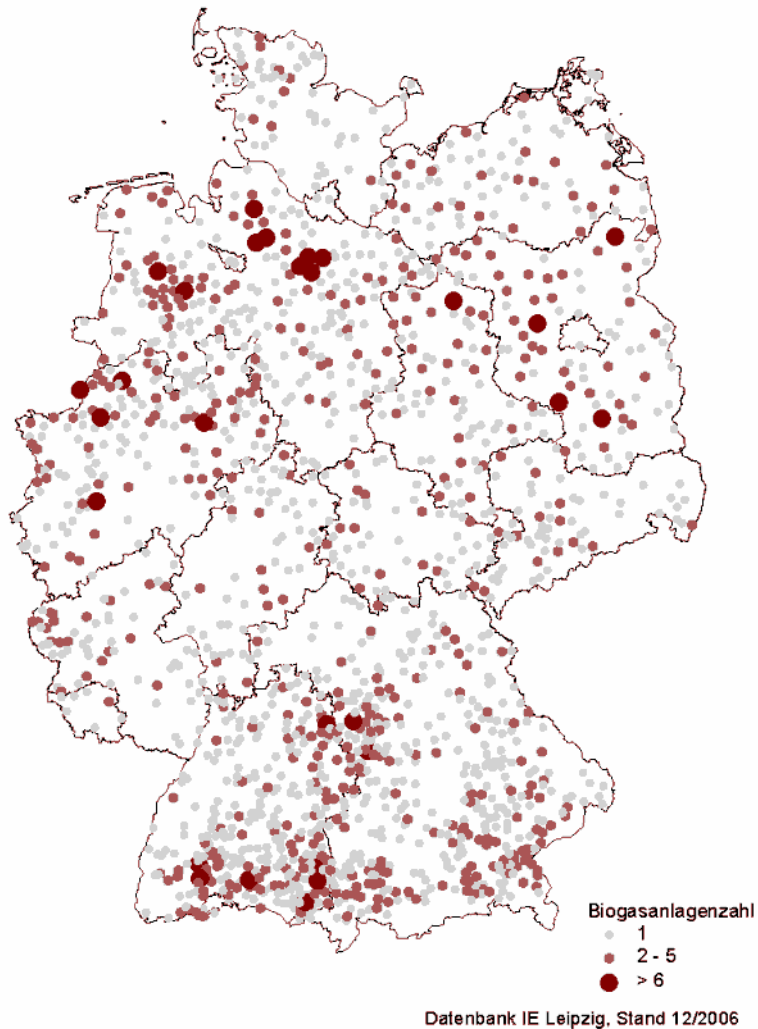




Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Plants in Germany





Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

History and Status Quo “Biogas in Germany”

	2005	2006	2007	2008	2009
Number of installed plants	2600	3500	3710	3900	4600
Electrical installed capacity (MWeI)	650	1100	1270	1370	1740
Electricity (TWh/a)	2.8	>5	7.4	10.3	
Contribution to overall electricity production	0.5%	>1%	1.4%	1.6%	
Manufacturers income generation (Billion €)	0.5	1	0.65	0.6	1.05
Operators income generation (Mio €UF)	360	650	750		
Participation in exporting sector	8%	12%	>15%		
Employments	5,000	10,000	10,000	8,500	10,500
CO2 Reduction (Mio t/a)	2.5	5	6.4		



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Increase of the number of biogas plants related to changes in laws and regulations

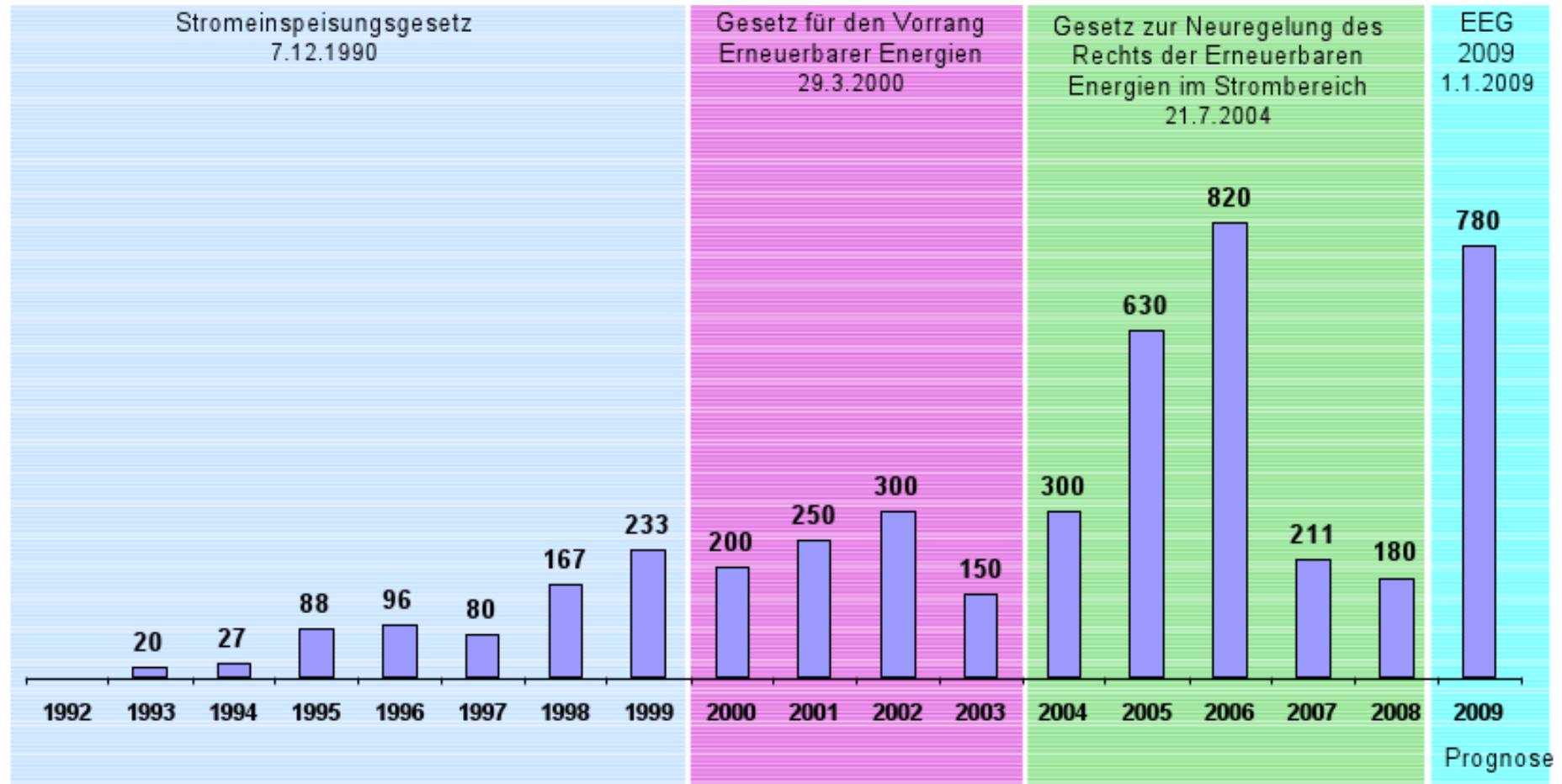


Abb. 2

Quelle Fachverband Biogas e.V. 2008



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Market development in Germany

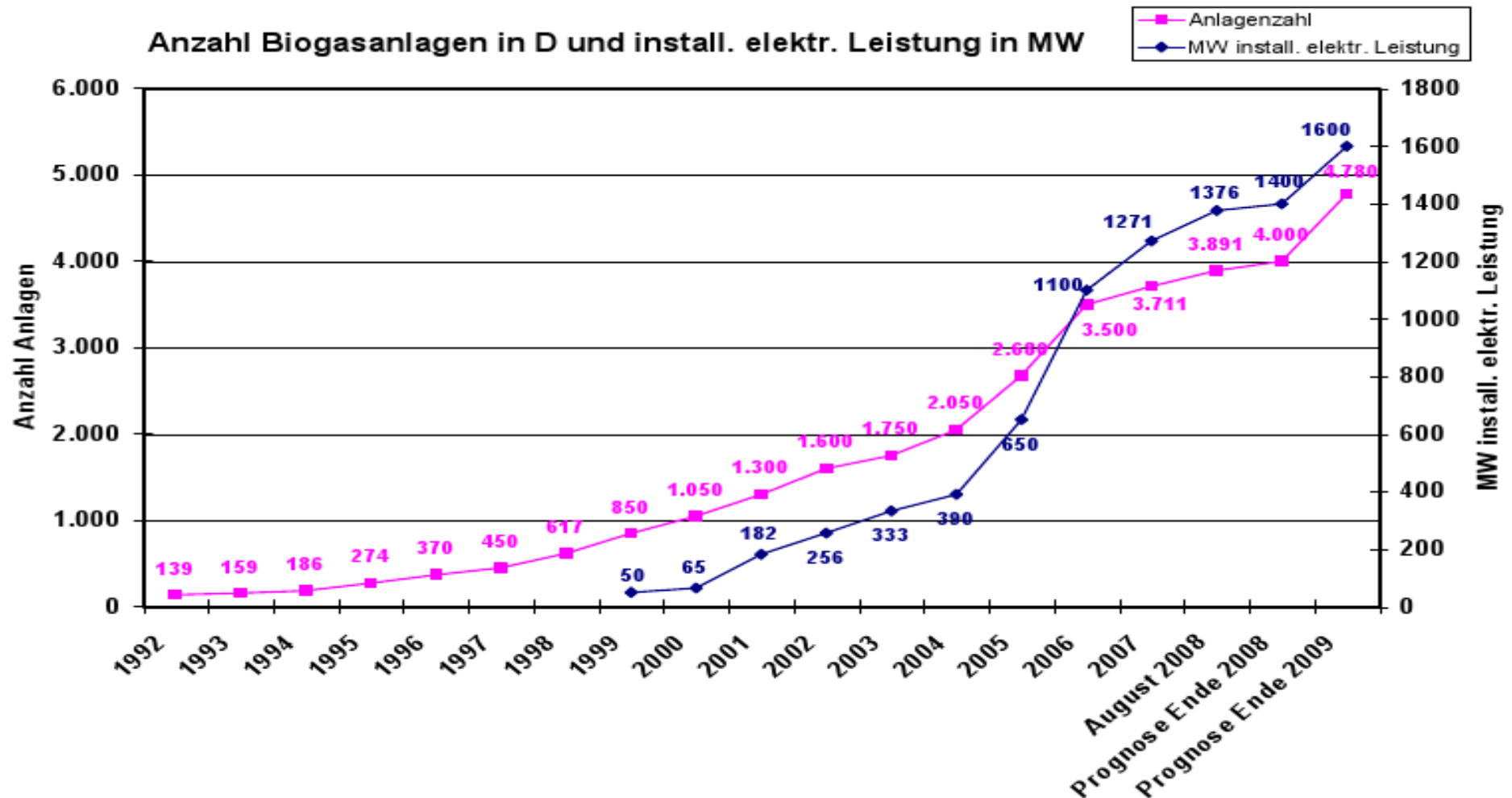


Abb. 1

Quelle: Fachverband Biogas e.V. 2008



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Reasons for Market Development

- High standards on technical development
 - ✓ Different standardized types of digesters and plant technologies
 - ✓ Consolidation of Dry Fermentation Technology
 - ✓ Automatisations of system control and operation
- Enabling environment & economic incentives
- Fixed Feed in Tariffs guaranteed for 20 Years, Energy Crop Bonus
- Regulated grid access at reasonable cost



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Market Development

- Over 1000 enterprises working in the sector
- About 4600 biogas plants operating
- Technologies for upgrading to biomethane (23 projects) and biogas as transport fuel (2 projects)
- Technologies for efficient use of thermal energy
- Advanced technologies for sludge treatment and its application as fertilizer



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas from Energy Crops in Germany

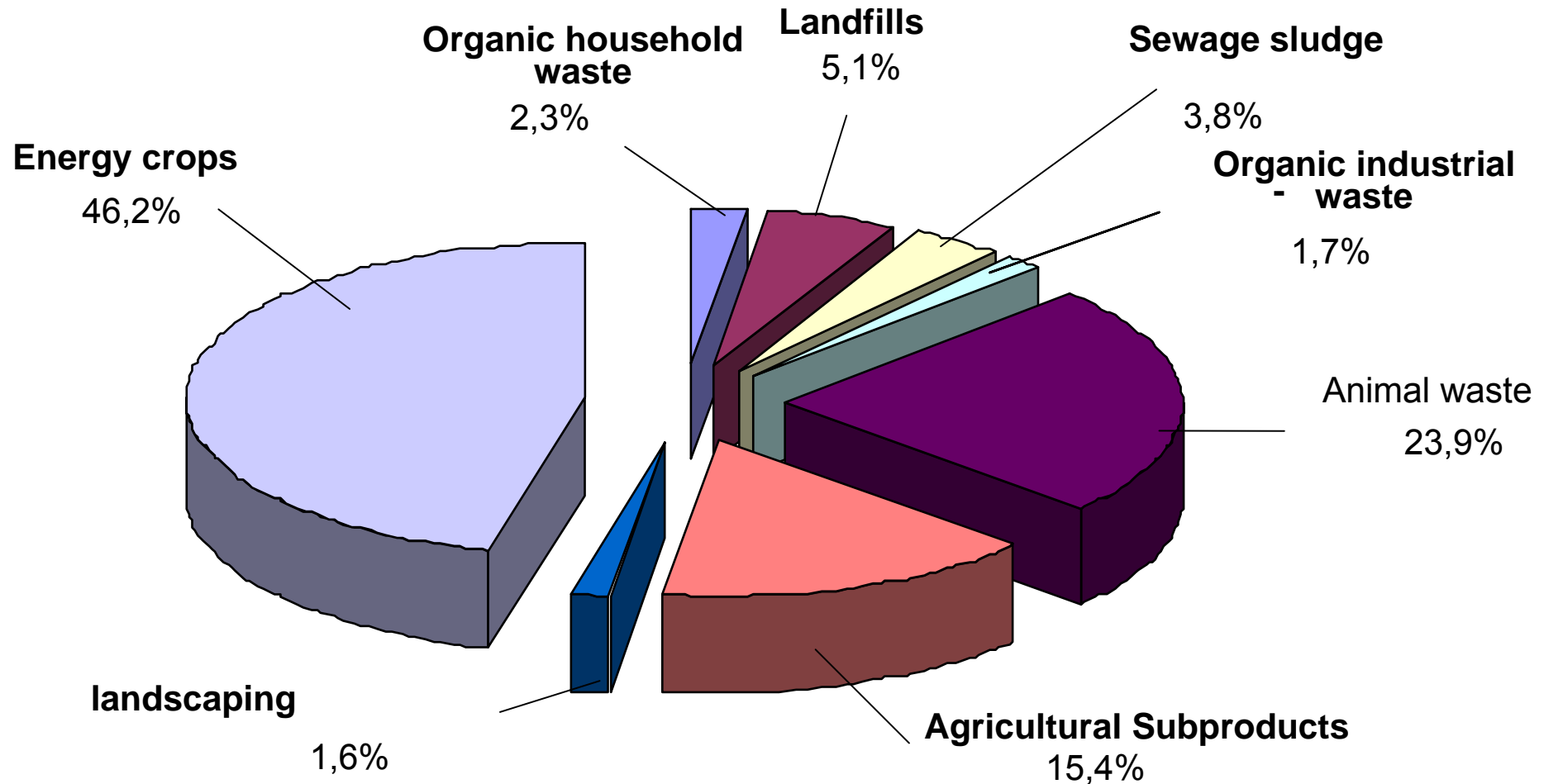
- Overview
- **Feedstock & Market Perspectives**
- Technology options: Energy Crops and Residues
- Economics: feasibility, yields, costs & benefits



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

In total: 24 Bln m³ Biogas: 50 Mio. MWh electricity and 72 Mio. MWh heat



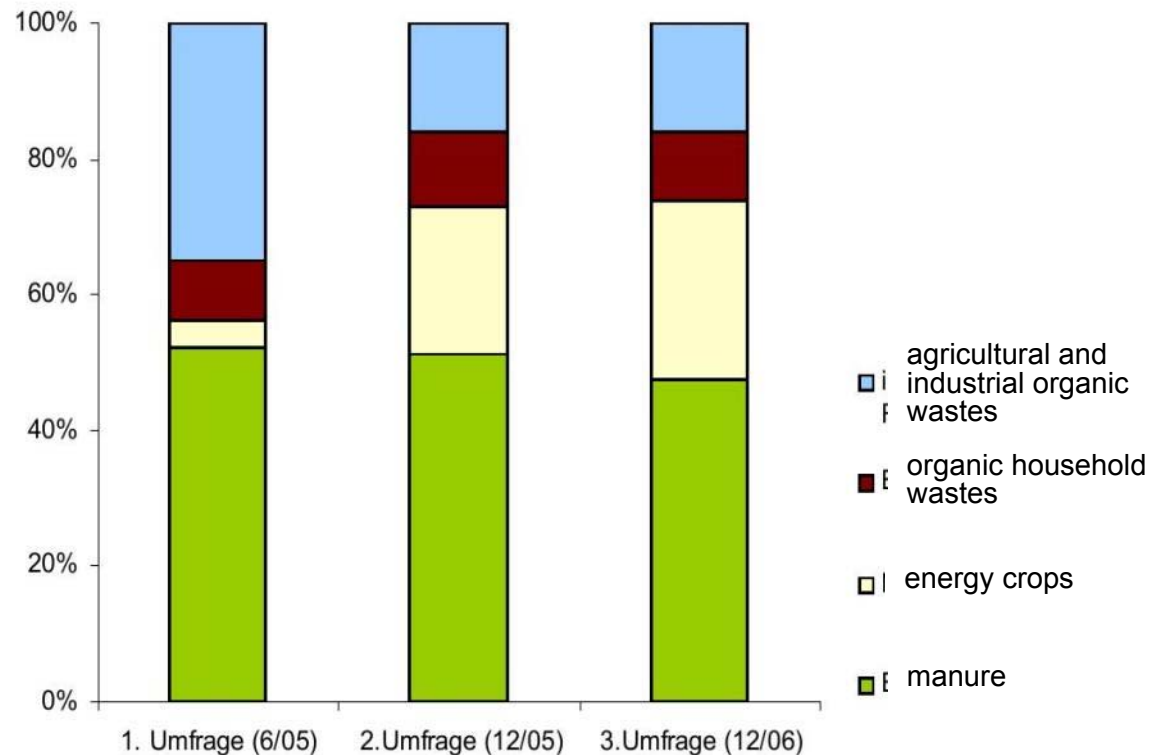
Feedstock for Biogas Production in Germany



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Status Quo: feedstock



Tendencies since 2005 :

- Strong increase in the use of energy crops (> 26%, on 500,000 ha)
- Corn at first place (> 80% of the land that is used for biogas crops)
- Optimized pre-treatment of substrates in order to improve biogas production .

source: IEL, 2007



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

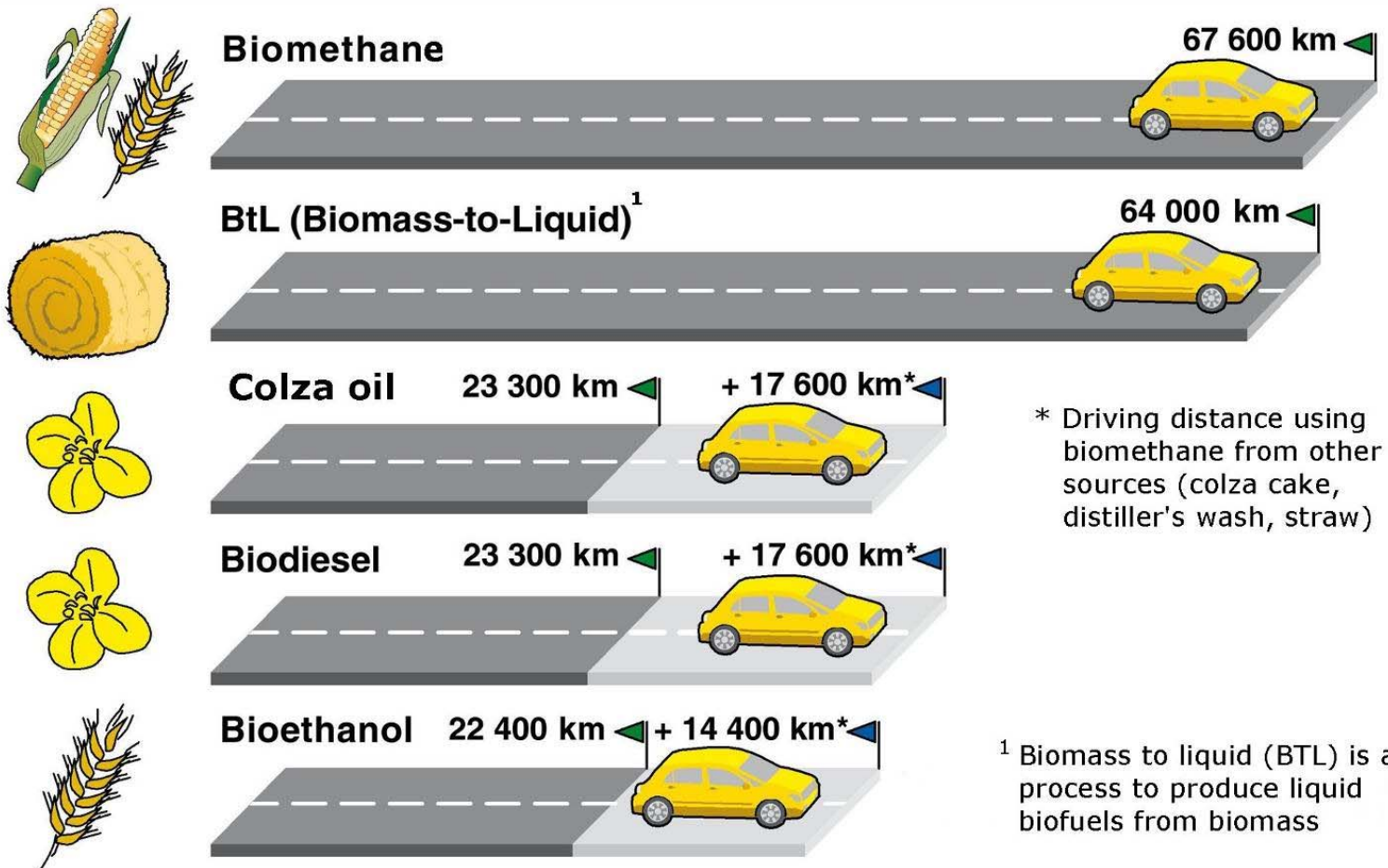
Different efficient ways to produce energy from biomass

Process	Energy yield		Average	
rape to bio-diesel	45 GJ/ha	55 GJ/ha	50 GJ/ha	38%
starch to ethanol	50 GJ/ha	53 GJ/ha	52 GJ/ha	39%
lignocellulose to ethanol	35 GJ/ha	65 GJ/ha	50 GJ/ha	38%
lignicellulose to biogas	105 GJ/ha	160 GJ/ha	133 GJ/ha	100%

Source: Institute for Energy and Environment, Leipzig, 2007: *Kosten und Ökobilanzen von Biokraftstoffen*



Driving distance of an automobile using fuel of 1 ha of cultivable land



Automobile fuel consumption: Otto 7,4 l/100 km, Diesel 6,1 l/100 km



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Market perspectives

1. Biomethane is
- like natural gas - but produced locally
 - like natural gas - but with guaranteed supply
 - like natural gas - but always economical

1. Potential:

- 10 Billion m³ produced on 10% of agricultural land (with an energetic yield of 62.000 kWh/ha)
- options to improve up to : 100.000 kWh/ha
- 16 Billion m³ de biomethane (corresponding to 50% of the gas imports from Russia)¹
- Up to 17% of the consumed electricity
- Up to 20% of the consumed natural gas
- Up to 35% of the consumed transport fuel

3. Energy crops present most of the potential.

4. Promising results with crops cultivated especially for biogas production

Quelle: BMU



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Sector Perspectives

- The amended Renewable Energy Law focuses on thermal efficiency, ecology and emission reduction of 12.5% until 2010
- From January 2009 on, new regulations for feed-in-grid EEG of biogas: more incentives for agricultural biogas plants and for the treatment of waste
- Since April 2008 GasNet Feed in Ordinance GasNZVO, Gas Feed in Law in preparation GEG
- Governmental goal: until 2030 at least 10% of biogas contained in the natural gas grid



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Situation in Germany

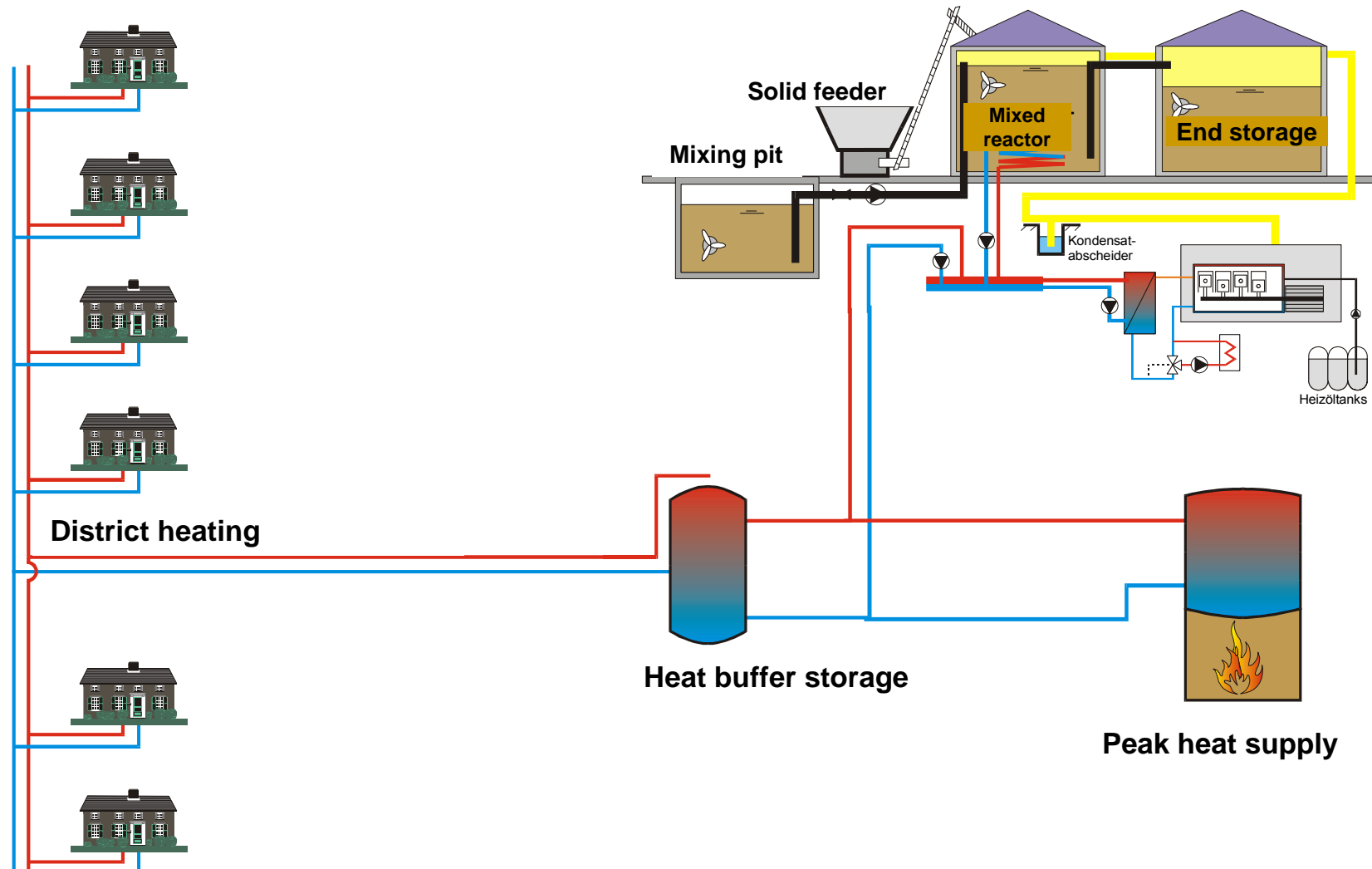
- Overview
- Feedstock & Market Perspectives
- **Technology options: Energy Crops and Residues**
- Economics: feasibility, yields, costs & benefits



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Components of a biogas plant with CHP unit





Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Plant **Thomas Karle - Kupferzell**



General Information

- In operation since 2001
- Added new plant in 2004
- Gas turbine and sludge drying system(2007)
- Agricultural area: aprox. 100 ha

Substrates

- Liquid manure (cattle)
- Corn silage
- Oat silage
- Harvest and production waste (DM~15%)

Technical description

- Digester : **1 x 600 m³**
- Digester (new plant) : **1 x 1600 m³**
- Storage tank (covered w/ double memb): **2000 m³**
- Feed-in system for substrate: **45 m³**
- CHP: **MDE gas motor 320 kWel**
- Microgas turbinrs (2): **130 kWel**
- Heat surplus production: “**electrical pig**” using greenhouse system for electrical drying of sludge



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Plant **Gebeke**



Substrates

Green silage: **27 t/d**

Corn silage: **4.7 t/d**

Cattle manure: **2 m³/d**

Agricultural land: **75 ha (greenland) + 7 ha (corn)**

Production data

Volume of Biogas: **7300 m³/d**

CH₄ content: **53.- %**

CHP: **CES – MAN gas motor**

Electrical capacity: **500kW**

Technical Description

Volume digester: **2 x 1,000 m³**

Post-digester : **1000 m³**

Temp. of operation: **48 °C**

Sludge storage: **3600 m³**

Installed electrical capacity: **500 kWel.**



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Dry Fermentation Plant (**Biomassehof Langenau**)



Dry fermentation plant (batch method)

Investment Costs: **1.9 Mio. Euros**

Substrate

Landscaping: **4.000 t/a**

Corn silage: **8.000 t/a**

Green and Grain Sillage: **2.000 t/a**

Cultivated land: **150-200 ha energy crops.**

Production data

Electricity input for operation: **aprox.2%**

CHP: **(3) MAN 180 kWel. c/u**

Electricity production: **4,050 MWh/a (7.500 h. operation/a)**

Use of surplus heat: **Wood drying, District heating (planned)**

Technical Description

Garage Digester: **7 x 500 m³**

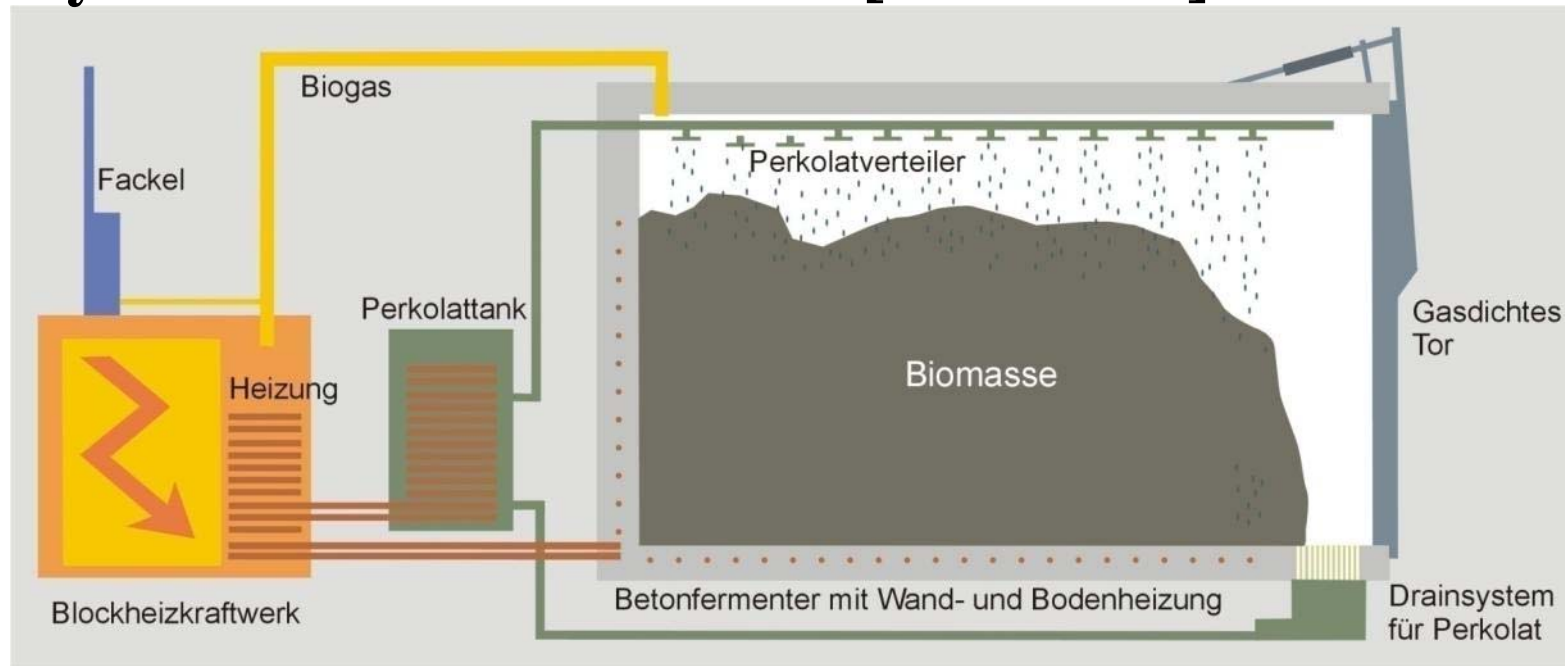
Percolation Tank: **320 m³**

Gas container (2 hours full CHP): **600 m³**

Sludge storage: **3600 m³**



Dry Fermentation of Biomass[DS > 20%]



„garage type“ digester
(BEKON, 2005)





Internationales
Biogas und
Bioenergie
Kompetenzzentrum

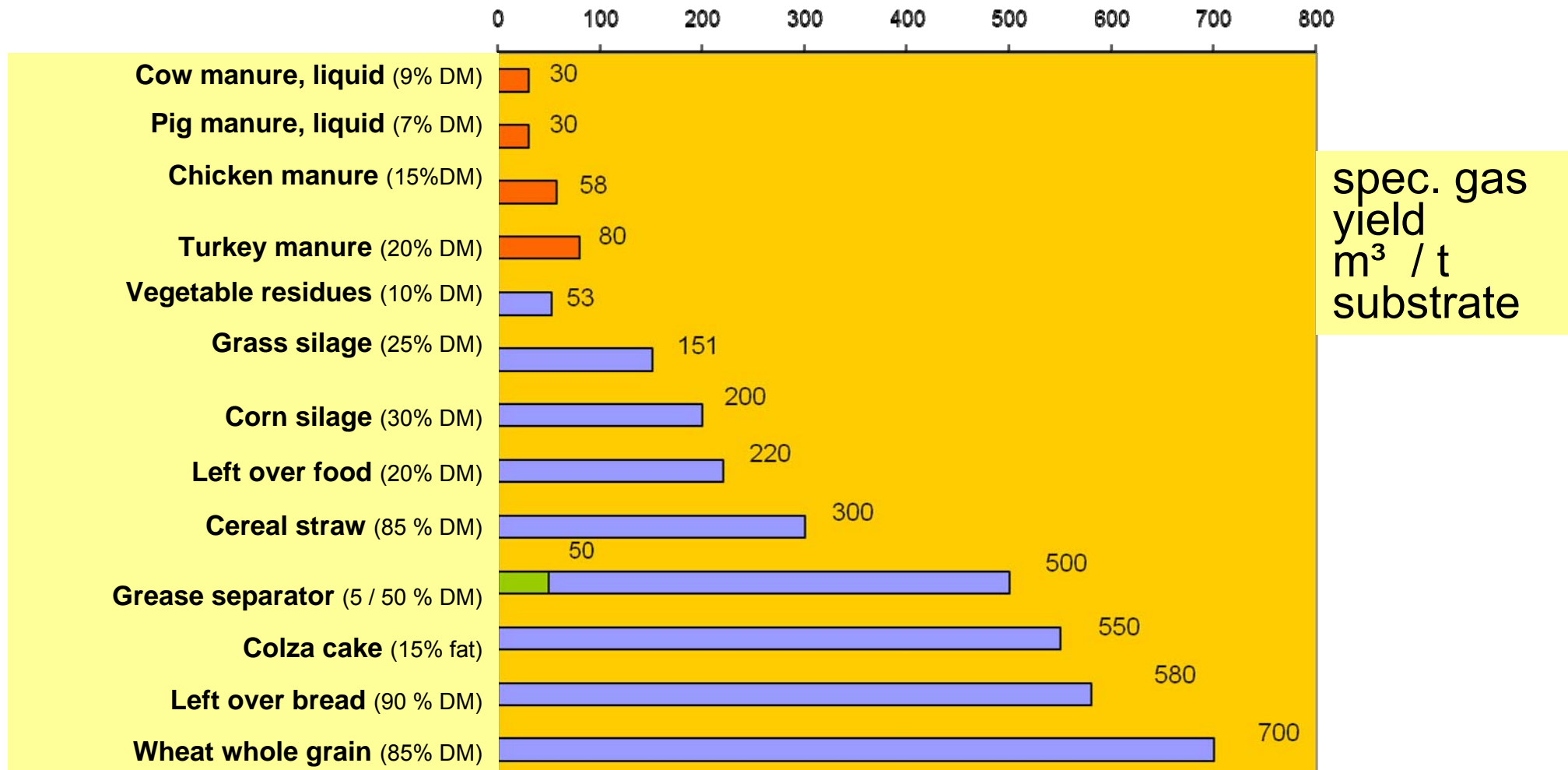
GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Biogas Situation in Germany

- Overview
- Feedstock & Market Perspectives
- Technology options: Energy Crops and Residues
- **Economics: feasibility, yields, Costs & benefits**



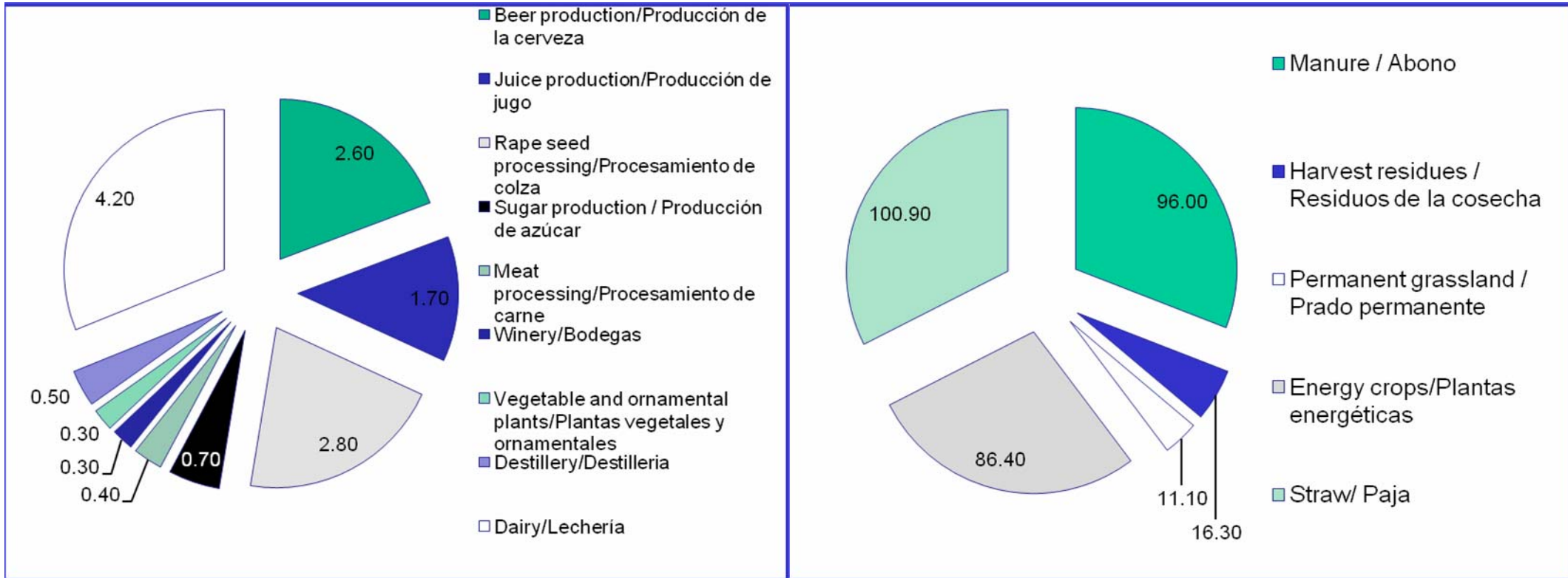
Gas yields from different substrates



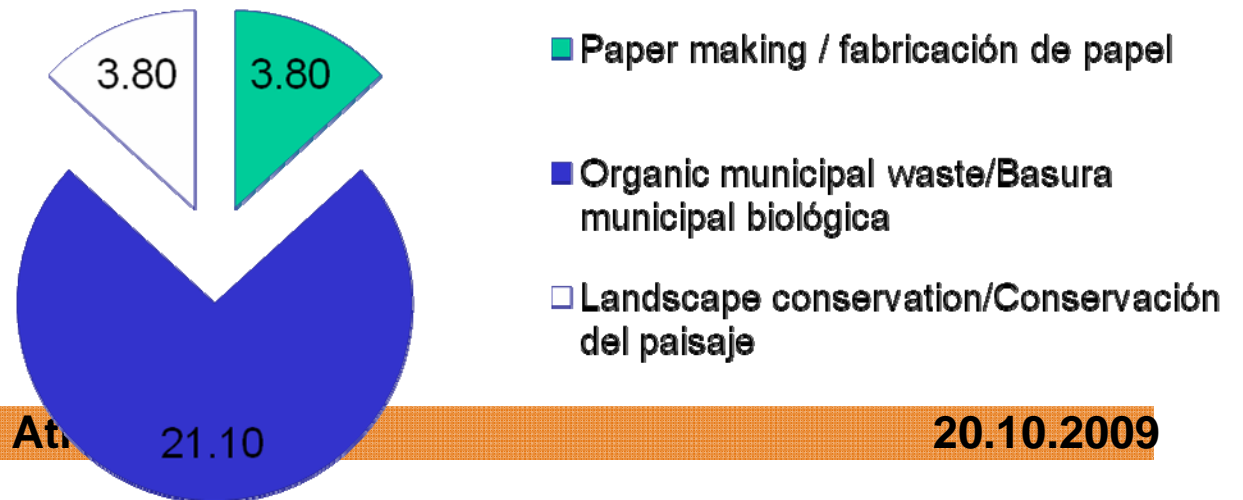
Industrial waste



Agricultural residues



Biodegradable Municipal waste



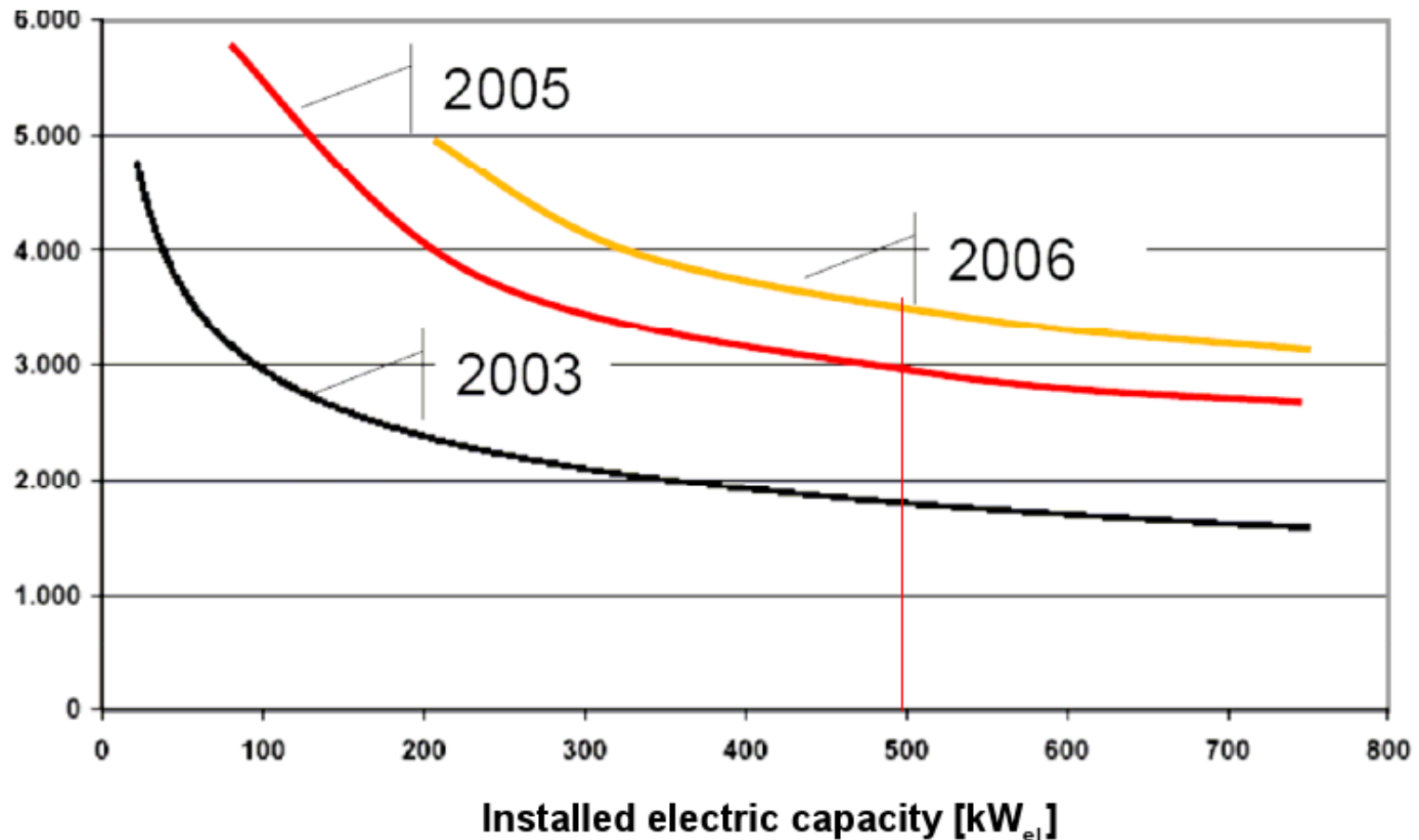


Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Investment costs of a biogas plant

Spec. investment costs €/kW_{el}



Quelle: DZ-Bank

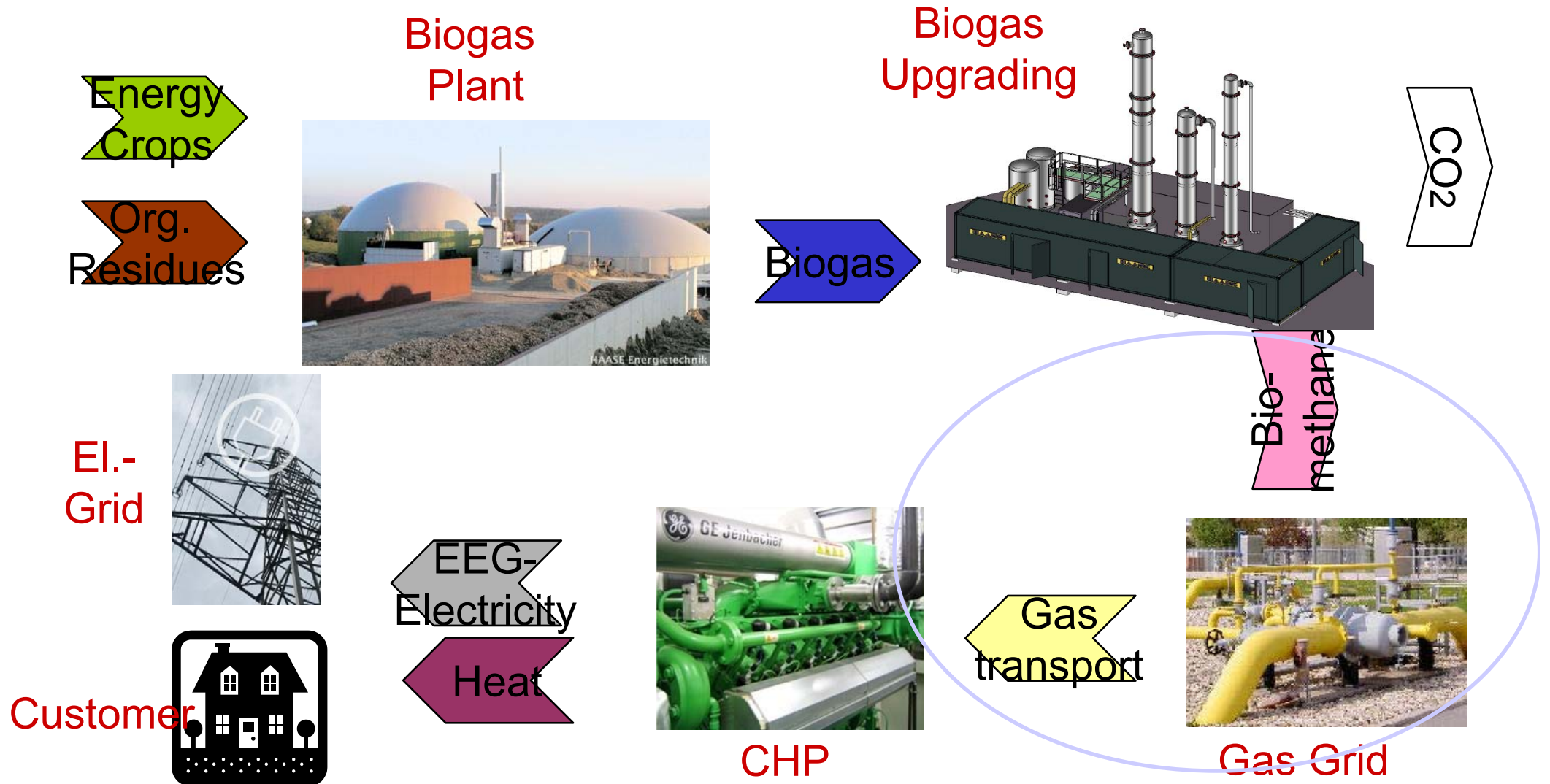
Source: DZ-Bank



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

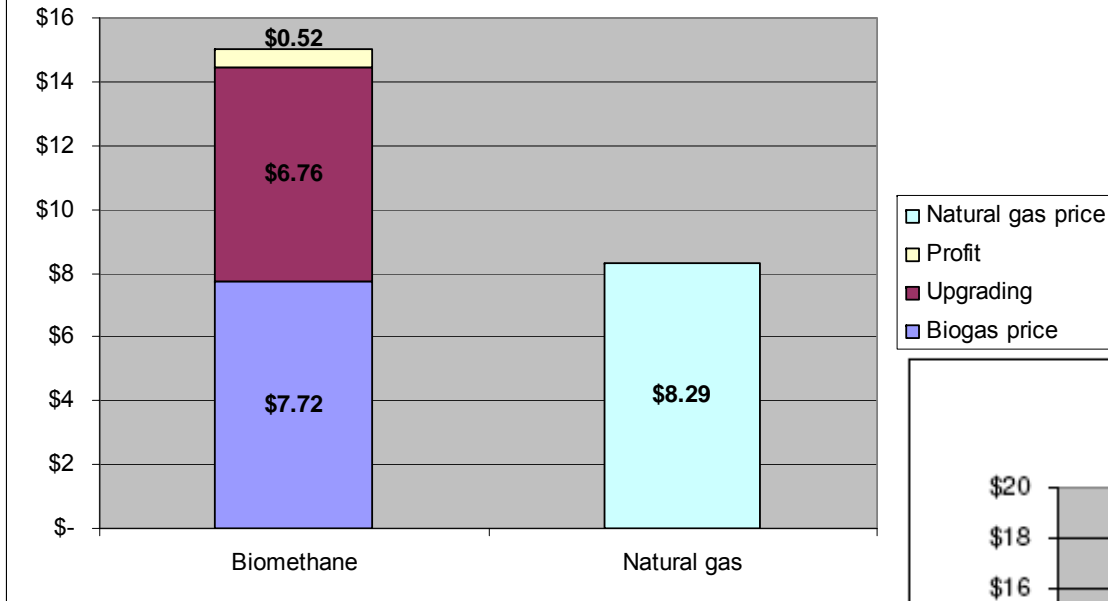
GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

Example Biogas Upgrading and CHP

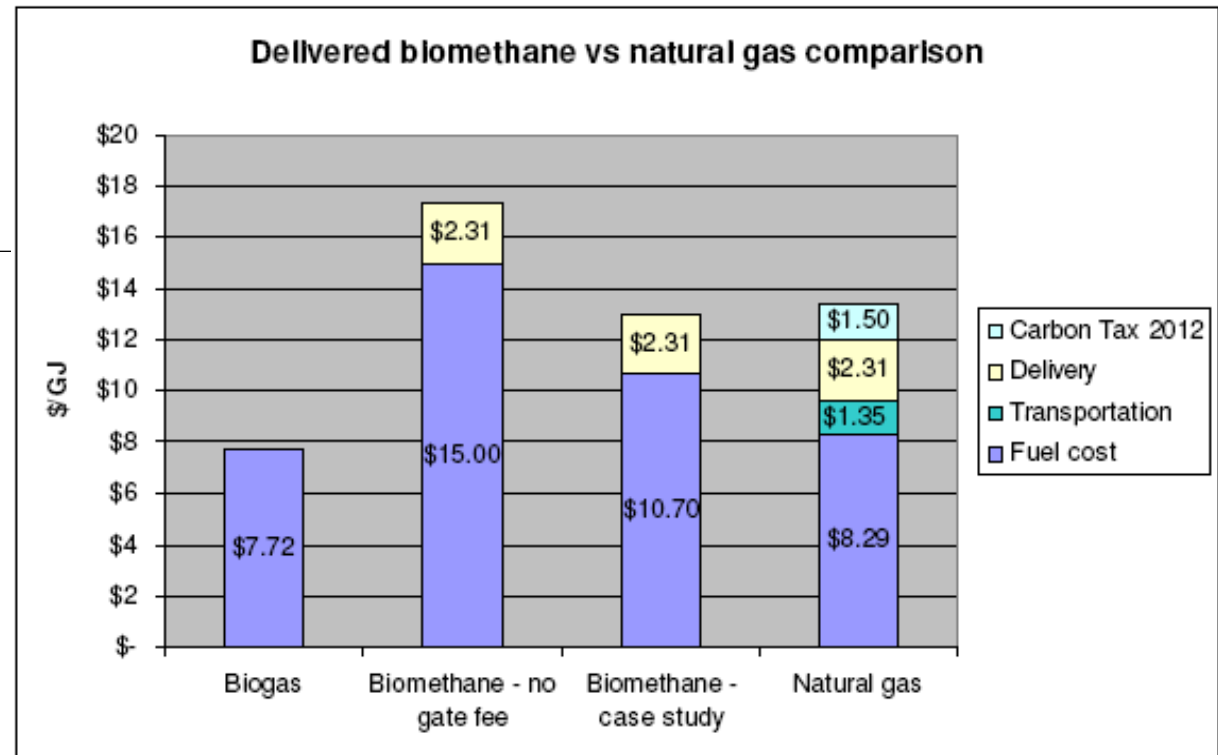




Worst case biomethane pricing



Economy of Biomethane Example Canada



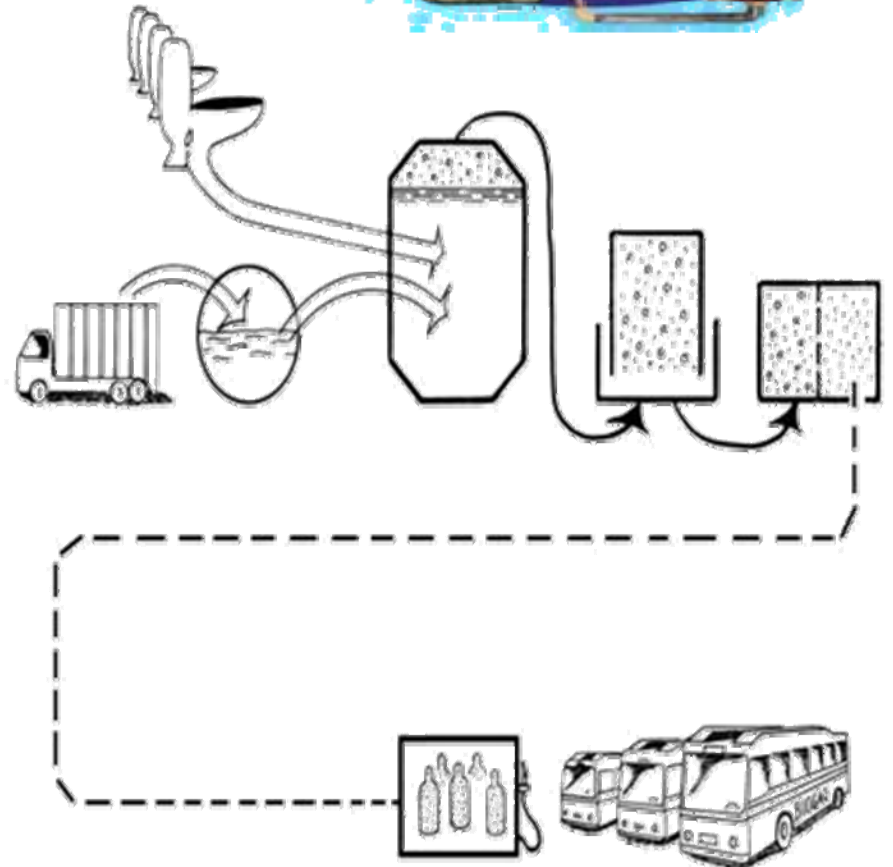


German Feed in Tariff for Electricity from Biogas in € cent/kWh; fixed for 20 years

	EEG 2000	EEG 2004	EEG 2009
Basic Compensation up to 150 KW	10 ct	11,5 ct	11,67 ct
150 – 500 KW	10 ct	9,9 ct	9,18 ct
over 500 KW	9 ct	8,9 ct	8,25 ct
Energy Crop - Bonus	-	6 ct	7 ct
Manure-Bonus (> 30%) to 150 KW	-	-	4 ct
150 – 500 KW	-	-	1 ct
Technology Bonus	-	2 ct	2 ct
Landscape Maintenance Grass Bonus (> 50%)	-	-	2 ct
Formaldehyd Emission Limit Bonus (only BimSch-Anlagen < 500 KW)	-	-	1 ct
Heat Utilisation-Bonus	-	2 ct	3 ct
Degression	1%	1,5% (only Basic)	1,5% (also Boni)



Closed loop economy





Internationales
Biogas und
Bioenergie
Kompetenzzentrum

GERBIO
German Society for Sustainable
Biogas and Bioenergy Utilisation

THANKS

for your attention!

Welcome to cooperate

www.gerbio.org
info@gerbio.org