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German Society for Sustainable Biogas and Bioenergy Utilisation

Big East Mobilization Campaign

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Riga - Latvia

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Report on the current situation and prospects of frame conditions for biogas technology in Germany and Europe

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GERBIO …

… is a German non-profit association
… was founded in 2001
… promotes sustainable closed-loop approaches as well as sustainable crop rotation systems
… opposes mono-cultures and GMO crops
… supports practioners with its knowledge and its world-wide network

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Focus points

- BIOGAS
- Plant oil utilisation
- Woodgas utilisation
- Manure management
- Decentralised wastewater treatment (ecosan)

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GERBIOs activities

- Knowledge transfer (seminars and trainings)
- Individual consultation
- Contacts to experts in planning, design and construction
- Contacts to companies
- Contact and networking to members in the different regions

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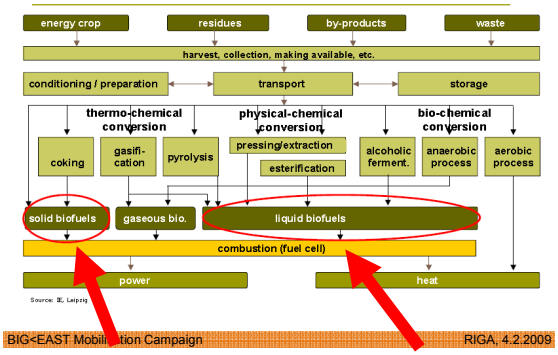
Technological Overview



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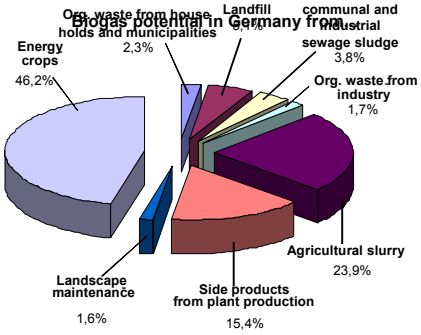
Result of conversion - Gaseous Biofuels -

Gaseous biofuels options:

- Fuel gas (CH_4; CO, H_2; …)
  - Gasification
- Biogas (CH_4)
  - Waste water treatment
  - Landfill gas
  - Livestock husbandry
  - Energy crops
  - Biowaste

Biogas potential in Germany from



Total potential: 24 Bil. m³ Biogas: 50 Mio. MWh power and 72 Mio. MWh heat

Quelle: P. Weiland FAL BS

Potentials of Biogas Technology

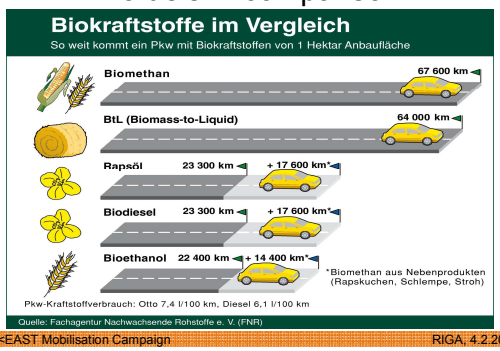
1. Biomethane is like natural gas - but home produced
   like natural gas - but supply secure
   like natural gas - but permanently economical

2. Potential: 10 Bil. cubic meter from 10% of the agricultural area
   (with an Energy production of 62.000 kWh / ha)
   - through optimisation possibly: 100.000 kWh / ha
   - 16 Bil. Cubic meter Biomethane (half of the imports from Russia)
   - up to 17% of the German Power Production
   - up to 20% of the German Natural Gas Consumption
   - up to 35 % of the German Traffic Fuel Consumption

3. Energy Crops have the largest Fraction in the Potential

4. First Successes in biogas specific Energy Crop production

Biofuels in comparison



Key Figures in the Development of the German Biogas Industry

	2005	2006	2007	2008	2009
Amount of Plants	2600	3500	3710	3900	4700
Installed capacity	650	1100	1270	1400	1600
Electrical energy (TW h/a)	2.8	> 5	7.4		
Fraction in German electricity production	0.5%	> 1%	1.4%	1.50%	1.70%
Turnover of Industry (Mrd. €)	0.5	1	0.65	0.5	1.05
Turnover of Operators (Mio. €)	360	650	750	850	950
Fraction in export	8%	12%	> 15%	>20%	25%
Employment	5000	10000	10000	8000	10500
CO2 Reduction Mio. t/a	2.5	5	6.4		

Source: Fachverband Biogas e.V. and own data

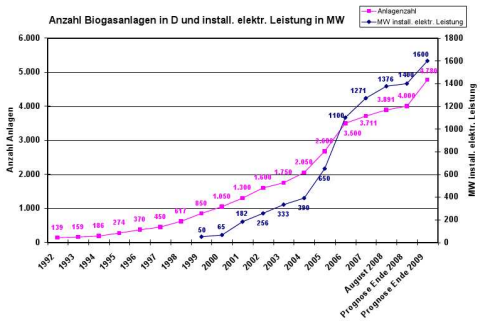


Abb. 1 Quelle: Fachverband Biogas e.V. 2008

Jährlicher Zubau von Biogasanlagen in Deutschland in Abhängigkeit der jeweils aktuellen rechtlichen Rahmenbedingungen – Entwicklung 1992 - 2009

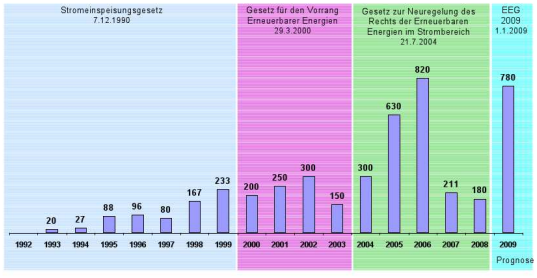
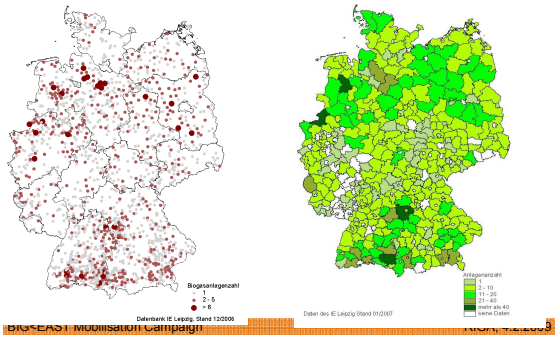
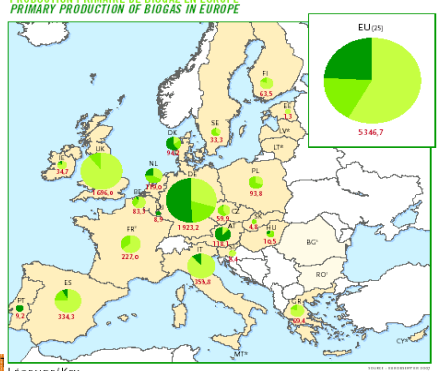


Abb. 2 Quelle Fachverband Biogas e.V. 2008

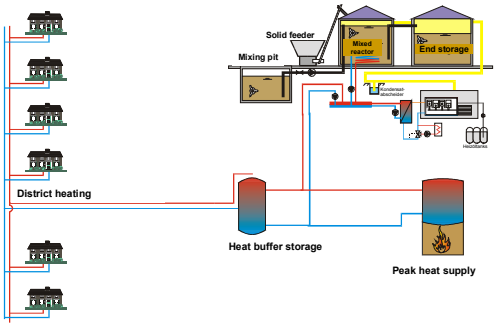
Biogas Plant Locations in Germany



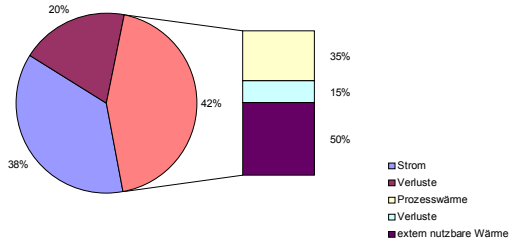
PRODUCTION PRIMAIRE DE BIOGAZ EN EUROPE
PRIMARY PRODUCTION OF BIOGAS IN EUROPE



Components of an Agricultural Biogas Heat and Power Station



Energy utilisation from biogas plants



Comparison between anaerobic digestion and composting of agricultural biomass

	Anaerobic digestion	Composting
Energy	production (300-600 kWh/t)	consumption (20-100kWh/t)
Sanitation	guaranteed under consideration of legal standards	guaranteed under consideration of legal standards
Emissions	low (odours, ammonia)	high (odours, ammonia, methane, nitrous oxide, hydrogen sulphate, germs)
N-Fertilising effect	fast	slow
Unsuitable substrates	tree and bush cuttings	half liquid substrates with no structure biomass without structure can only be composted after wood or other straw has been added

Biogas-technology: Cosubstrates

Organic waste

Old bread
Apple marc
Brewers grains
Biowaste
Separation fat
Flotation fat
Greace
Vegetable waste
Grain cleanings
Destillery grains
Glycerin
Coffee draff
Cocoa shells
Potatoe greens
Potatoe peeling waste
Destilled potatoes
Leaves
Molasses
Wey
Fruit peelings
Rapeseed cake
Grass cuttings
Canteen waste
Onion peels

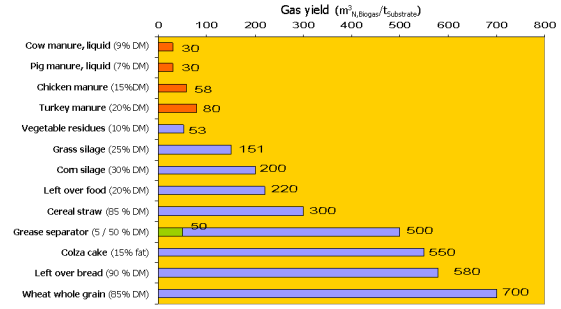
Since EEG 2004 Trend

evtl. high returns (gate fees)

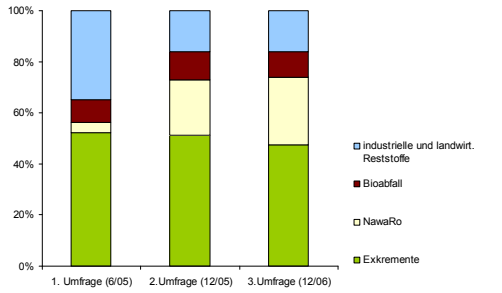
Energy crops

CCM
Fodder peas silage
Fodder beet silage
Grain destillery waste
Straw
Grassilage
Green rye silage
Green oat silage
Potatoes
Potatoe destillery waste
Clover grass silage
Lucerene silage
Maize
Maizesilage
Rape seeds
Rye
Clover silage
Fodder beet silage
Sunflower silage
Triticale
Grassilage
Wheat
Green wheat silage
Sugarbeet silage

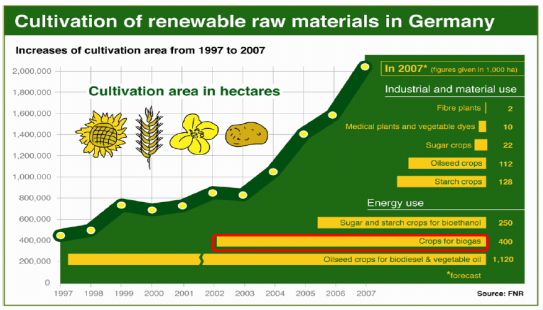
Biogas yields from different substrates

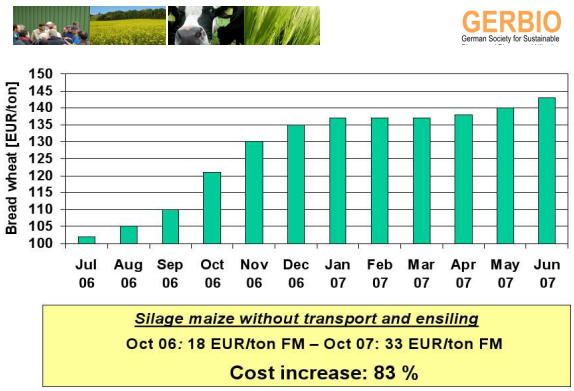


Feedstock in German Biogas Plants



German status of energy crop utilisation





Silage maize without transport and ensiling

Oct 06: 18 EUR/ton FM – Oct 07: 33 EUR/ton FM

Cost increase: 83 %

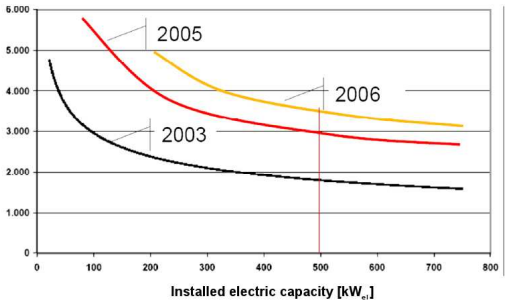
Source: vTI Johann Heinrich von Thünen-Institut

Profit of a 500 kW biogas plant with silage maize (7,750 h/a, η_{el}=37 %, no heat utilization)

Silage maize [EUR/ton]	Investment costs [EUR/kW_{el}]		
	3,000	3,500	4,000
18.00	155,500	129,800	104,000
20.00	135,800	110,000	84,300
22.00	116,00	90,300	64,600
24.00	96,200	70,500	44,800
26.00	76,500	50,700	25,000
28.00	56,700	31,000	5,300
30.00	36,900	22,200	-14,500

Source: DZ-Bank

Spec. investvestment costs €/kW_{el}



Source: DZ-Bank

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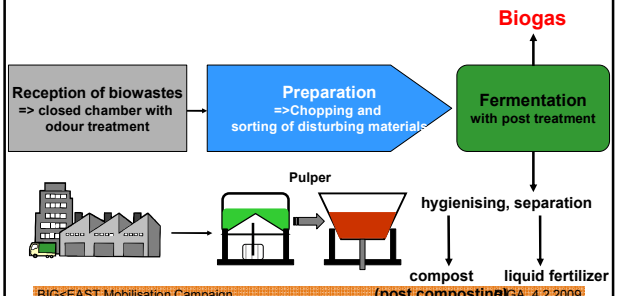
Example Process chain for the digestion of biowaste



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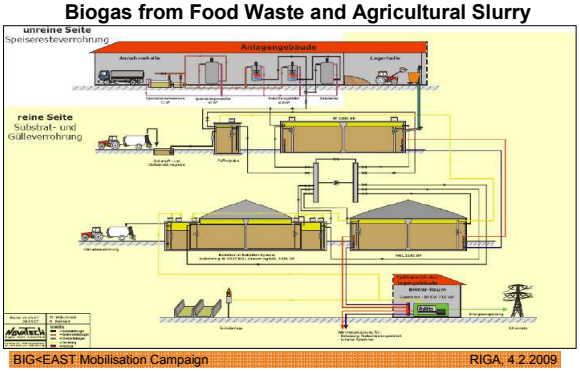
Biogas from Food Waste and Agricultural Slurry



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Economy of biowaste treatment plants:

- Income of gate fees and energy sales
- Higher technological standard => high investment costs
- Higher approval conditions => higher costs
- Examination and testing costs
- No agricultural subsidies
- Restricted spreading possibilities

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Digester Systems

Wet Fermentation
- Completely mixed digester
- Plug flow digester

Dry Fermentation
- Plug flow digester
- Garage type batch digester

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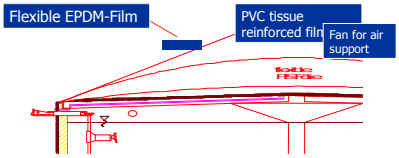

Advantages:
- simple digester repair
- integrated gas holder
- well weather prooved
- easy indication of gas yield

Disadvantages:
- more expensive than one cover
- not 100% gastight
- permanent energy consumption through air fan

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Concrete digester with double membrane cover

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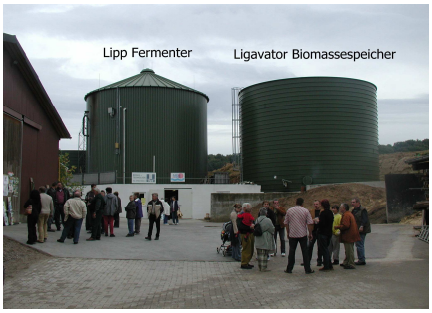
Stainless steel digester



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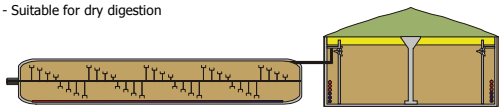
Horizontal digester with paddle stirrer

Advantages:
- digesting high solids content
- high loading rate possible
- little short cut flow
- automatic sand drain
- complete mixing
- high digester productivity
- Suitable for dry digestion

Disadvantages:
- high price
- only possible with after digester
- limited in size



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Horizontal digester with paddle stirrer

Steel or Concrete

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„garage type“ digester

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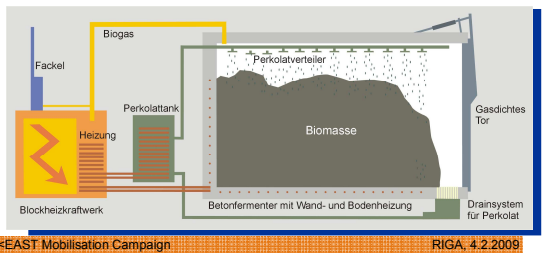
Dry Fermentation System for Biomass over 20% DS

Principal Function



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Outlook 2009

- New EEG is in place with focus on efficiency, ecology and emission reduction
- New biogas grid feed in regulations are in place since March 2008
- More incentives for on farm biogas plants and waste treatment
- 20 projects for grid injection in the planning phase, 13 are in place
- Aim of Federal Government of 10 % Biogas in the natural gas grid by 2030

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New EEG and compensation for Energy utilisation from biogas

	Installierte elektrische Leistung	2009, (altes EEG) Ct (kWh)	2009 (EEG Novelle) Ct (kWh)	Differenz Ct (kWh)	Gültig für alte Anlagen
Grundvergütung	bis 150 kW_{el}	10,67	11,67	1,00	ja
	150 - 500 kW_{el}	9,18	9,18	-	
	500 kW_{el} – 5 Mw_{el}	8,25	8,25	-	
NaWaRo-Bonus	bis 150 kW_{el}	6,00	7,00	1,0	ja
	500 kW_{el} – 5 Mw_{el}	4,00	4,00	0	
Gülle-Bonus(1)	bis 150 kW_{el}	-	4,00	4,00	ja
	150 - 500 kW_{el}	-	1,00	1,00	ja
KWK-Bonus(2)		2,00	3,00	1,00	ja
Technologie-Bonus(3)		2,00	2,00	-	
BImSchG-Bonus(4)	bis 500 kW_{el}	-	1,00	1,00	ja
Landschaftspflege-Bonus(5)		-	2,00	2,00	ja

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Thank you for your Attention!

Michael Köttner

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