



Internationales
Biogas und
Bioenergie
Kompetenzzentrum

Big East Mobilization Campaign

***10 September 2008
Sofia - Bulgaria***

Michael Köttner

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



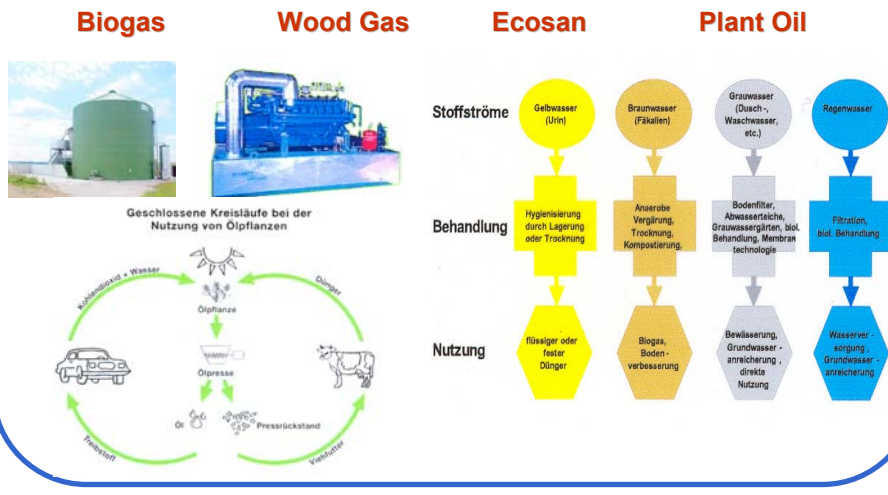
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The **International Biogas and Bioenergy Competence Center (IBBK)** is an amalgamation and network of experts and companies, as well as interest groups and educational institutes in the field of **biogas and bioenergy**. The work of the **IBBK** covers regional, national and international activities. The Competence Centre is setting up an additional impulse beyond the traditional lobby work and is striving to cover the growing demand for independent, neutral dissemination of information in the field of biogas and bioenergy. The main emphasis is in educational and project work.

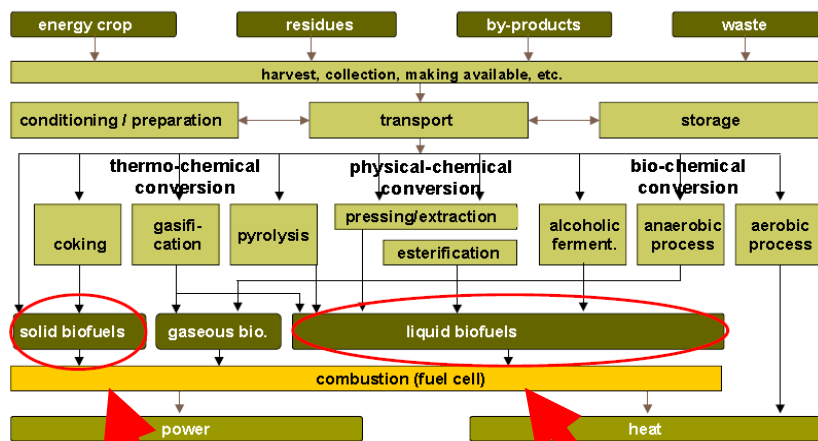
The services of IBBK are:

- **Consulting**
- **Studies**
- **International Cooperation**
- **Seminars, Conferences**
- **Fieldtrips, Study Tours**
- **Lobby work**

IBBK understands its work as an additional impulse to a traditional associations- and lobby work and is striving to cover the growing demand in company independent, neutral knowledge transference in the following subjects:



Technological Overview



Result of conversion

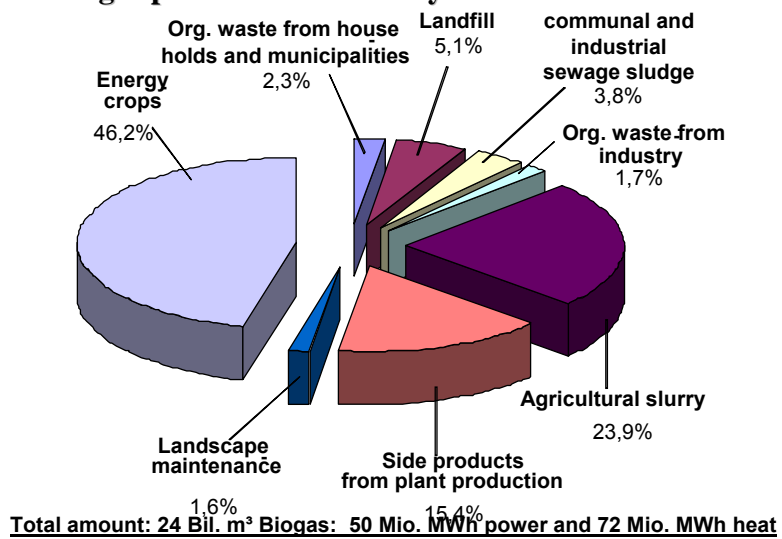
- Gaseous Biofuels -

Gaseous biofuels options:

- Fuel gas (CH₄; CO, H₂; ...)
- Gasification
- Biogas (CH₄)
- Waste water treatment
- Landfill gas
- Livestock husbandry
- Energy crops
- Biowaste



Biogas potential in Germany from...



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

Key Figures in the Development of the German Biogas Industry

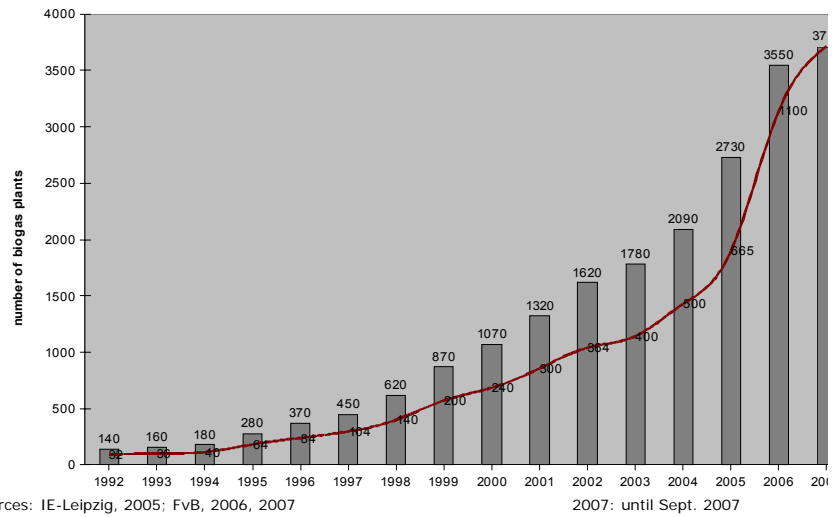
	2005	2006	2007	2008	2009
Amount of Plants	2600	3500	3710		
Installed capacity	650	1100	1270	1370	1740
Electrical energy (TW h/a)	2,8	> 5	7,4		
Fraction in German electricity production	0,5%	> 1%	1,4%		
Turnover of Industry (Mrd. €)	0,5	1	0,65	0,6	1,05
Turnover of Operators (Mio. €)	360	650	750		
Fraction in export	8%	12%	> 15%		
Employment	5000	10000	10000	?	10500
CO2 Reduction Mio. t/a	2,5	5	6,4		

Source: Fachverband Biogas e.V. and own data

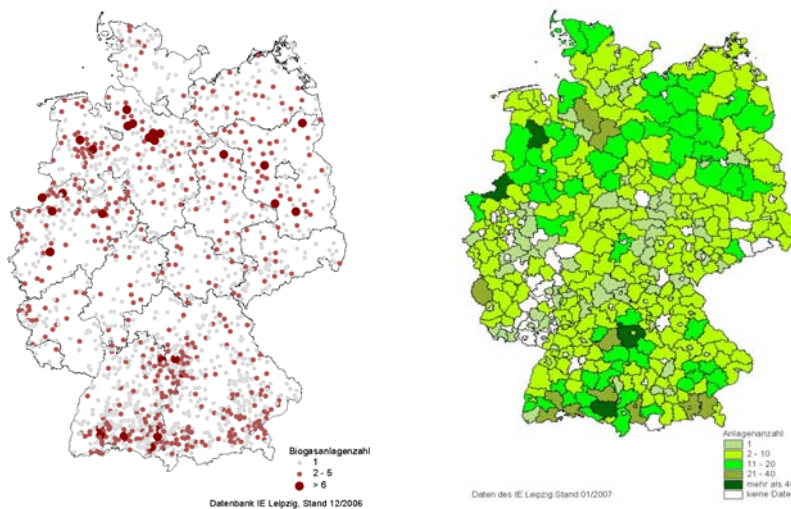


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Agricultural Biogas Plants in Germany



Biogas Plant Locations in Germany

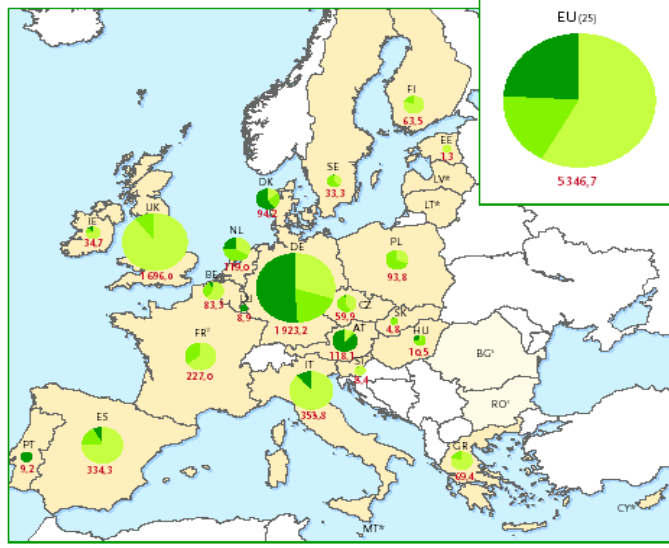




Fachgruppe Biogas, Westfälische

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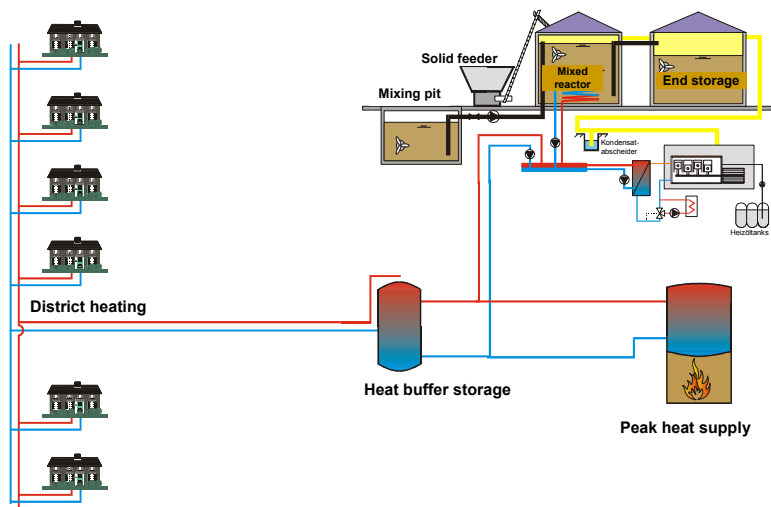
PRODUCTION PRIMAIRE DE BIOGAZ EN EUROPE PRIMARY PRODUCTION OF BIOGAS IN EUROPE



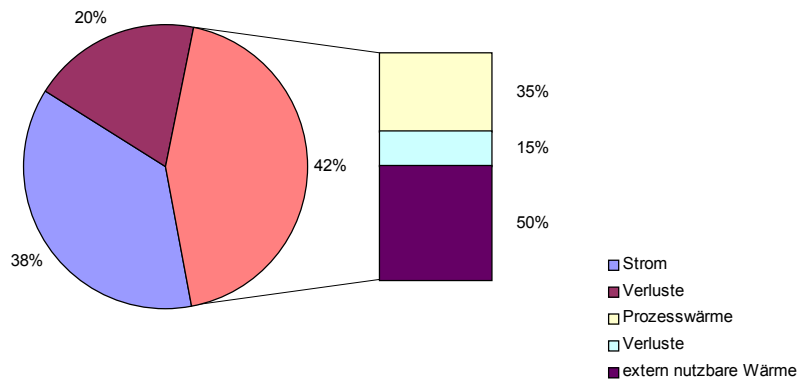
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Components of an Agricultural Biogas Heat and Power Station



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



Organic waste

- Old bread
- Apple marc
- Brewers grains
- Biowaste
- Separation fat
- Flotation fat
- Grease
- 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
-

Biogas- technology: Cosubstrates

Since EEG 2004 Trend

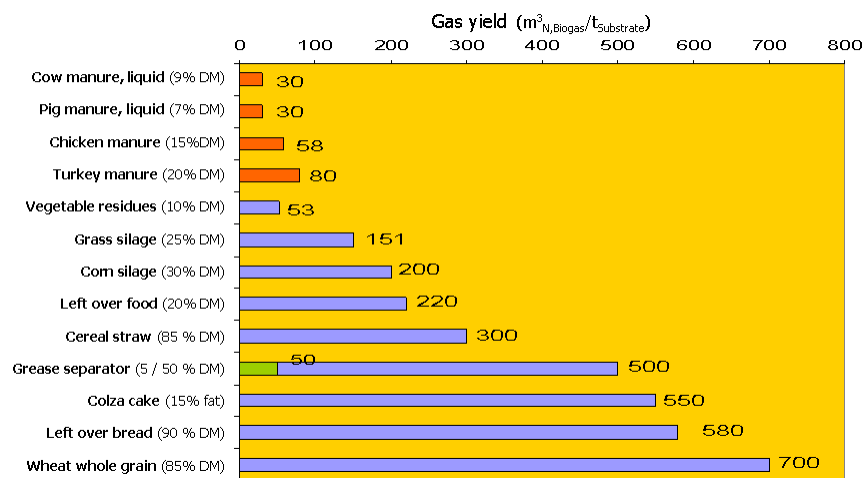
evtl. high returns
(gate fees)]

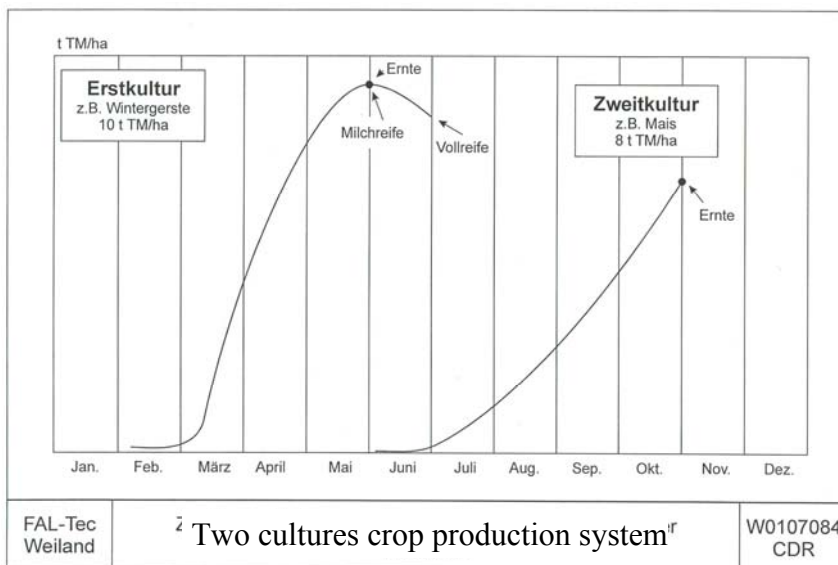
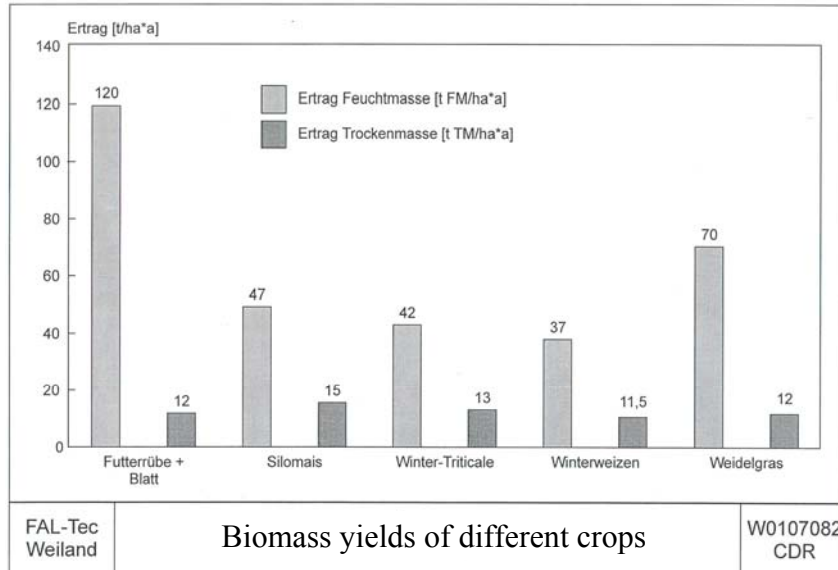
Energy crops

- 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







Advantages of energy crop digestion

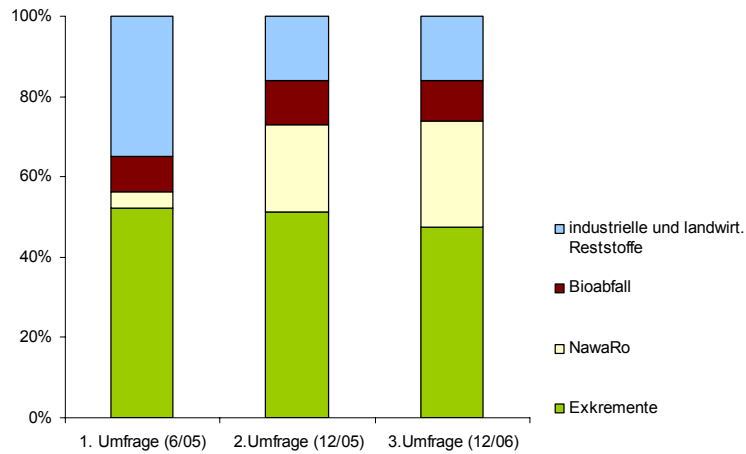
- Undisturbed availability of substrates through crop production on demand in the vicinity of the biogas plant
- High biogas yields through a high energy density of easily digestible organic dry matter
- Possibility of an exact biogas production through easily digestible organic dry matter



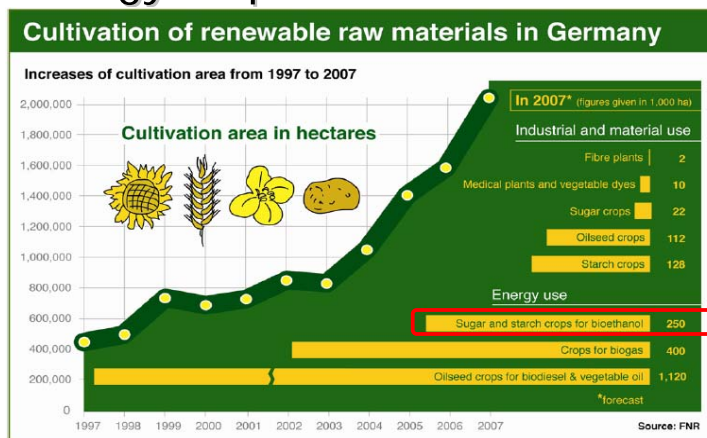
Advantages of energy crop digestion

- patogen free, therefore unrestricted application on farms with animal husbandry
- No dependency of the free market and the availability of biowastes
- Unrestricted application of digestate as fertilizers as there are no toxic and heavy metal contaminants

Feedstock in German Biogas Plants



German status of energy crop utilisation



source: Fachagentur Nachwachsende Rohstoffe, 2007

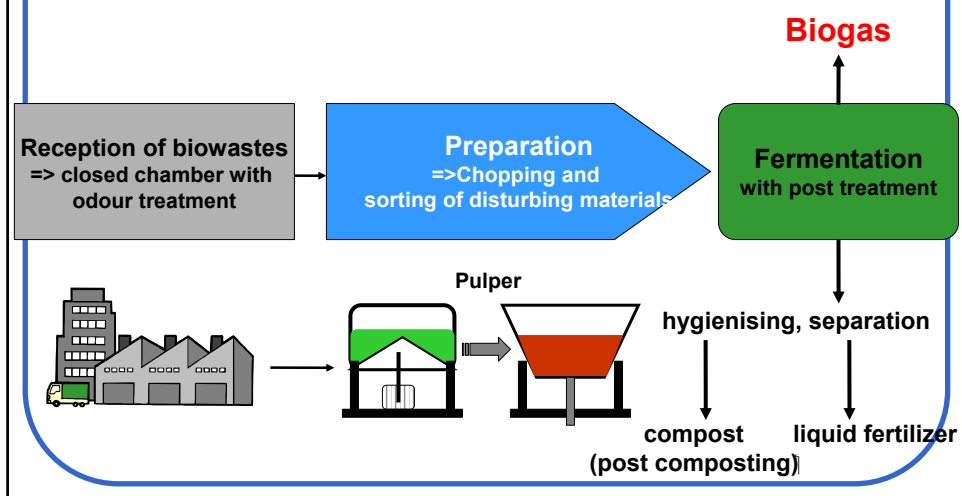
German status of energy crop utilisation

	1. Survey (2005)		2. Survey (Dec. 2006)		2007 *	
	average costs [€/ t]	variations [€/ t]	average costs [€/ t]	variations [€/ t]	average costs [€/ t]	variations [€/ t]
Corn silage	23,5	15 – 35	26	15 – 40	30	20 – 45
Cereals	101,8	95 – 110	112	70 – 150	180	120 – 250
Total plant silage	16	6 – 30	23	20 – 29	n.a.	n.a.
Grass silage	17,9	5 – 30	25	14 – 40	n.a.	n.a.



source: IEL, 2007, * own data

Example Process chain for the digestion of biowaste



Contaminants Removal from Biowaste

Typical contaminations are for example, bones, glass, plastic bags, tins, knives or plates.



Food waste
from Restaurants



Food waste (expired stuff)
from Supermarkets



Organic waste, separate
collected from households

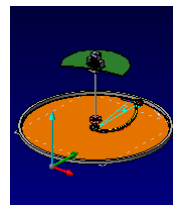
The Contaminant Removal Process



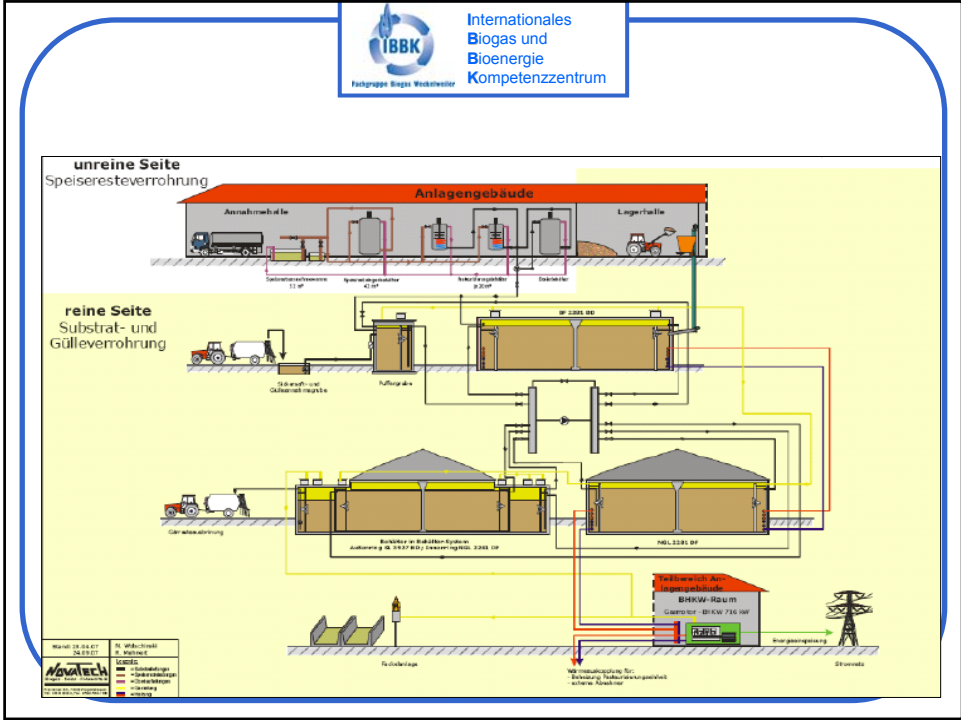
A) Conditioning
(Shredder)



B) Pre-Treatment
80% removal



C) Final Removal
100% removal



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

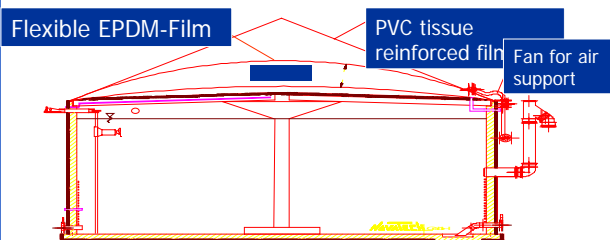
Digester Systems

Wet Fermentation

- Completely mixed digester
- Plug flow digester

Dry Fermentation

- Plug flow digester
- Garage type batch digester



Advantages:

- simple digester repair
- integrated gas holder
- well weather proofed
- easy indication of gas yield

Disadvantages:

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



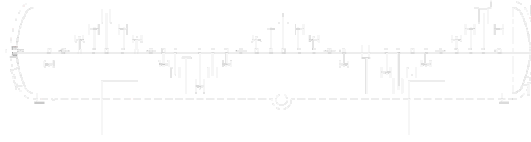
Concrete digester with double membrane cover



Stainless steel digester



Horizontal digester with paddle stirrer

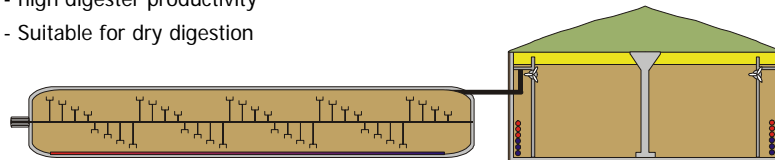


Advantages:

- 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



Horizontal digester with paddle stirrer



Steel or
Concrete



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„garage type“ digester

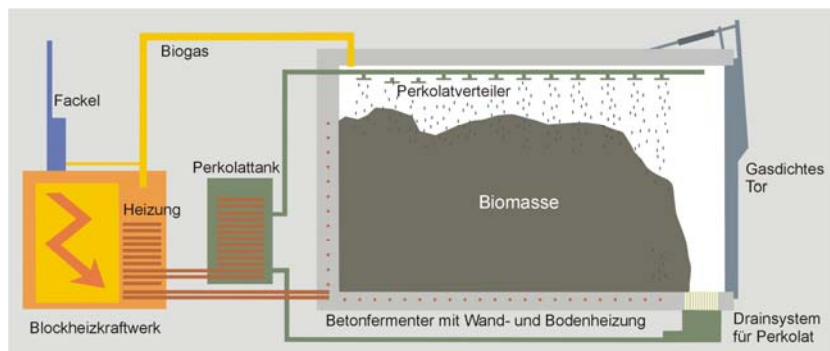


Fachgruppe Biogas/Windenergie

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Dry Fermentation System for Biomass over 20% DS

Principal Function





Status of Development

- High technological standard of development
- Over 1000 companies in the field
- Over 3700 Biogas plants in operation
- Technology for biogas upgrading and fuel for vehicle available
- 6 biogas feed in and 2 fuel for vehicle projects
- Technology for heat and digestate utilisation



Constraints for development

- **Crop prices too high for energy production**
- **High retail prices for biogas plants**
- **Increasing problems with public complaints**
- **Not enough waste for cofermentation**
- **Export can't grow fast enough**
- **More than half of existing plants in financial difficulties**
- **Slow down in 2007 from 800 to 200 new projects**
- **In 2008 almost no contracts for new projects**

Outlook 2008

- New EEG is on the way 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
- Aim of Federal Government of 10 % Biogas in the natural gas grid by 2030

New EEG and planned compensation for Energy utilisation from biogas

Biogas	Plant size	2009, present in Ct(kWh)	draft in Ct(kWh)	Difference in Ct(kWh)	For existing plants
Basic compensation	Up to 150 kW	10,67	11,67	1,00	Yes
	150 to 500 kW	9,18	9,18	-	
	500 kW to 5 MW	8,25	8,25	-	
Energy Crop Bonus	Up to 500 kW	6,00	8,00	2,00	Yes
	500 kW to 5 MW	4,00	4,00	-	
Manure Bonus	Up to 150 kW	-	2,00	2,00	Yes
Heat Bonus¹		2,00	3,00	1,00	
Technology Bonus		2,00	2,00	-	Yes ²

1: pro kWh
only for biogas plants starting heat utilisation in 2009

2:



Biogas Compensation Systems in Europe (2008)

Country	Tariff Range [€/cent/kWh]	Tariff System	Amount of agricultural Biogas Plants	Installed capacity
Austria	Biogas 11.9 – 16.94 Sewage gas 4.04 – 5.94	2008 Law 13 years fixed price until end 2004 approval and went in force at half 2006 (sewage gas) and at end 2007 (biogas)	159 – 150 until End 2007	29 – 40 MW until End 2007
Belgium	6.5 – 10 8.44	Green certificates (Quota system) 15 years fixed tariff + Aid until 20% of the cogeneration unit construction cost (max. 15 000€) In Wallonia: additional 1 or 2 years aid	6	12.62 MW
Croatia	11.73 10.8	<1 MW >1 MW	Data not showed	Data not showed
Denmark	10	10 years fixed tariff	58 (single farm) 20 (community)	40 MW
Finland (2007)	3.1	Tax reduction, market price	-	-
France	11 – 14	Fixed Price since August 2006	4	-
Germany	11.67 – 26.17	20 years fixed tariff	>3500	1100 MW
Great Britain (2007)	11 – 12.47	Quota system (variable)	<20	< 2 MW
Greece	7.3 – 8.46	Fixed for 10 years	-	-
Ireland	7 7.2	Sewage gas Biogas Green certificates (variable)	5	0.2 MW
Italy	30 6.5 + 12.4	Feed-in tariff for installation < 1 MW Green Certificates > 1 MW	120 in South and North Italy	81.64 MW
Latvia	17	10 years fixed tariff, coupled with gas market prices	Data not showed	Data not showed
Netherlands (2007)	9.7	Until End 2006	30	3.8 MW
Poland	10.9	Market price (3.8) + Green certificate (variable: in June 2008 = 7.1)	-	-
Portugal	11.5 – 11.7	15 years fixed prices	-	-
Slovakia	12.9 17.6 15.97	Sewage and waste gas Biogas from 1 MW less plant Biogas from 1 MW more plant Tariffs are fixed year after year and not on the long term. The feed-in tariff law could even disappear this year.	Data not showed	Data not showed
Spain	8.23 + 4.08 13.35 + 10.08 9.96 + 6.61	Sewage gas (feed-in tariff + bonus) Biogas (feed-in tariff + bonus, power < 500kW) Biogas (feed-in tariff + bonus, power > 500kW)	-	-
Sweden (2007)	-	Green Certificates / Market price +25% Subsidy (biogas as a vehicle fuel, no electricity)	-	-



Thank you for your Attention!

Michael Köttner

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