Internationales
Biogas und
Bioenergie
Kompetenzzentrum

Fachgruppe Biogas Weckelweiler

Methane to Markets Partnership Expo
30 October - 1 November 2007
China World Hotel, Beijing, China

German and European Biogas Experience

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1. German Biogas potential and substrates supplied
2. Regulatory Climate - Germany & Europe
3. Applied Technologies
4. Summary

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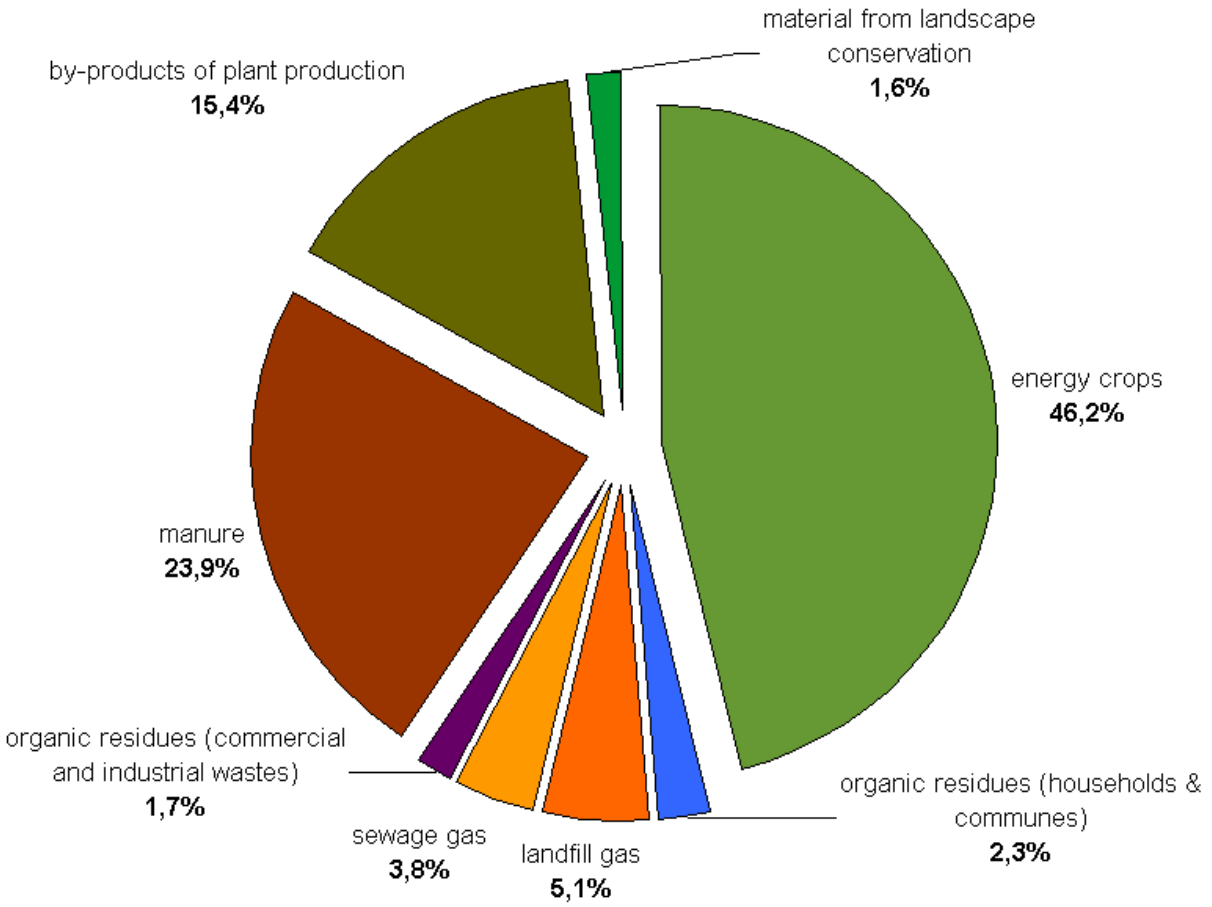
The **International Biogas and Bioenergy Competence Center (IBBK)** is an amalgamation and network of experts and companies, as well as interest groups and educational institutes in the field of **biogas and bioenergy**. The work of the **IBBK** covers regional, national and international activities. 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, Confernces**
- **Fieldtrips, Study Tours**
- **Lobby work**

Biogas potential in Germany from...



Total potential of biogas production in Germany:

24 billion m^3

corresponding energy production:

electricty

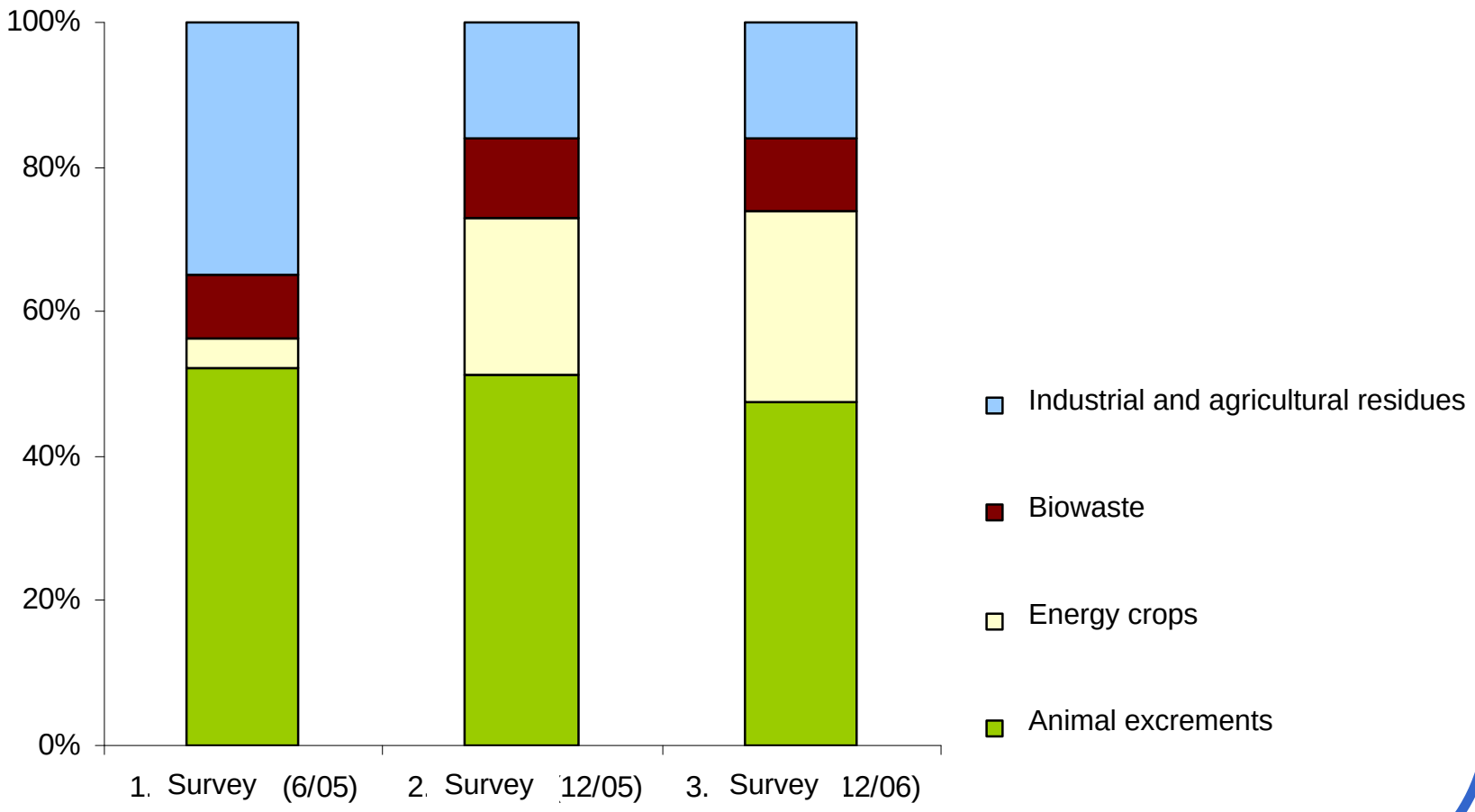
50 million MWh

heat

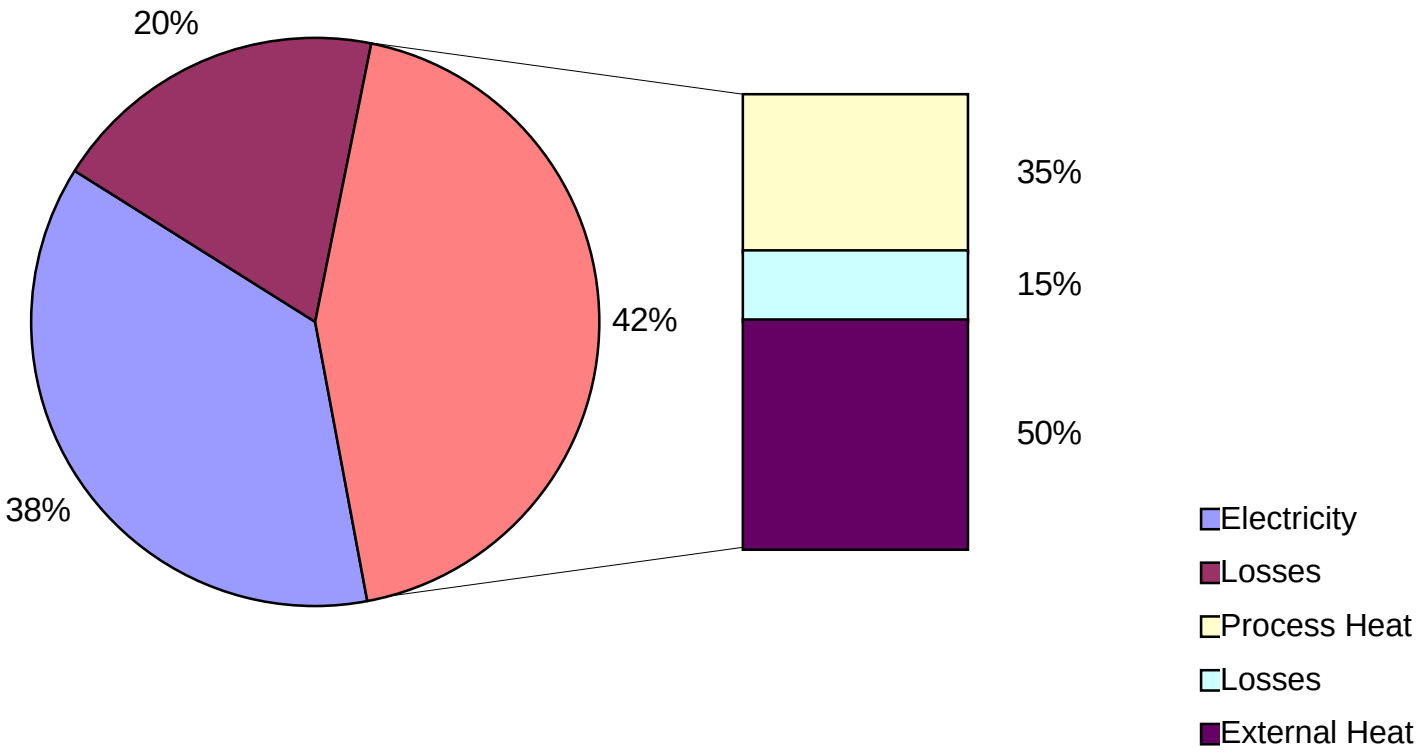
72 million MWh

Source: P. Weiland FAL BS

Feedstock in German Biogas Plants



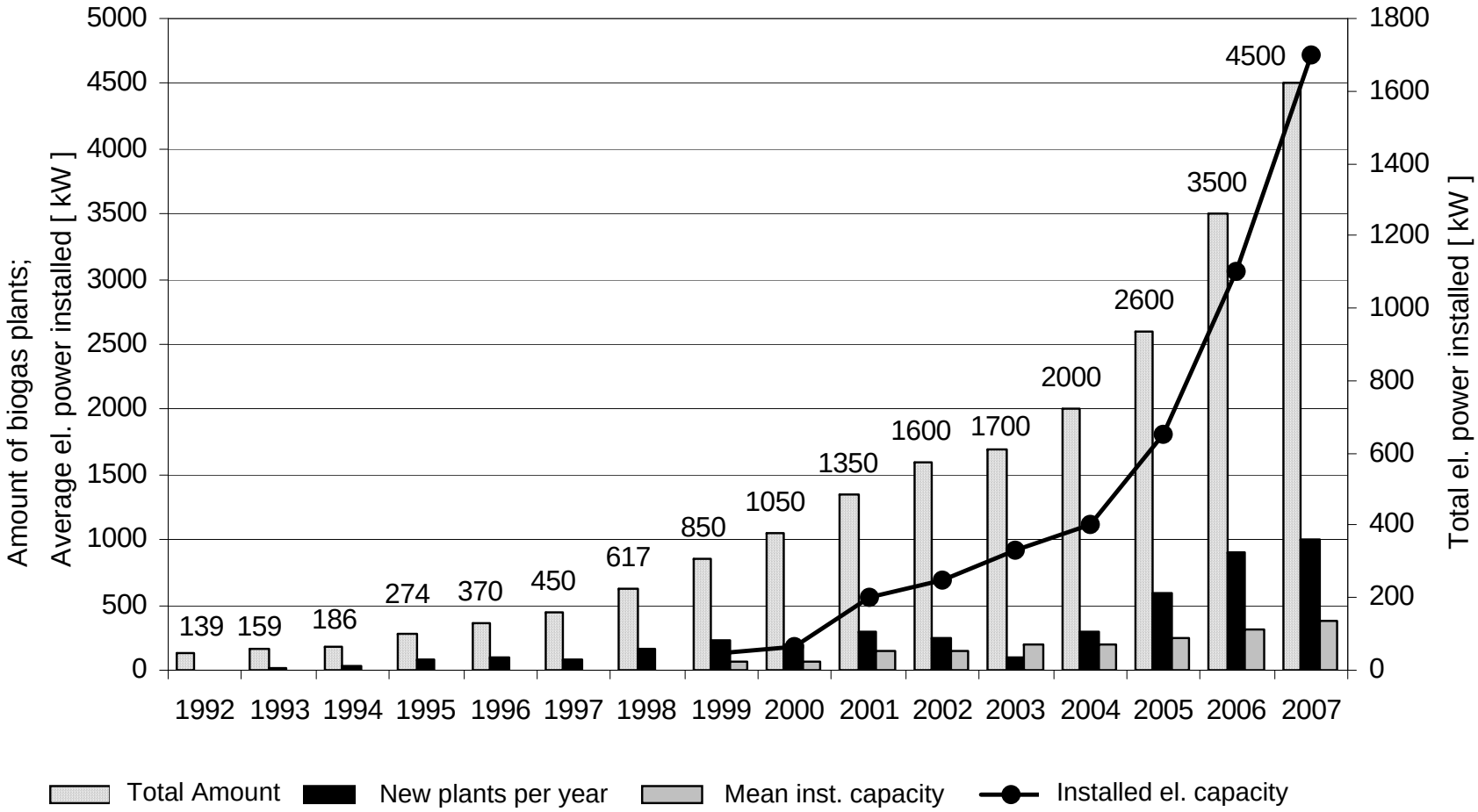
Energy utilisation from Biogas plants



Regulatory Climate - German feed-in tariffs 2007

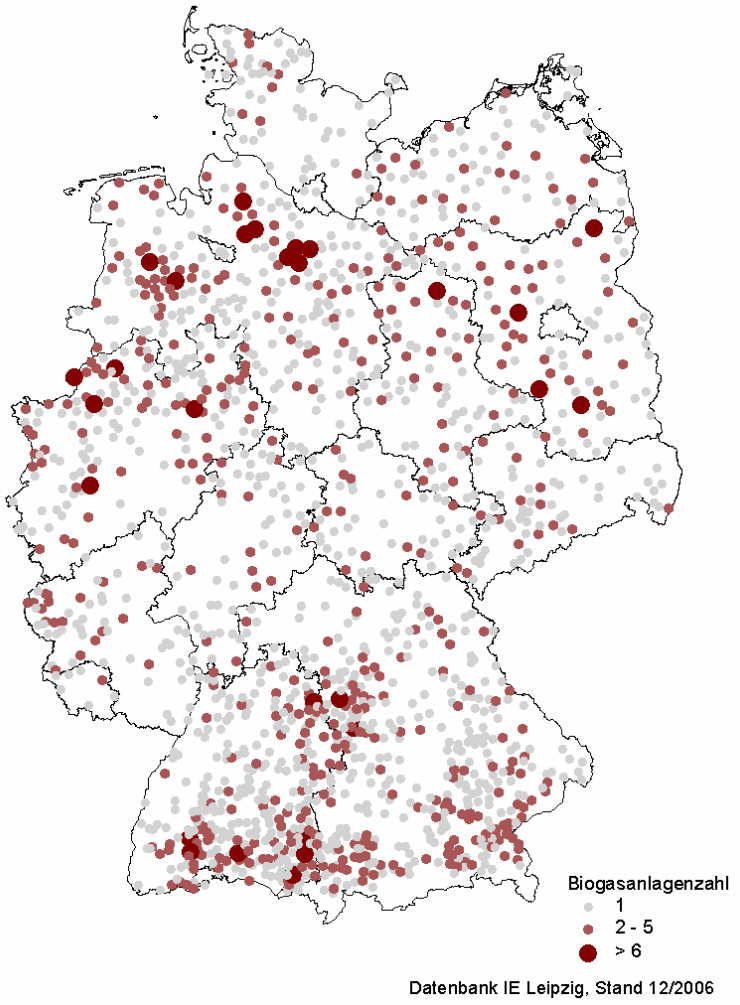
		Up to 150 kW_{el}	Up to 500 kW_{el}	Up to 5 MW_{el}	over 5 MW_{el}
Basic compensation	Old plants	like before			
	New Plants	10,99	9,46	8,51	8,03
Bonus for energy crops	Old plants	6	6	4	-
	New plants	6	6	4	-
CHP Bonus	Old plants	-	-	-	-
	New plants	2	2	2	2
Technology Bonus (only if CHP condition is fulfilled)	Old plants	-	-	-	-
	New plants	2	2	2	-

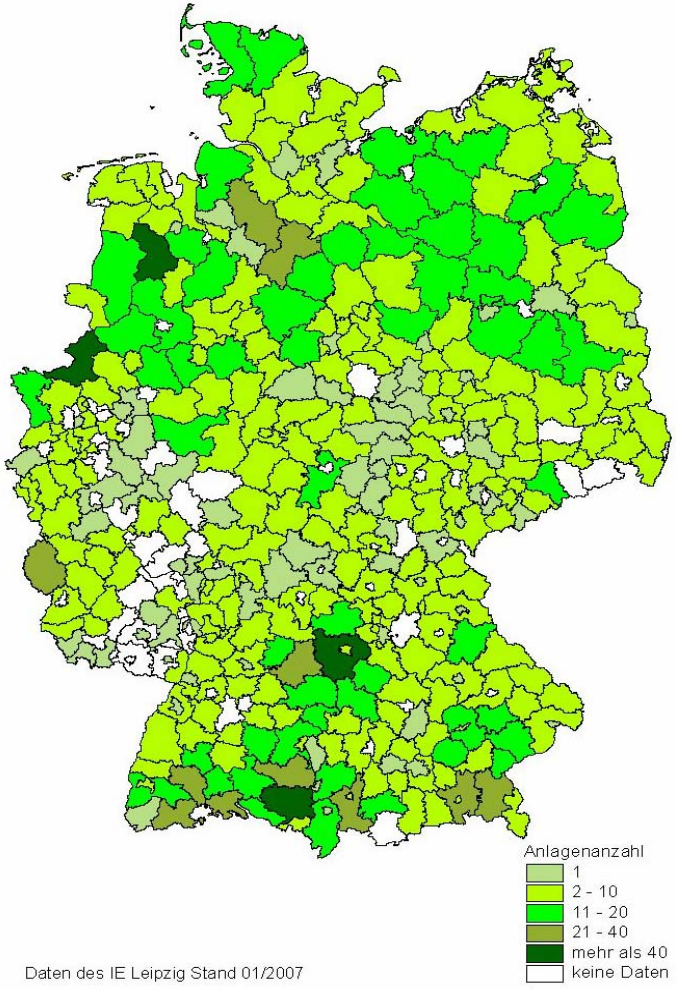
Regulatory Climate - Results 1



Source: German Biogas Association 2007

Regulatory Climate - Results 2





Regulatory Climate - Results 3

	2005	2006	2020
Amount of Plants	2.600	3.500	?
Installed capacity	650	1.100 MW	9.500 MW
Electrical energy	2,8 TWh/a	>5 TWh/a	76 TWh/a
Fraction in german power production	0,5%	> 1%	ca. 17%
Turnover of Industry	490 Mio.	> 1 Mrd.	7,6 Mrd.
Turnover of Operators	360 Mio	650 Mio	11,1 Mrd
Fraction in export	8%	12%	> 30%
Employment	5.000	10.000	85.000
CO_2 Reduction	2,5 Mio t/a	5 Mio t/a	103 Mio t/a

Regulatory Climate - Compensation Systems in Europe (2007)

Country	Tarif Range [€Cent/kWh]	Tarrif System	Amount of agricultural Biogas Plants	Installed Capacity
Belgium	**6 – 9**	**Green certifikates (Quota system)**	**6**	**12,62 MW**
Germany	**8.4 – 21.3**	**20 years fixed Tarrifs**	**> 3000**	**1100 MW**
Denmark	**8**	**10 years fixed Price**	**58 (simgle farm) 20 (community)**	**40 MW**
Finland	**3.1**	**Tax reduction, Market Price**	**-**	**-**
France	**11 - 14**	**Fixed Price since August 2006,**	**4**	**-**
Greece	**7**	**Fixed for 10 years**	**-**	**-**
Great Britain	**11 – 12.47**	**Quota system (variable)**	**< 20**	**< 2 MW**
Ireland	**3.765 – 5.916**	**Green Certificates (variable)**	**5**	**0,2 MW**
Italy	**6.5 + 12.40**	**Electricity stock exchange + Green Certificates (Quota system, variable)**	**120 in Southtirol and North Italy**	**81,64 MW**
Netherlands	**9.7**	**Until End 2006**	**30**	**3,8 MW**
Austria	**10.3 – 16.5**	**13 years fixed price until end 2004 approval and building until end 2007, at the moment not enough incentive for new projects**	**159 + 150 until End 2007**	**29 + 40 MW until End 2007**
Poland	**7,8**	**Market price + Green Certificate (variable)**	**-**	**-**
Portugal	**6.1984**		**-**	**-**
Spain	**Up to 16,5**	**Fixed price since June 2007**	**-**	**-**
Sweden	**-**	**Green Certificates / Market price + 25% Subsidy (Biogas as a vehicle fuel, no Electricity production)**	**-**	**-**
Switzerland	**10**	**Fixed price, difficult application procedures**	**71**	**n/a mostly heat utilisation**

Technology applied - Digestion System

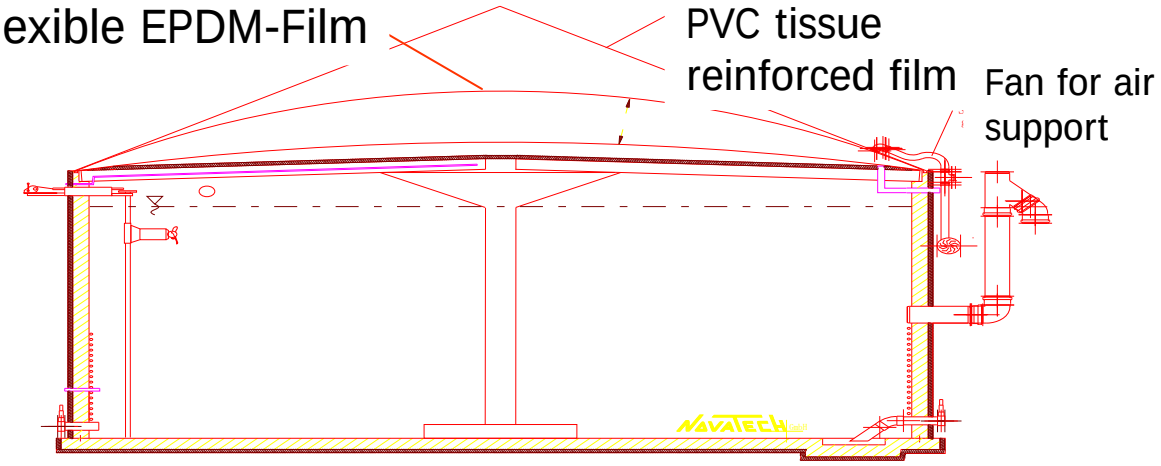
1) Wet Fermentation

- Completely mixed digester
- Plug flow digester

2) Dry Fermentation

- Plug flow digester
- Garage type batch digester

Technology applied - Wet digestion



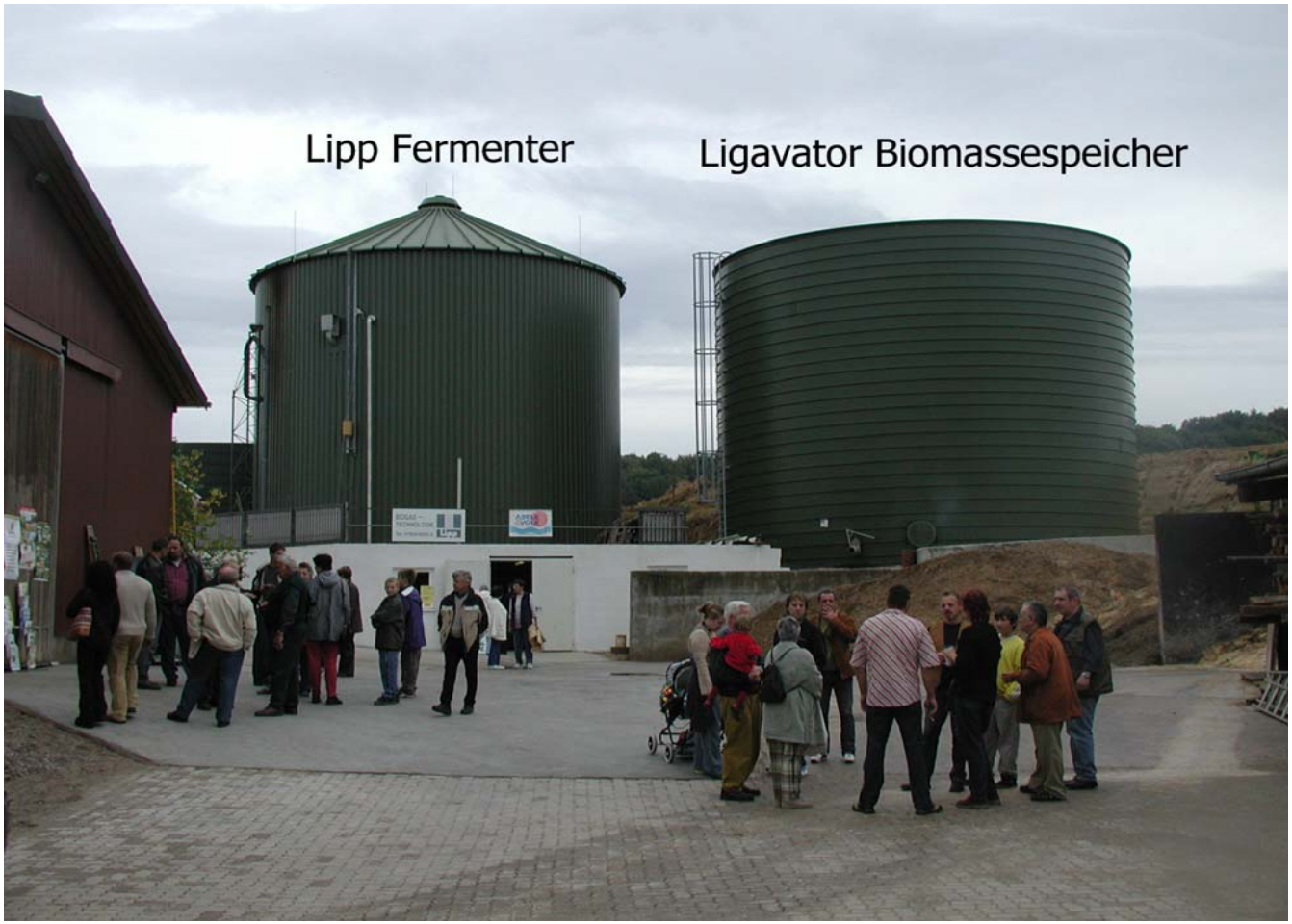
Advantages:

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

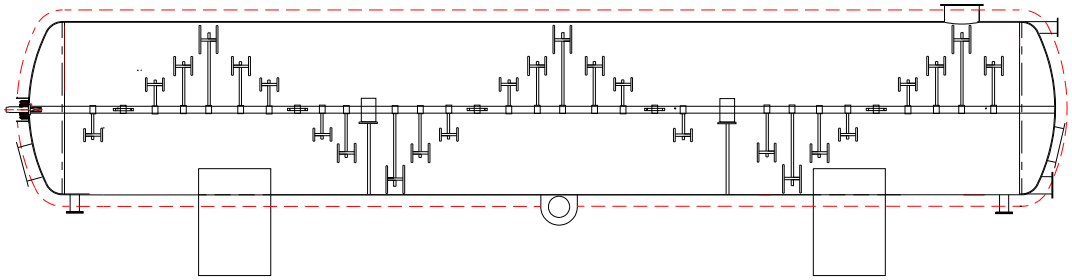
Disadvantages:

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

Technology applied - Stainless steel digester



Technology applied - Horizontal digester

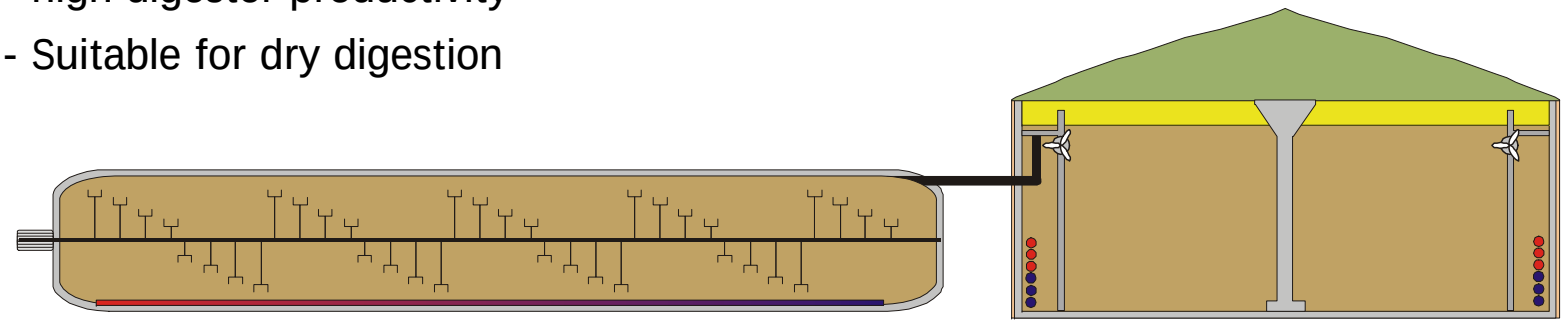


Advantages:

- 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



Technology applied - Horizontal digester

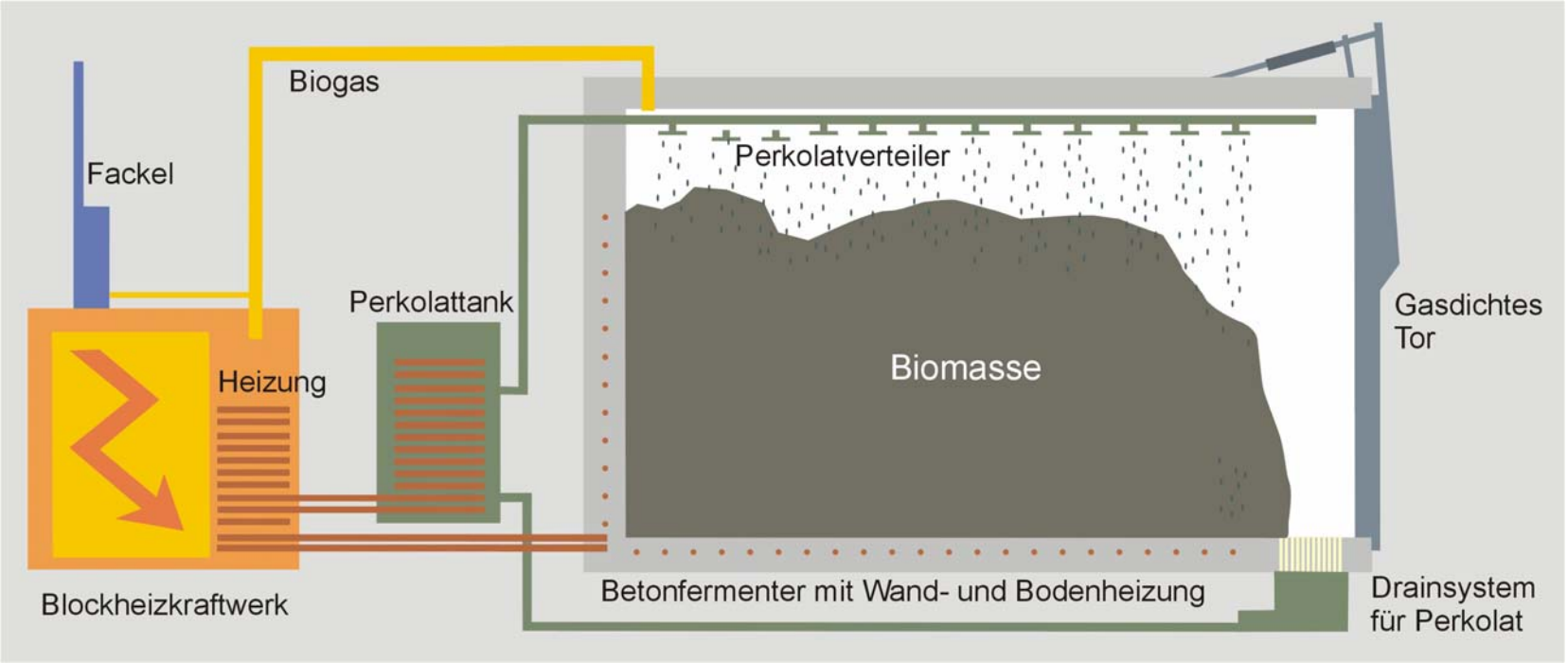
Concrete

Steel

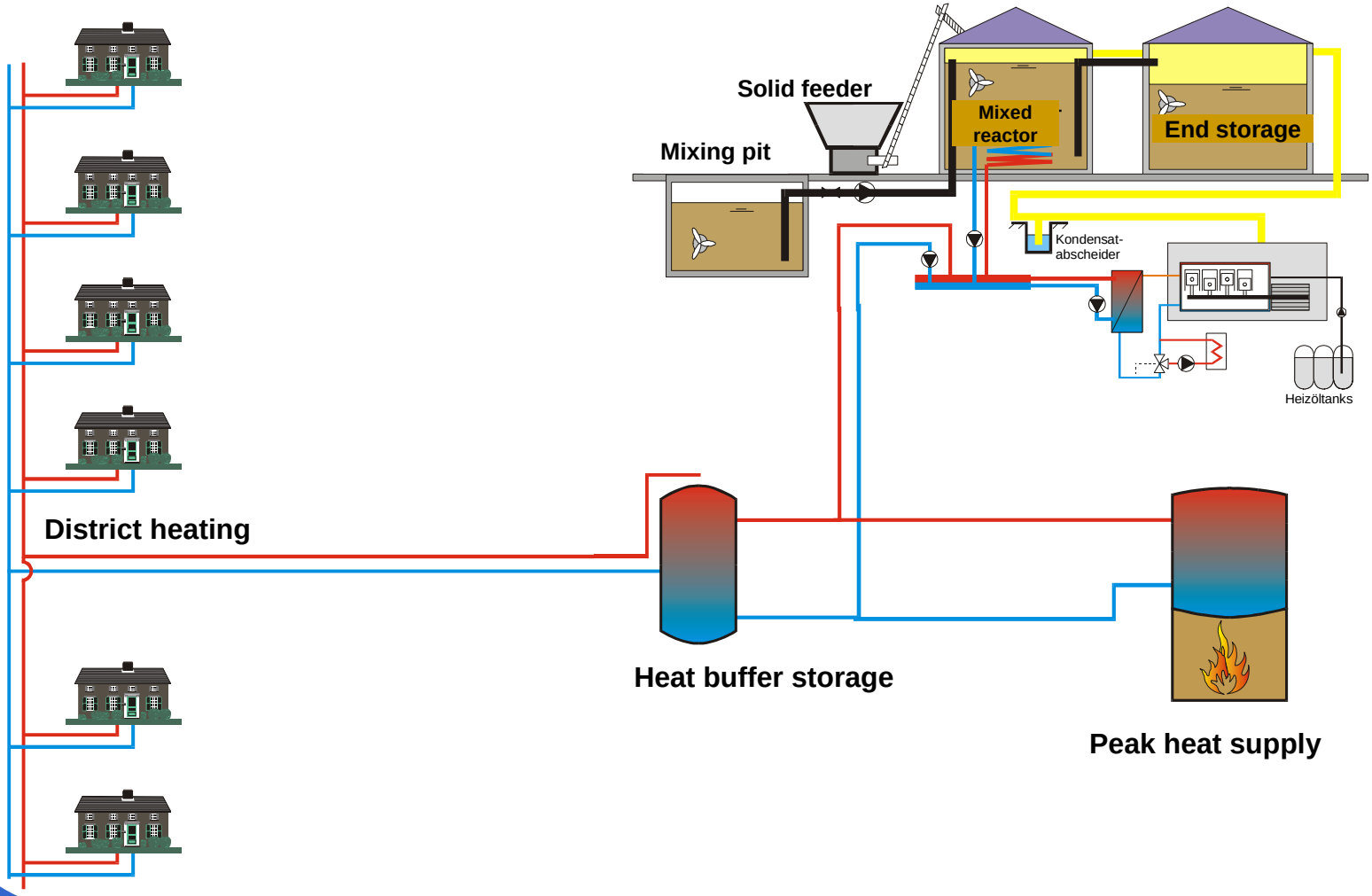
Technology applied - „Garage Type“ Digester

Dry Fermentation System for Biomass over 20% DS

Principal Function



Technologies applied - Ideal set-up



Agricultural Biogas Basic Investment Figures

CHP-Plant (Dual Fuel Engine)	700 - 1200 €/kW (120 – 30 kW_{el})
CHP-Plant (Gas-Otto-Engine)	500 - 1900 €/kW (400 – 15 kW_{el})
Investment Costs per m3 Dig. Vol.	250 - 450 €
Investment Costs per LU	800 - 2.000 €
Investment Costs per kW installed electrical Capacity	3.000 - 6.000 € 400 – 30 kW_{el}

Drivers behind AD in Germany

- **Guaranteed access** to electricity grid at good rates
- Access to long term low interest loans
- **Good infrastructure** for supporting those interested in biogas plants

New developments through EEG incentive

- specialized digester and plant technology
- dry fermentation
- automation and controlling
- slurry technology and feed in of solid substrates
- gas upgrading for fuel cells (research & pilot stage)
- biogas in vehicles,
- integrated gas and heat distribution systems

Important Trade Fairs: www.agritechnica.de, www.messen-profair.de

Questions?

Thank you

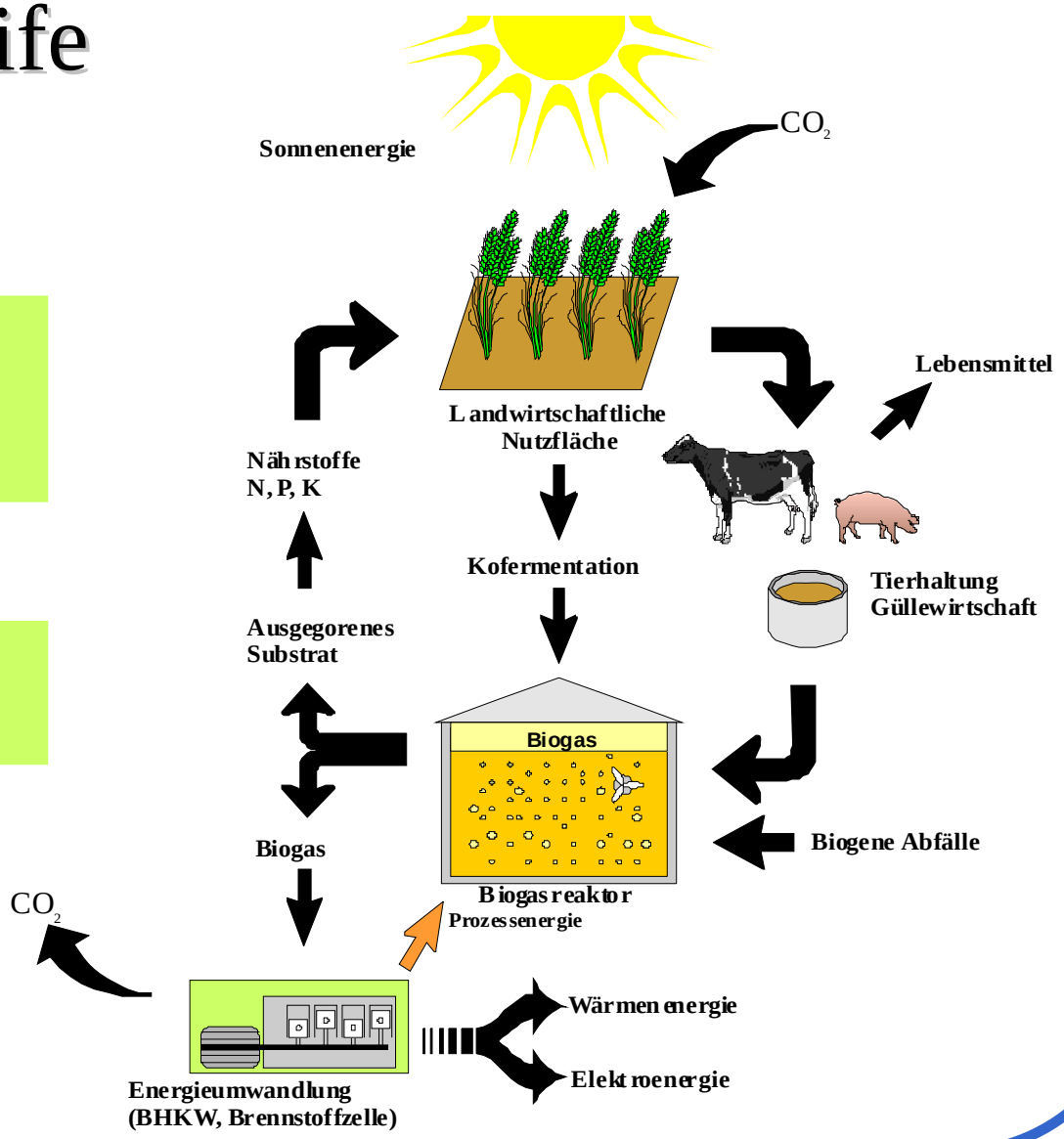
for your attention!

www.biogas-zentrum.de, info@biogas-zentrum.de

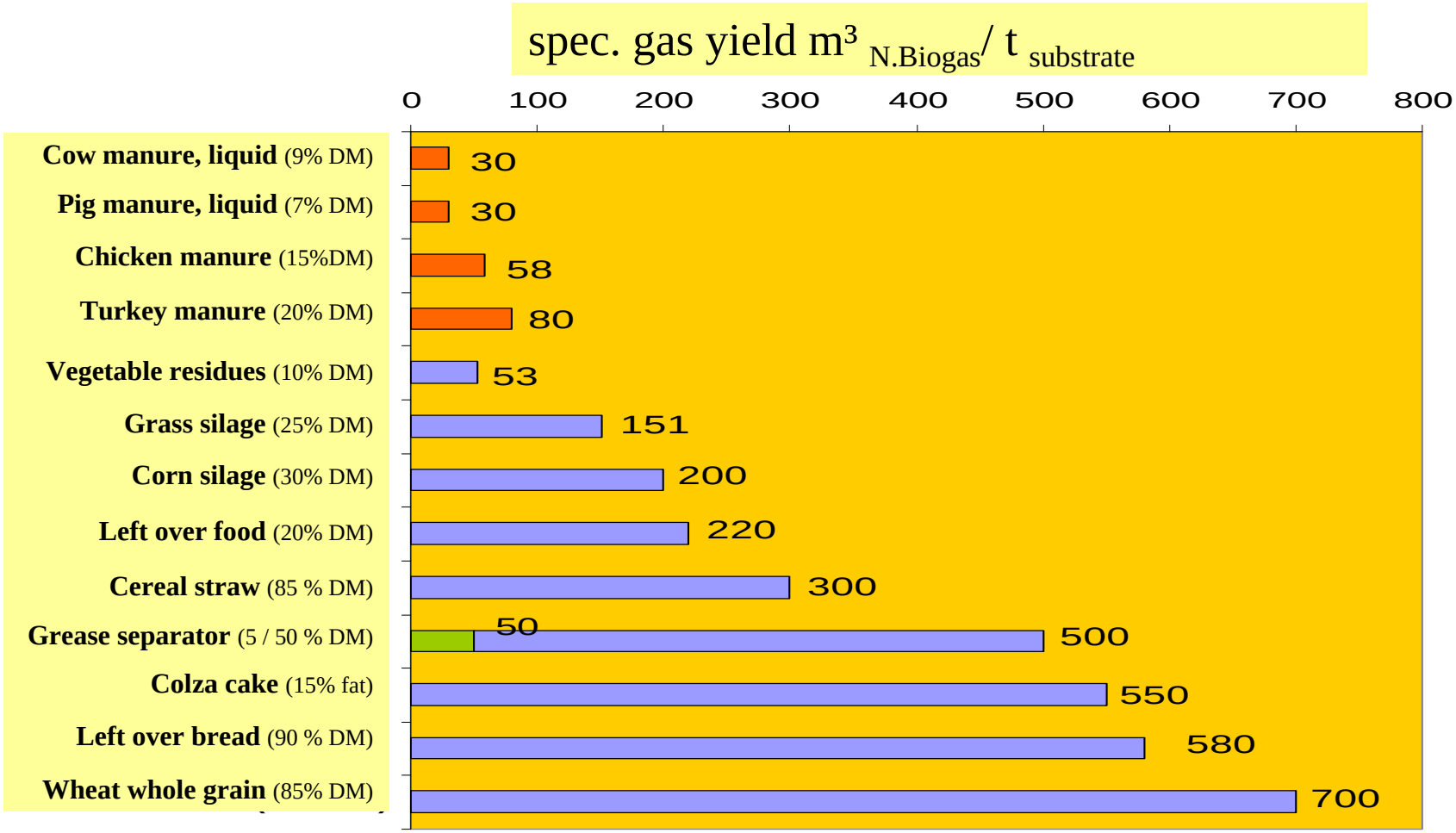
Biogas closes life cycles

„In an ecological system all organic material is recycled“

„Energy is produced through this system“



Biogas yields from different substrates



Tariffs for electricity – who receives what?

Assuming an average consumer price of 18 ct/kWh :

Quelle: Bundesverband erneuerbare Energien e.V., Dezember 2003

Energetic evaluation of decentralized houshold waste water treatment

- Amount of waste water comes to 150 l per person and day.
- Contents faeces, organic waste from food preparing and left overs
- Additional content of detergents, shampoos etc
- Around 0,9 kWhel per person and day can be produced or 150 Euro/year
- Saving of waste water treatment fees up to 10 times as high.
- Saving of connecting fees to the public sewer

Economy of biowaste treatment plants:

- Income of gate fees and energy sales
- High technological standard => high investment costs
- High approval conditions => higher costs
- Abolition of agricultural subsidies
- Restricted spreading possibilities

Technology applied - Concrete digester

Key Lessons from the German Experience

Germany:

- Government support in the form of:
  - High price for electricity from AD plants
  - Low interest long term loans
- Numbers of farm based plants doubled in a very short space of time
- Government support has proven to be crucial and very effective
- New energy crop bonus

Potential from Biogas Technology

- **10 Bil. cubic meter Biogas 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

- Energy Crops have the largest fraction in the potential

- First Successes in biogas specific Energy Crop production