

# IEA Bioenergy Task 37, Moss, Norway, April 18 - 20, 2012

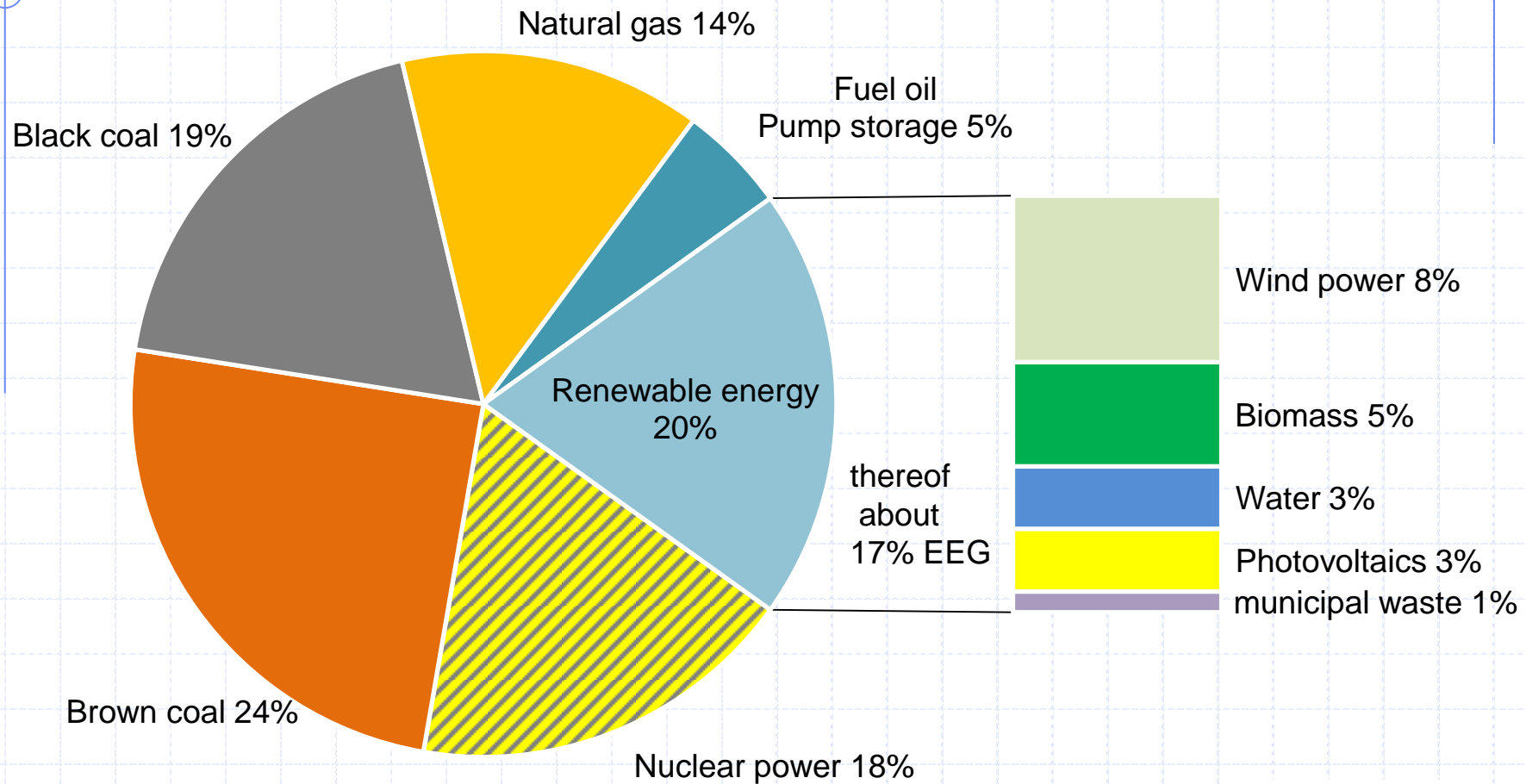
## Country Report, Germany

Bernd Linke  
Leibniz-Institute for Agricultural Engineering  
[www.atb-potsdam.de](http://www.atb-potsdam.de)

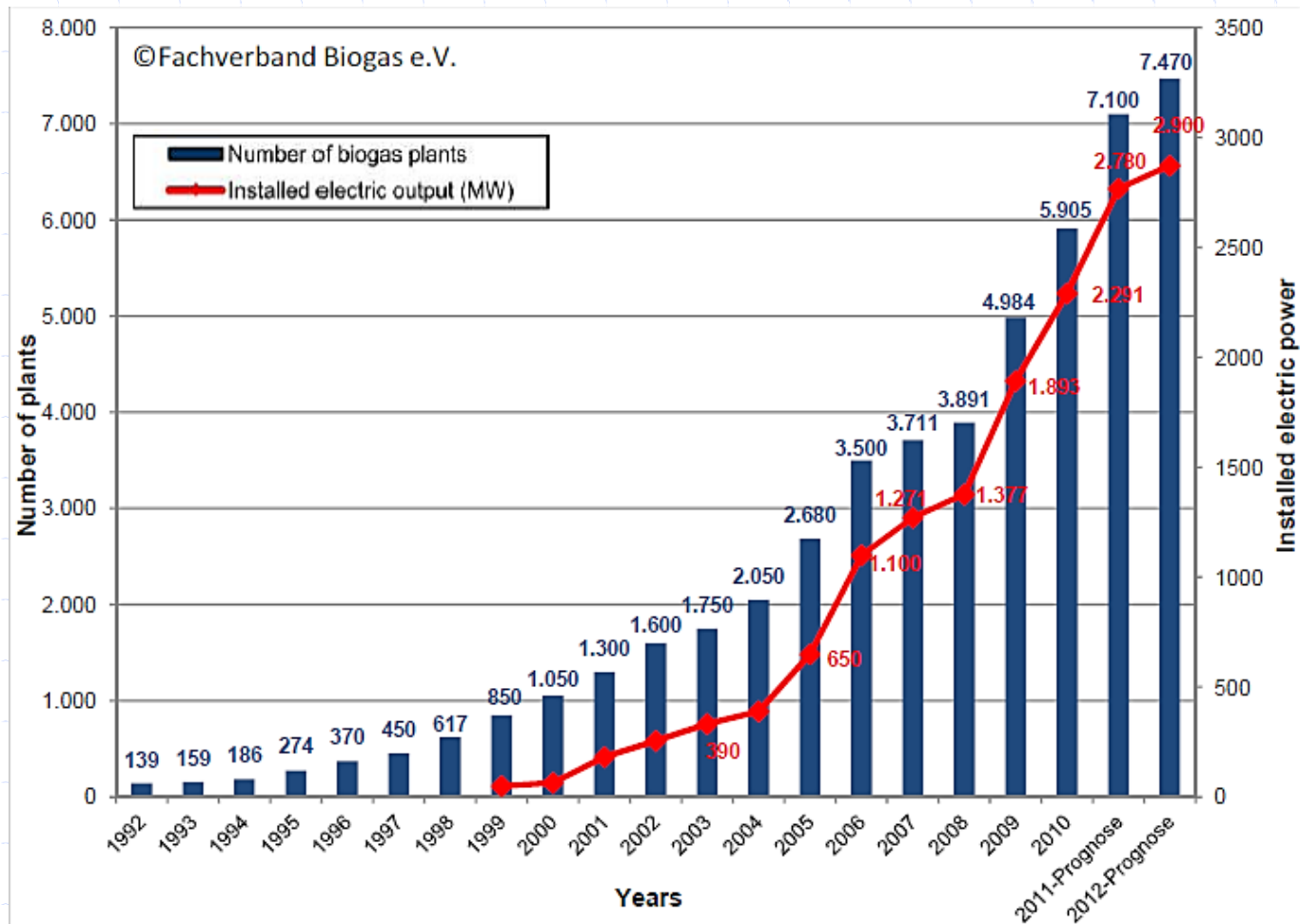
- ✓ Biogas plants inventory
- ✓ Amount of vegetable waste
- ✓ Best practice examples
- ✓ Research activities
- ✓ EEG 2012



# Electricity generation in Germany, Index by energy source, December 14, 2011



# Development of agricultural biogas plants



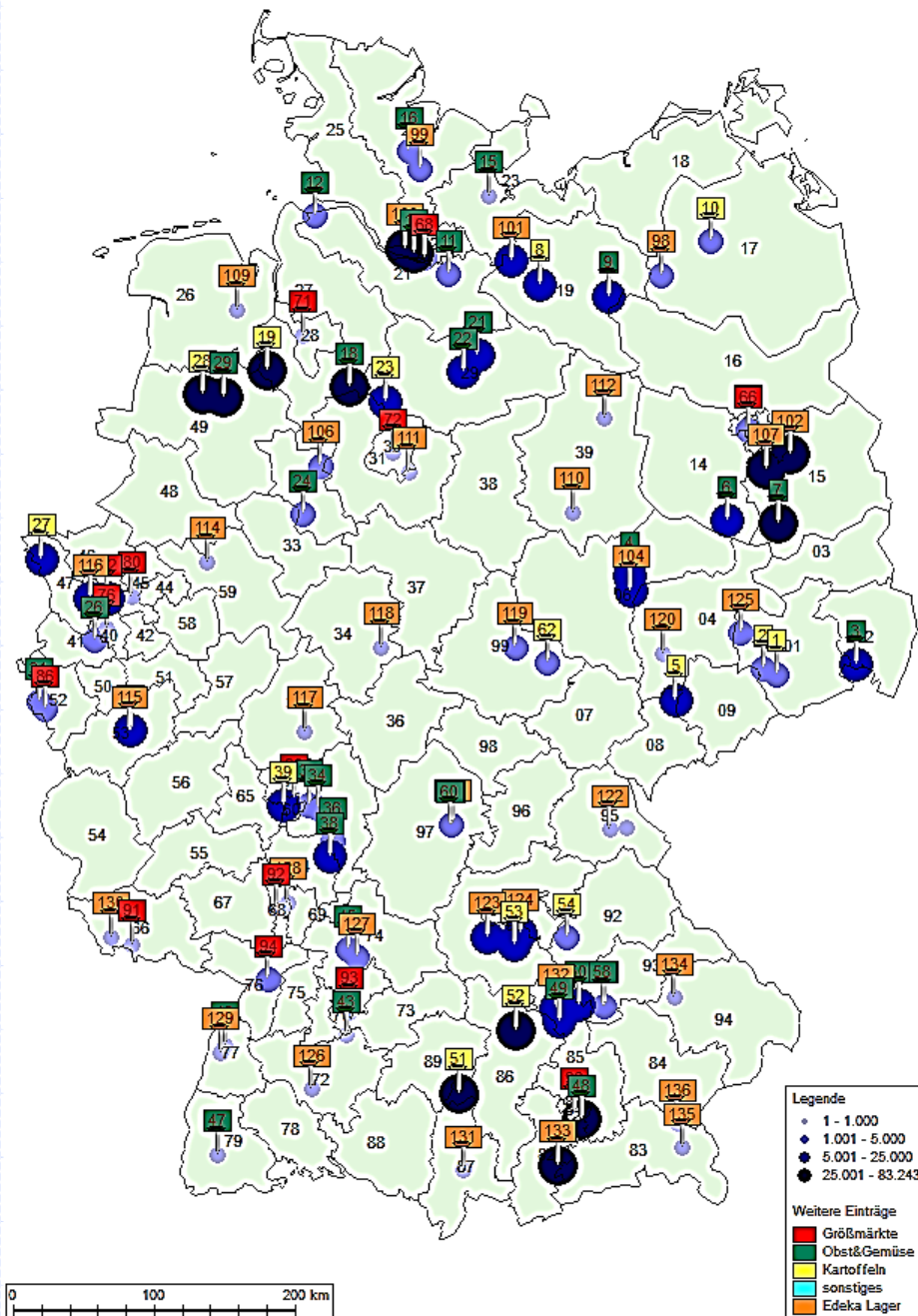
Source: German Biogas Association, 2011

# Figures of agricultural biogas plants, Germany

Parameter	End of 2010	Forecast 2011	Forecast 2012
Number of plants of these feeding methane	5905 45	7100 60	7470 80
Installed electric power (MW)	2291	2780	2900
Net electricity production (MWh/a)	15 Mio	18 Mio	20 Mio
Homes supplied with electricity	4.2 Mio	5.1 Mio	5.7 Mio
Proportion of electricity consumption (%)	2.5	3.1	-
Turnover in Germany	5.1 Billion	6.1 Billion	5.6 Billion
Jobs	39100	46000	46000
Export rate (%)	10	10	25

Source: German Biogas Association, 2011

# Amount and distribution of vegetable waste in Germany (t/a)



- ✓ Data from Nielsen and Edeka Company 2009/2010
- ✓ 10-15 % of the volume of sales allotted to fruit, vegetables, potatoes and salad (wet waste)
- ✓ 1-1.5 Mass.-% waste volume of fruit, vegetables, potatoes and salad
- ✓ Wet waste accounts to 768.600 t/a (fruit,- vegetable and potatoes processing 473.200 t/a; juice production 200.000 t/a, supermarkets 80.800 t/a, whole sales 8.500 t/a; Edeka stores and distribution centres 6.100 t/a)

Source: Abschlussbericht EtaMax  
Teilprojekt 2 „Rohstoff und Rohstoffaufbereitung  
K. Wessiepe Softwareentwicklung & Vertrieb,  
41516 Grevenbroich)



# Best practice examples (1)

## Biogas for village heat and grid injection

### Bioenergy village Malstedt, Lower Saxony

- ✓ Participation of citizens in the planning
- ✓ 15 farmer as partner, contribution of 800 acres arable and grassland for substrate
- ✓ Animal slurry from dairy cattle and sows as basic substrate for co-fermentation
- ✓ Supply of 60 households over the whole year with heat
- ✓ Biomethane injection of 350 Nm<sup>3</sup>/h (MT Biomethane)
- ✓ Investment costs: Biogas plant € 7 Mill.  
substrate supply € 1 Mill, heat grid € 0.9 Mill.  
Biogas upgrading € 1,1 Mill.



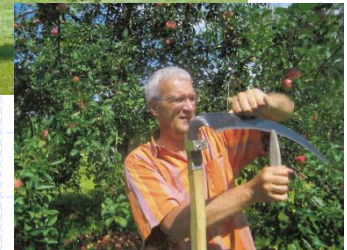
Source: German Biogas Association, 2011

# Best practice examples (2)

## Biogas regional electricity

### Nature conservation and biogas complied

- ✓ Grass from 110,000 acres of orchard in Baden Württemberg for biogas available
- ✓ Contract between BUND (Friends of the Earth in Germany) and energy supplier EWS, production of regional electricity ([www.bund-regionalstrom.de/](http://www.bund-regionalstrom.de/))
- ✓ Biogas plant from Norbert Marschall: 85 acres, 25 of that orchard grassland, slurry from 20 cattle's, 190 kWel, heat supply of 4 households, split logs drying
- ✓ Regional electricity initiative extended on 5 regions in Baden Württemberg



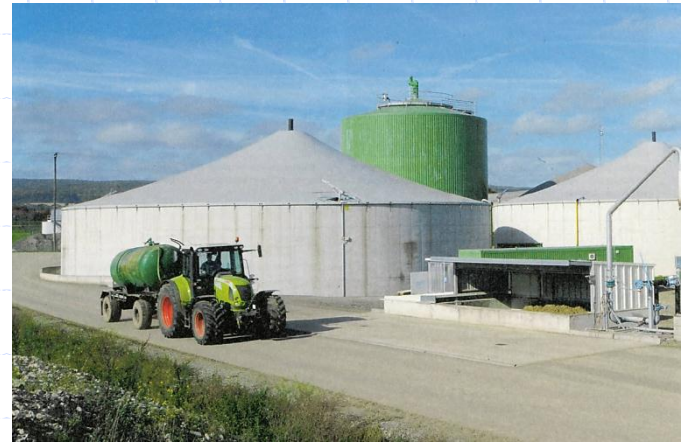


# Best practice examples (3)

## Biogas for tinned food production

### Heat from CHP for food processing

- ✓ Operating companies: Vogteier Erdenwerk GmbH and Niederorla farm GmbH
- ✓ Maize silage (70%), grass silage (20-25%) and farmyard manure,
- ✓ Thermophilic digester (2000 m<sup>3</sup>), post digester (1500 m<sup>3</sup>) and gas tight storage tank (3500 m<sup>3</sup>), CHP 537 kW<sub>el</sub>.
- ✓ Steam production (160°C) from CHP flue gas,
- ✓ 70% heat utilisation, increase of 90% planned by installing of wheat and wood drying



Source: German Biogas Association, 2011



# Research program: Bioenergy 2021

## Example (1): Etamax, more biogas from municipal bio-waste

GEFÖRDERT VOM



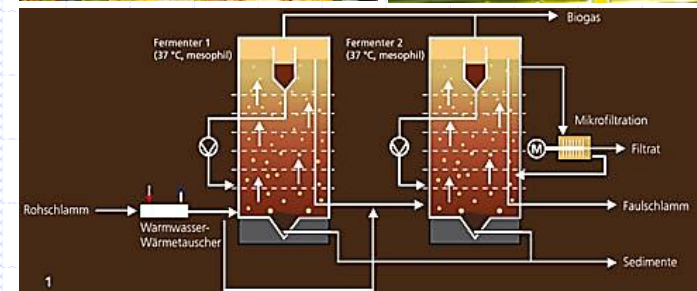
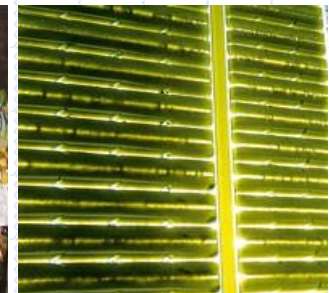
Bundesministerium  
für Bildung  
und Forschung

**PTJ**  
Projektträger Jülich  
Forschungszentrum Jülich

### Aims of the research project

- ✓ Biogas from municipal bio-waste for car fuel
- ✓ Application of high performance modular digestion technology
- ✓ Utilisation of CO<sub>2</sub> and nutrients from digestate for micro-algae production
- ✓ Hydrothermal gasification of digestate for additional CO<sub>2</sub> and CH<sub>4</sub> production
- ✓ Construction of a pilot plant, 300 000 m<sup>3</sup> biomethane for driving garbage collection trucks in Stuttgart

**Fraunhofer**  
IGB



Source:

[http://www.igb.fraunhofer.de/de/kompetenzen/umweltbiotechnologie/bioenergie/etamax\\_auto\\_fahren\\_mit\\_biogas\\_aus\\_bioabfaellen.html](http://www.igb.fraunhofer.de/de/kompetenzen/umweltbiotechnologie/bioenergie/etamax_auto_fahren_mit_biogas_aus_bioabfaellen.html)

# Research program: Bioenergy 2021

## Example (2): Biogas crops networks

GEFÖRDERT VOM

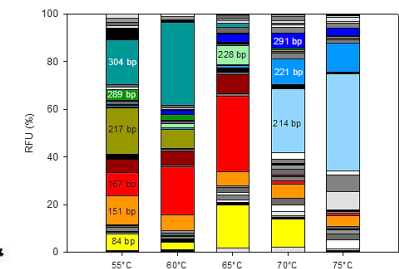
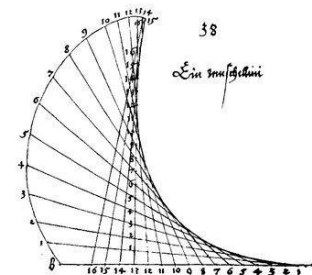


Bundesministerium  
für Bildung  
und Forschung



### Aims of the network

- ✓ Enzymatic disintegration of biomass
- ✓ Analysis of hydrolytic microbial diversity in biogas fermenters
- ✓ Optimization and modelling of two-phase digestion technologies (batch and continuously)
- ✓ In situ upgrading of biogas in digesters
- ✓ Combination of biogas and biochar production
- ✓ Assessment of technics, economy and environmental effects

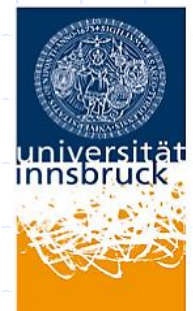


# Research program: Bioenergy 2012 Example (3)

## BERBION: The future city with Zero-Waste Biorefinery

### Aims of the project

- ✓ Inventory of biomass from food processing industry, local parks, agriculture and private households
- ✓ Optimisation for collection and transport of biomass
- ✓ Pretreatment of biomass for biogas production (e.g. enzymatic, steam, ultrasonic)
- ✓ Bioethanol production from liquid and solid waste streams
- ✓ Production of high quality organic fertilizers
- ✓ Evaluation of technologies by means of mass and energy balance studies



# Essential modifications of the Renewable Energy Sources Act (EEG) 2012 in Germany

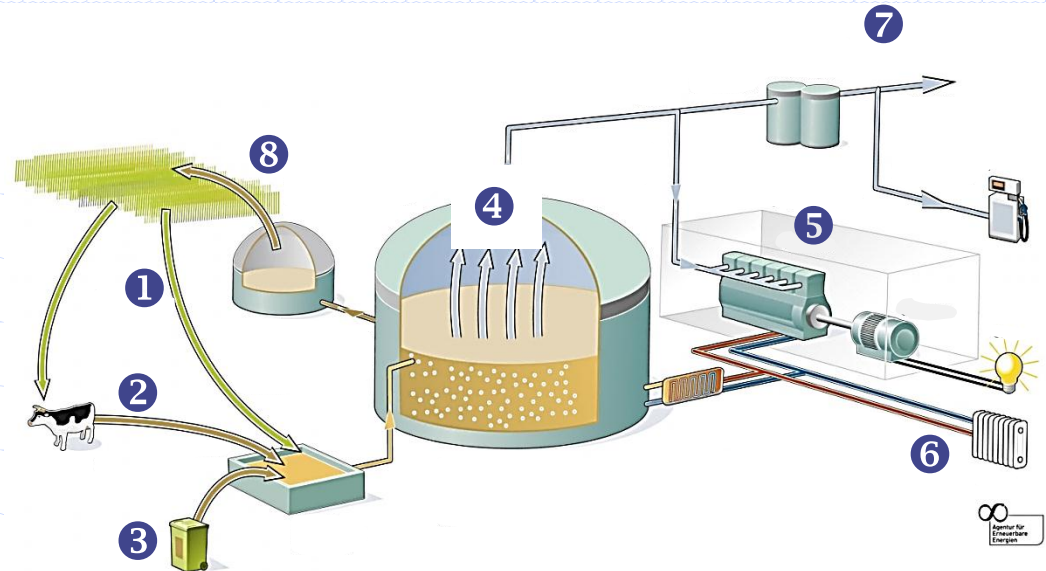
① Two different boni for biogas crops: 6...4 ct/KWh<sub>el.</sub> and 8 ct/KWh<sub>el.</sub>, depending on plant size

② > 60 Ma.% animal slurry as condition for biogas crops boni, > 80 Ma.% animal slurry 25 ct/KWh<sub>el.</sub> for < 75KW<sub>el.</sub>

③ Whole refund of 14 ... 16 ct/kWh<sub>el.</sub> for OFMSW digestion

④ New operating state: all parts of biogas plants are ready for permanent biogas production

⑤ New plant definition: several CHP's get biogas from the same plant



⑤ ⑥ >60% power-heat cogeneration or > 60% animal slurry digestion for refund, direct marking of electricity possible

⑦ gas processing bonus from 1...3 ct/KWh depending on plant size

⑧ Legal application of waste disposal act for animal slurry digestate



# IEA Bioenergy Task 37, Moss, Norway, April 18 - 20, 2012

## Country Report, Germany

✓ Thank you for your attention

