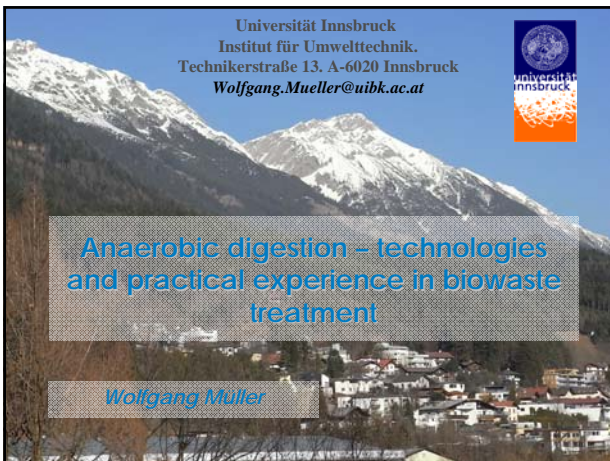
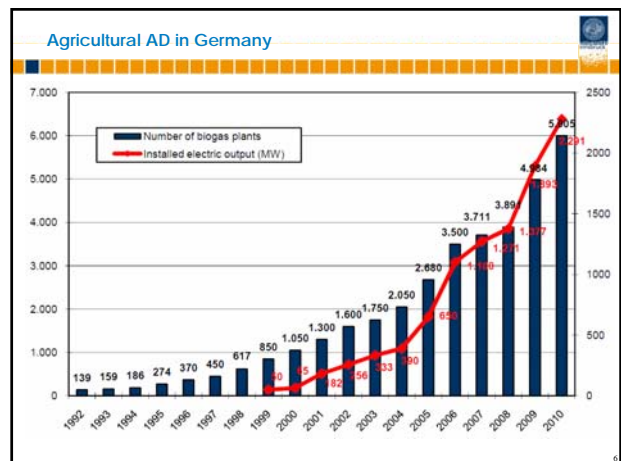
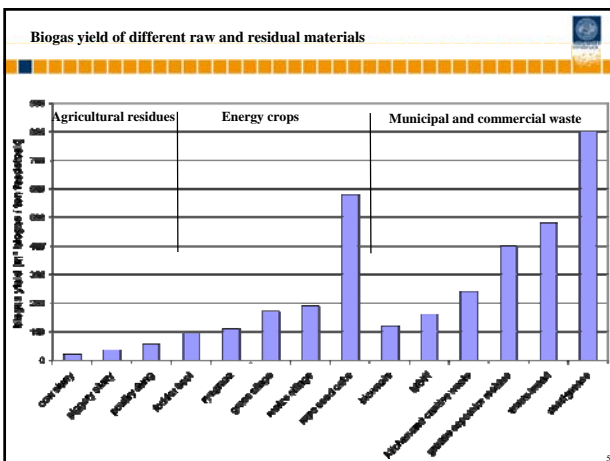
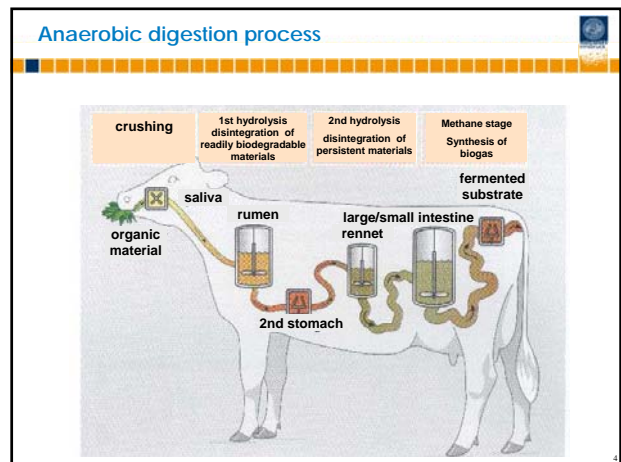
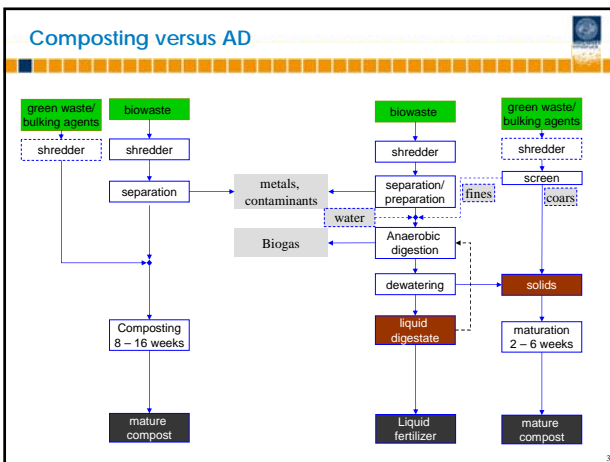


3rd Baltic Biowaste Conference, 23/24 Nov. 2011, Vilnius
" Anaerobic digestion – technologies and practical experience in biowaste treatment"
Wolfgang Müller, Universität Innsbruck, Austria



contents

- Introduction
- Comparison composting versus anaerobic digestion
- Overview AD technologies
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- Costs
- Summary



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Agricultural AD versus waste AD technologies

Agricultural AD

Feedstock:

- * manure, slurry
- * energy crops (maize silage, grass etc.)

homogenous, uniform, "clean" (no contraries)

- no feedstock preparation required, direct feeding into the digester
- easy process control
- no dewatering/post treatment (spreading of liquid digestate)

Wet digestion, continous process

"Biowaste": Source Separated Kitchen and Garden Waste

"Biowaste": Source Separated Kitchen and Garden Waste

Agricultural AD versus waste AD technologies

Waste, industrial AD

Feedstock:

- * source separated organic waste from households
- * industrial organic waste (food processing, supermarkets, Restaurants)
- * mixed waste

heterogenous, changing composition, contraries: plastic, stones, glass, metals, sand, etc.

- high-quality feedstock preparation required, to separate the contraries to avoid problems in the digester to get a clean products (compost, digestate)
- process control more difficult
- dewatering/post treatment required (in most cases)

Wet digestion, continous process

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Waste preparation with pulper and grit-removal

www.bta-international.de

Waste preparation with pulper and grit-removal

www.rosroca.de

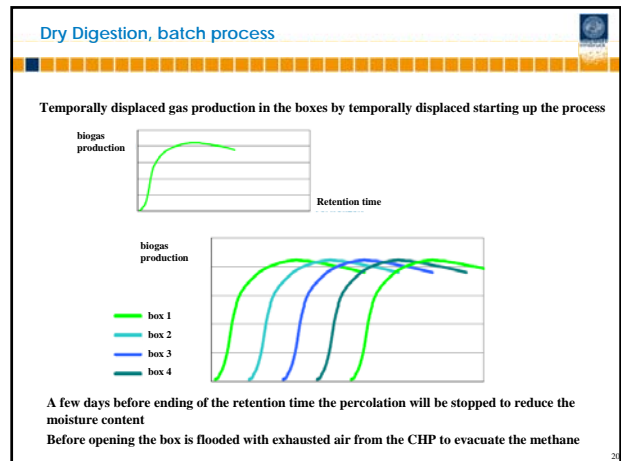
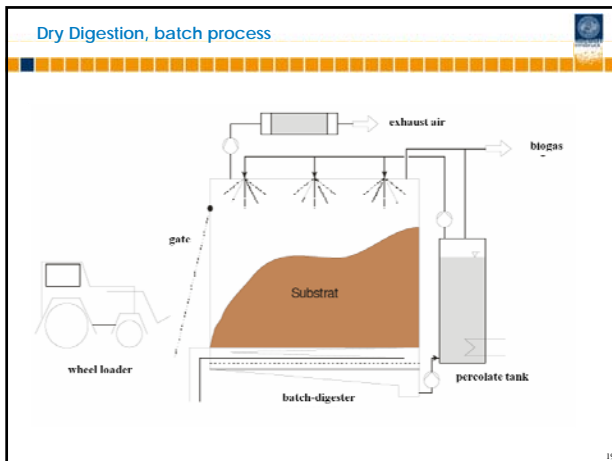
Contraries (separated in wet separation)

Dry Digestion, continous process, horizontal digestors

Dry Digestion - continous process, vertical systems

Dry Digestion, batch process

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Nutrient concentration of liquid digestate and solid digestate compost

	Dry matter content	Nitrogen (N)	Phosphorous (P ₂ O ₅)	Potassium (K ₂ O)
	%	g/kg TM		
Liquid digestate (screw press)	16	19,4	10,0	30,7
Solid digestate compost	58	14,2	8,9	10,6

- Characterisation of liquids as fertilizer of continuous and batch AD processes
- Nutrients and organic matter concentration increases with dry matter content
 - Enriched with K₂O
 - Nitrogen,
 - high ammonia concentration (directly available to plant growth)
 - little organically bound nitrogen
 - Heavy metals similar to biowaste (in relation to the dry matter)
 - Value of nutrients approx. 10 €/m³ for liquids with high dry matter content (15 – 18 %)
 - Risk of high nitrogen losses when spread to land without special techniques (deep injection)
 - Limitations for land application (Winter, pastry land, fodder growing land)
 - storage necessary
 - Sanitisation required

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AD-technologies – capacities and costs

	typical capacity	Invest cost (indicative only)
Batch fermentation new developments „Smartfarm“	> 10,000 tpa 4,000 tpa	4 - 6 Mio €
Dry digestion, continuous process	> 15,000 tpa	6 – 9 Mio €
Wet digestion	> 30,000 tpa	12 - 18 Mio €

Costs – agricultural versus waste AD

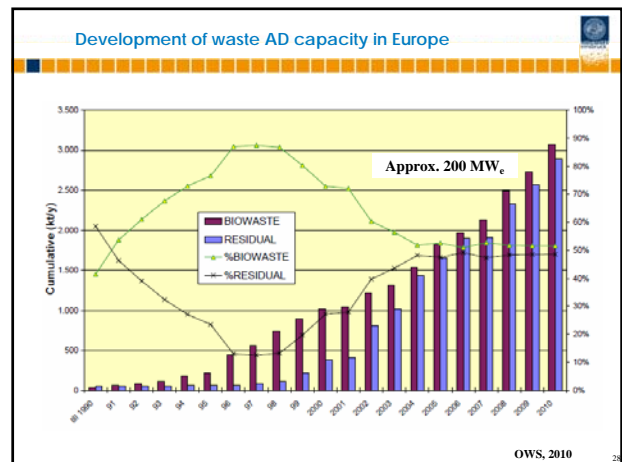
	Agricultural AD	Biowaste AD
Invest cost		
Per MW electrical power installed (€)	3.500 (2.000 – 6.000)	10.000 – 12.000
Per t treatment capacity (€/t)		350 - 500

Treatment costs composting versus AD

Feed-in tariff electricity from waste biogas in Germany: 14 – 16 €/kWh

→ AD is economically advantageous compared to composting only under optimum conditions

- market with revenues for compost and liquid digestate
- utilisation of heat with revenues



- Conclusions**
1. AD experienced a rapid development in the last 10 – 15 years
 2. With AD renewable energy can be produced
 3. The invest costs for waste AD are substantially higher compared to composting
 4. Whether AD is economically viable depends on the local conditions and the revenues for the renewable energy
 5. Compost from digestate is suitable for agricultural use independent of the type of AD process
 6. No problem to achieve mature compost and good plant tolerance
 7. Digestate compost shows higher quality for substrate production than composting alone due to reduced salt and soluble nutrients content
 8. Process water from AD is rich in readily available nutrients and can therefore be used as liquid fertilizer
 9. AD can be integrated into an existing composting facility

Thank you for your attention

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