Biogas for a sustainable future

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The contribution is made up of 3 parts:

- Advantages of anaerobic digestion
- Types of installations
- Sustainability criteria

Advantages of biogas production

Anaerobic Digestion (AD) is the most promising method to

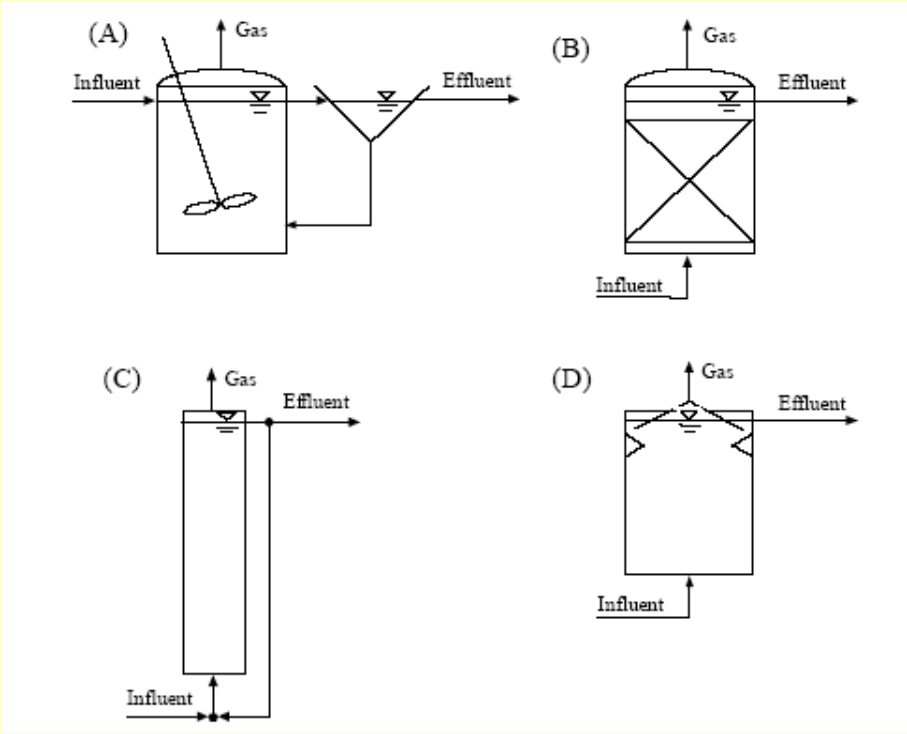
- upgrade waste water from household or industry
- stabilize sewage sludge
- treat the organic fraction of municipal solid waste
- improve fertilizer quality of animal waste
- digest energy crop to biogas

with clear environmental advantages like

- Hygienisation of waste material (at 55°C)
- reduction of GHG emissions
- substitution of fossil fuels

Technologies of biogas production

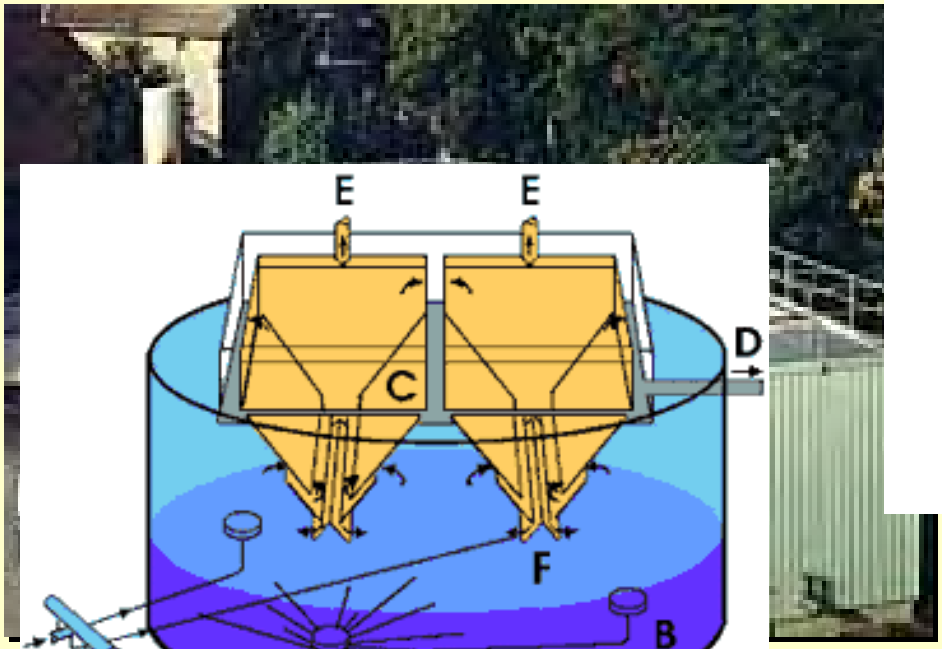
Upgrade of waste water from household and industry

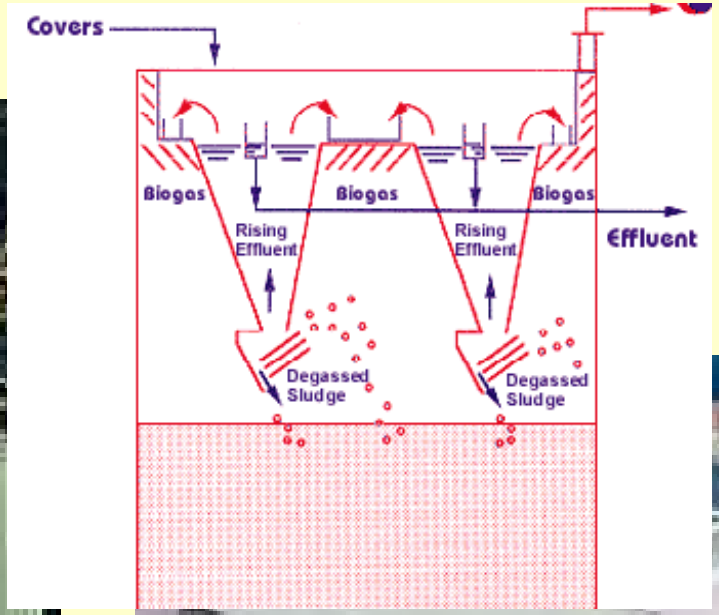


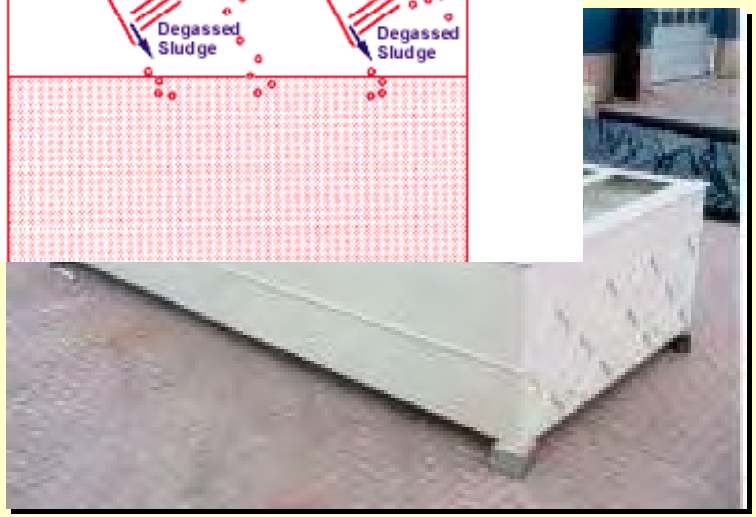
More than 3000 high-rate digesters are operated world wide for WWT from industry and household

A: Contact reactor B: Up-flow anaerobic filter
C: Fluidized bed D: UASB

UASB cover 2/3 of all industrial WWTP







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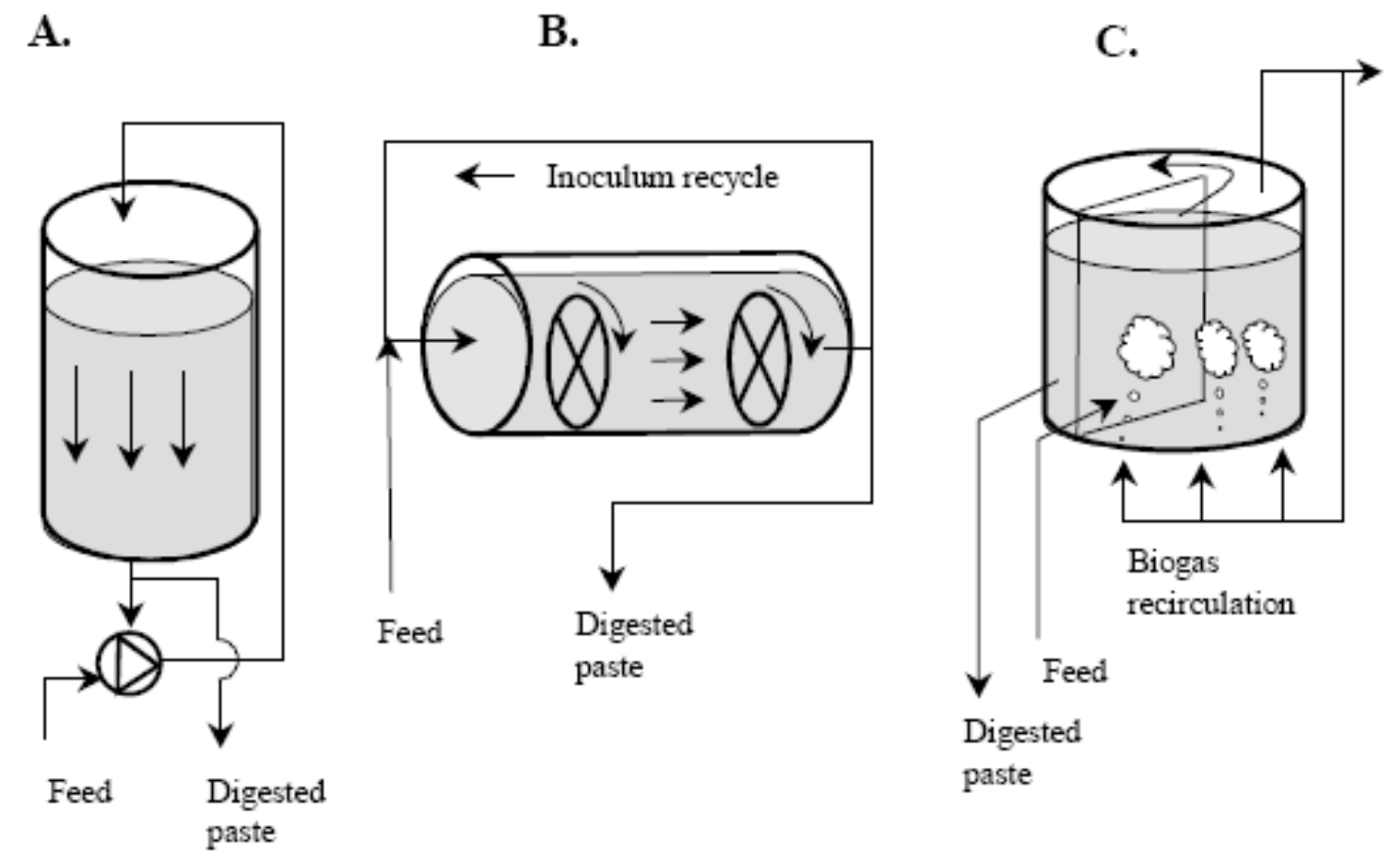
Dry fermentation systems



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Industrial dry fermentation systems

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Industrial wet fermentation systems

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Agricultural wet fermentation systems

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Improved fertilizer quality of animal & source separated wastes

- better nutrient availability
- improved homogeneity
- less plant burning
- reduced C/N ratio
- odour reduction
- elimination of plant pathogens and weed seeds

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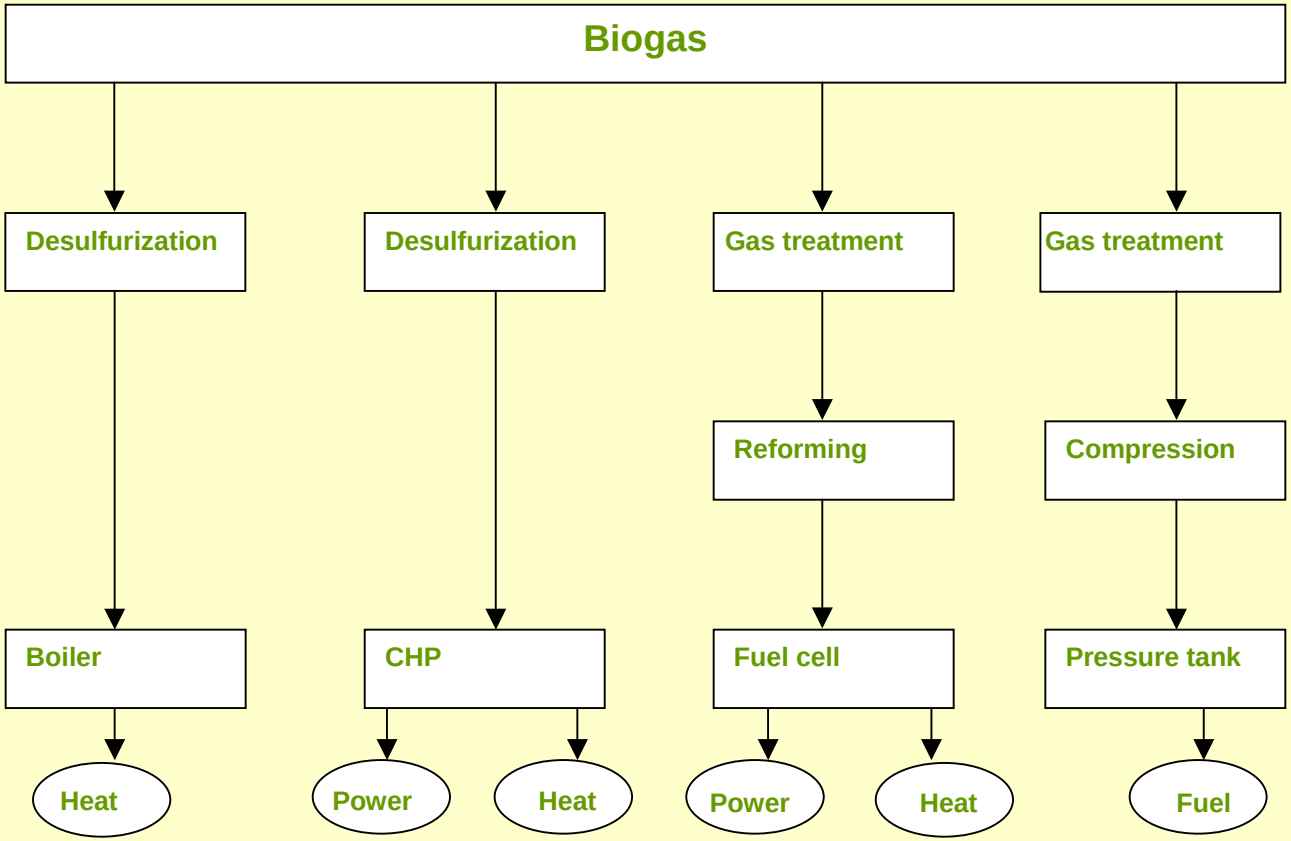
Energy remains the major driving force of biogas production



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Electricity production

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Driving with biogas has a long tradition

Classic beetle

Citroen

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The choice of makes is increasing

Citroën
(Werk)


C3


Berlingo First X

Fiat
(Werk)


Doblò


Multipla


Panda


Grande Punto

Ford
(Schweiz Retrofit)


S-Max


Fusion


C-Max


Focus Station Wagon


Focus Limousine


Focus ST


Mondeo Station Wagon


Mondeo Limousine


Galaxy


Kuga

Mercedes-Benz
(Werk)


B170

Opel
(Werk)


Zafira


Combo Tour


Zafira Turbo CNG

Peugeot
(Schweiz Retrofit)


207 Limousine


207 Station Wagon


207 CC


807


308 Limousine

Volkswagen
(Werk)


Touran


Caddy Life


Passat TSI


Passat Variant TSI

Volvo
(Schweiz Retrofit)


V70 2.0 Multi-Fuel


V50 Multi-Fuel


V70 2.5 Turbo Multi-Fuel

GROWTH RATES 2006-2007

January 2008

	2006	2007	%
WORLD	4.6 Million	7.55 Million	64%
CHINA	97,200	200,873	107%
BRAZIL	1 Million	1.48 Million	48%
EUROPE	556,000	748,749	35%
UKRAINE	67,000	100,000	49%
ITALY	382,000	432,900	13%

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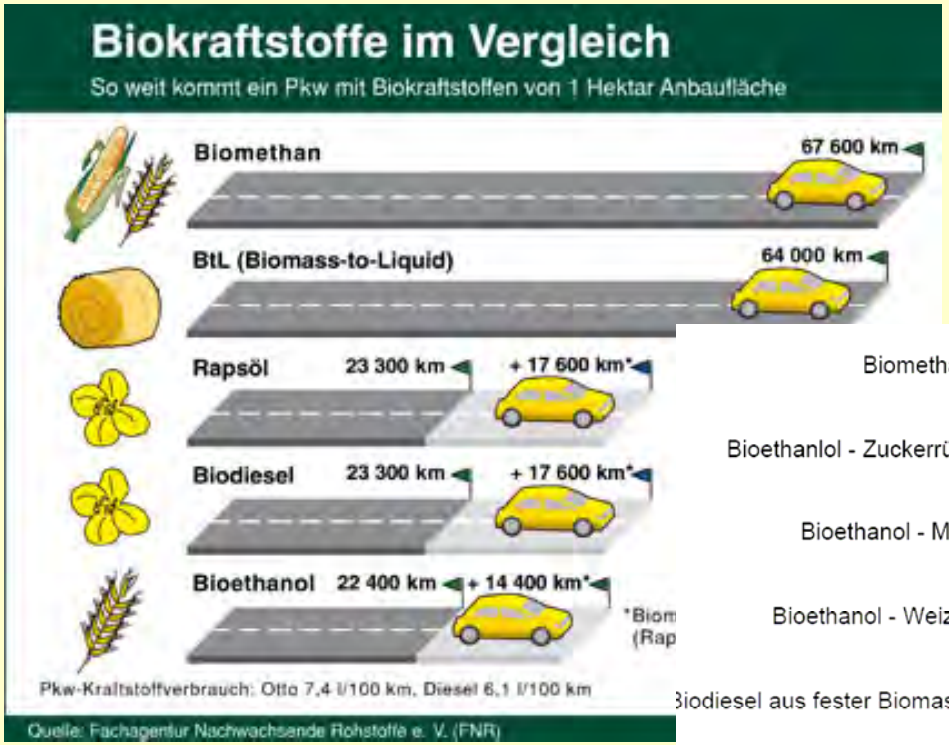
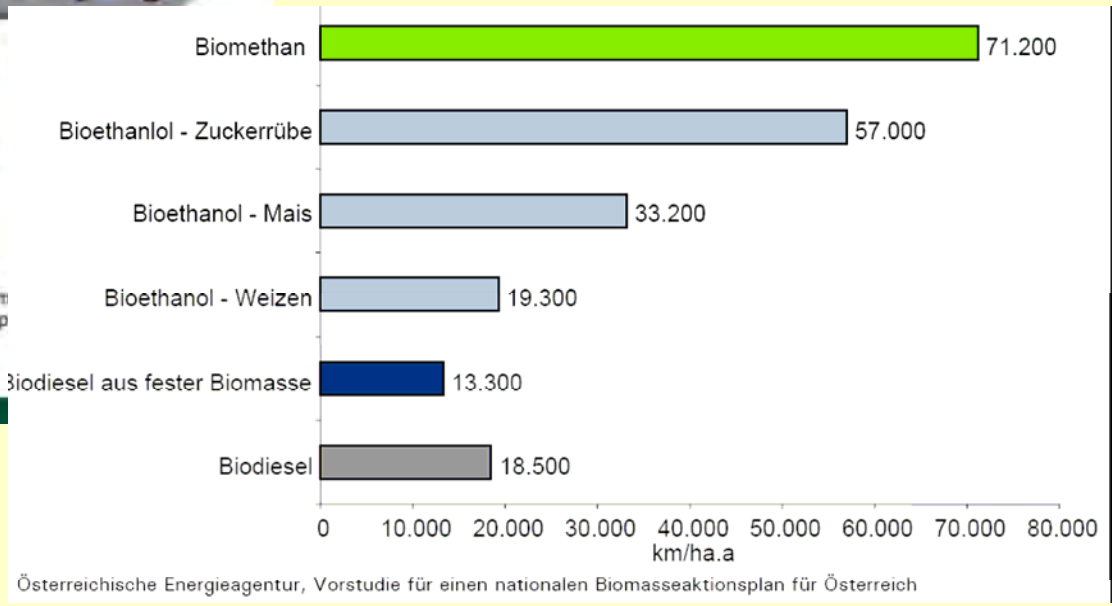
Comparison to other bio-fuels

How far can a car run with different biofuels produced on 1ha of land ?





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Sustainability criteria

- No or low emissions (methane slip) during methane production or upgrading
- No or low emissions during storage
- Reduced GHG emissions during biogas utilisation
- Limited competition with food:
  - Optimised growth conditions
  - Plants with high gas yields
  - Growth on marginal land
- Significant emissions from land-use change are be avoided

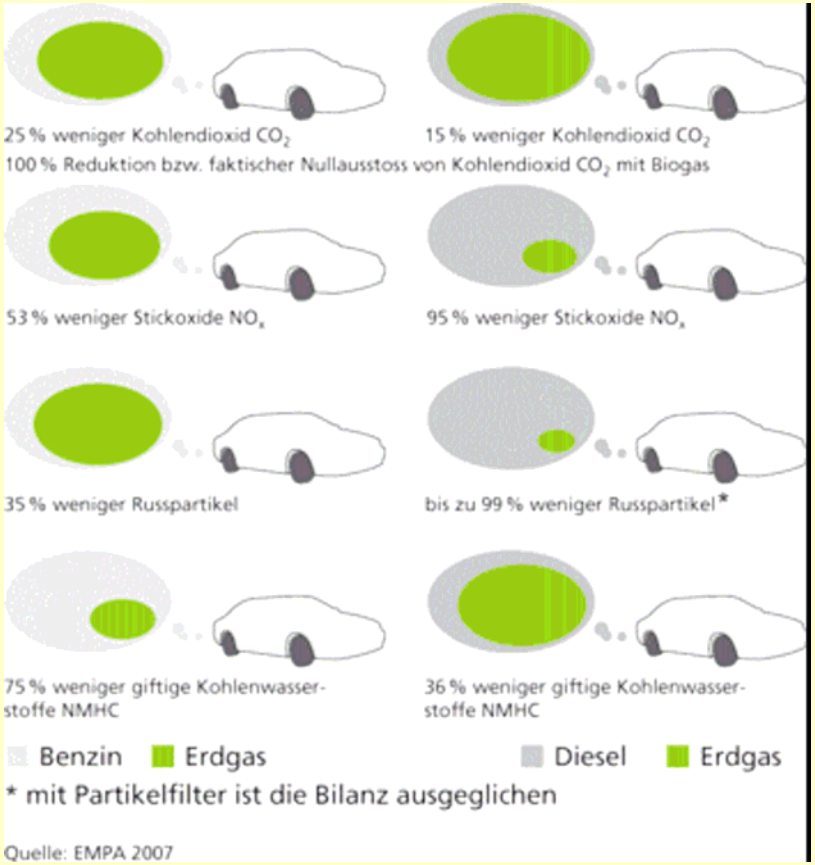
Methane slip

- Flameless oxidation (e.g. Flox)
- Catalytic conversion
- Absorption with <0.5% slip

Emissions during storage

Low noise – low emission

- Reduced GHG emissions during biogas utilisation

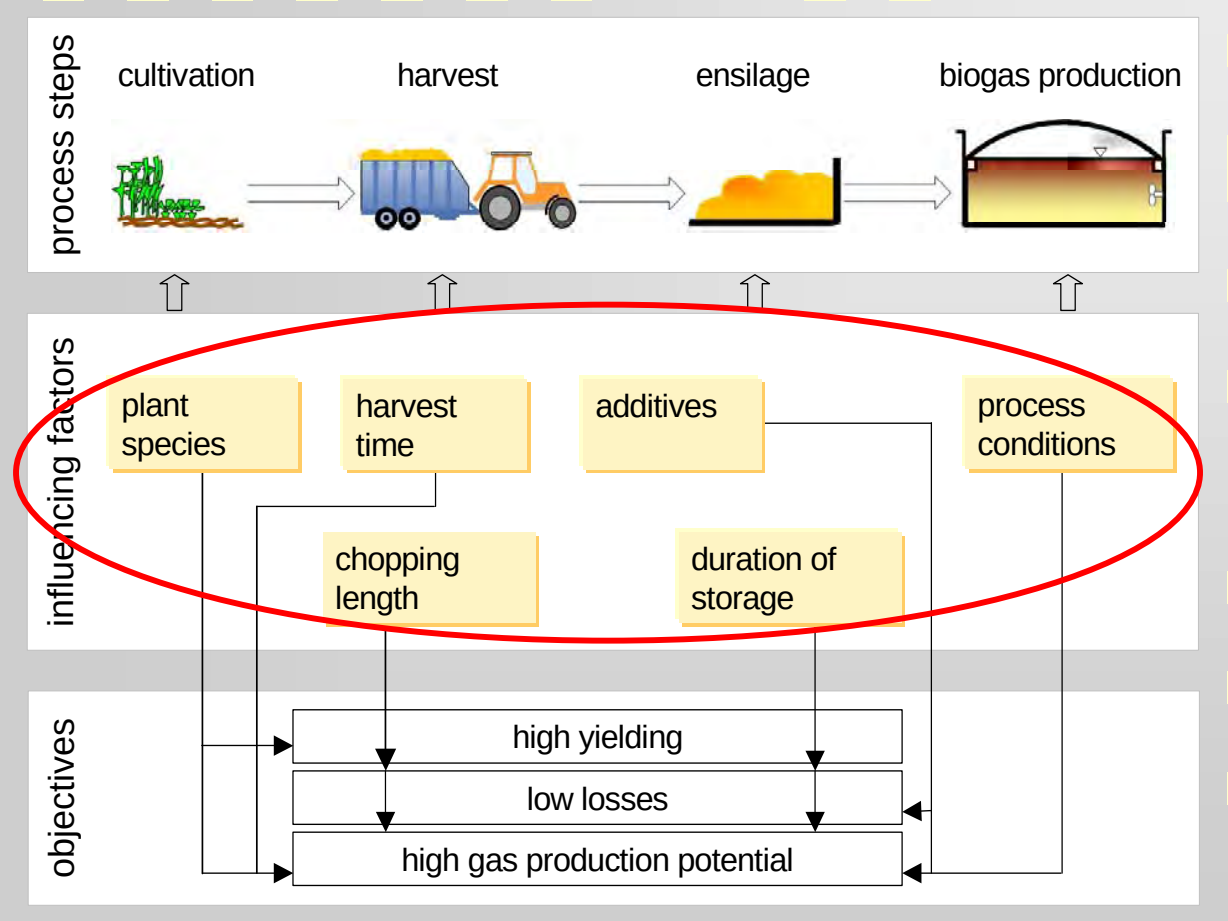


Reduction with biogas as compared to

	petrol	diesel
CO2	100%	100%
NOx	53%	95%
Soot	35%	99%
NMHC	75%	36%

Optimal growth conditions

- Limited competition with food:
  - Optimised growth conditions
  - Plants with high gas yields
  - Growth on marginal land

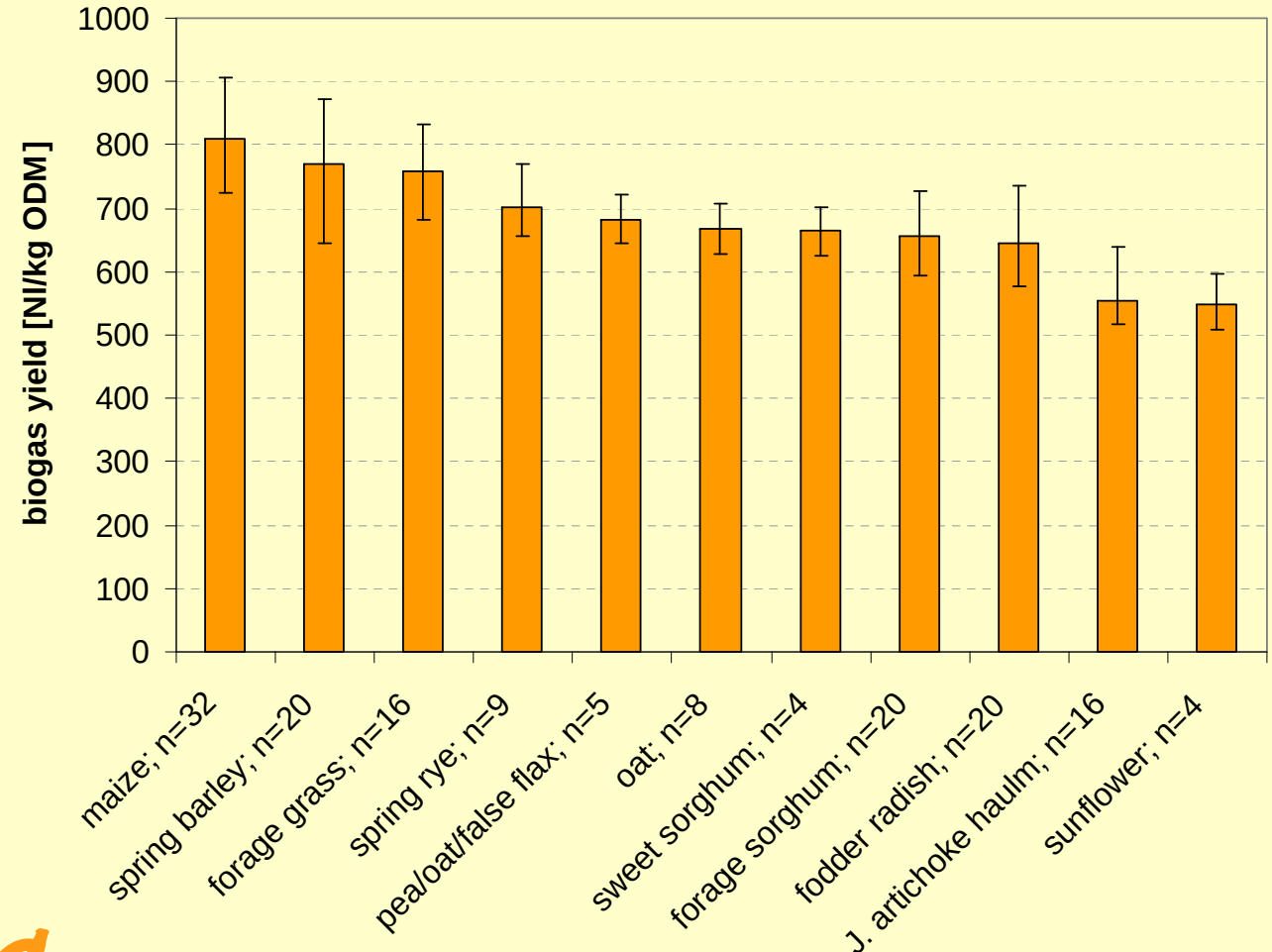


Source: Heiermann

Plant species - Biogas

- Silages (n=162)

Source: Heiermann



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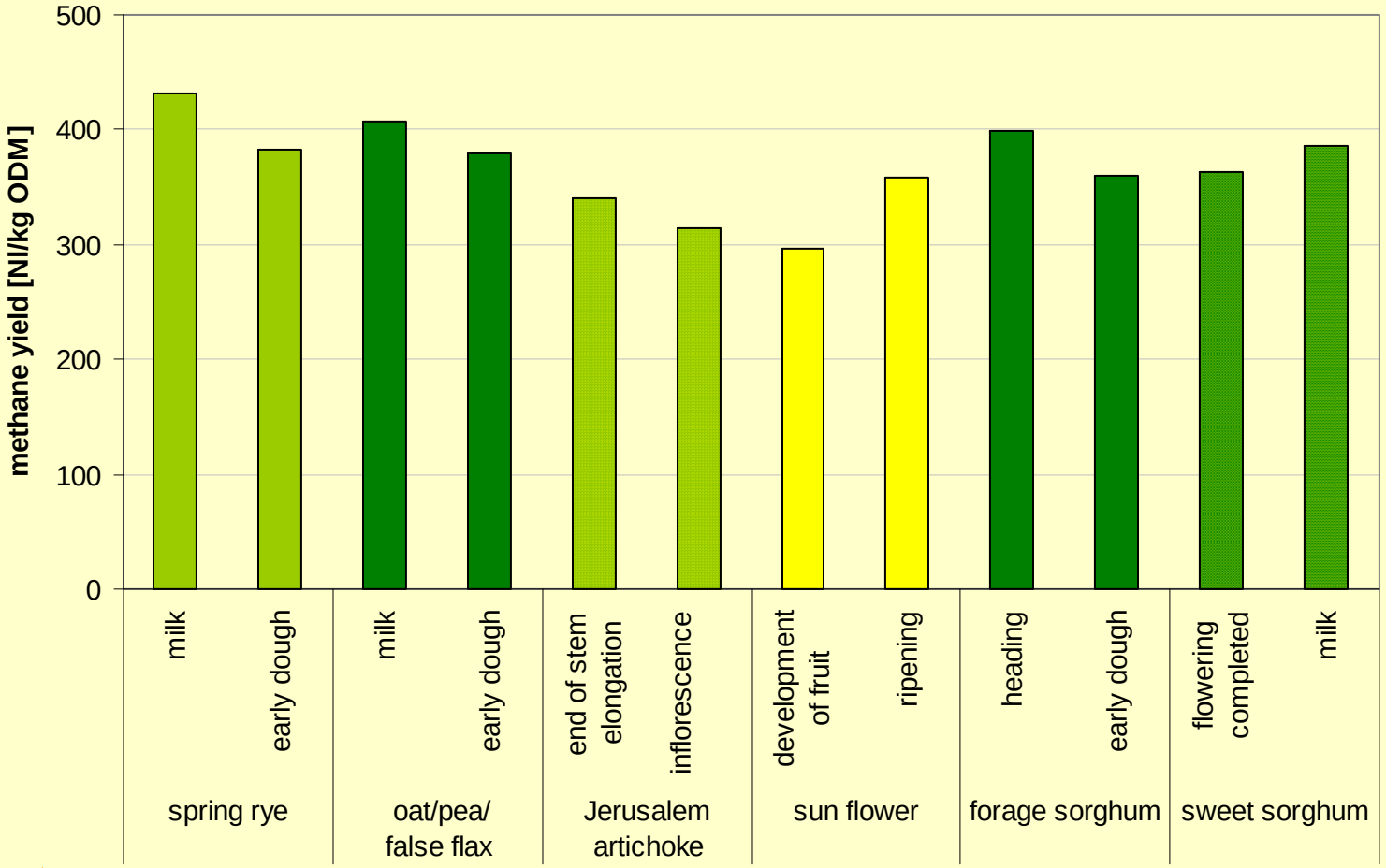
Plant species – Harvest time

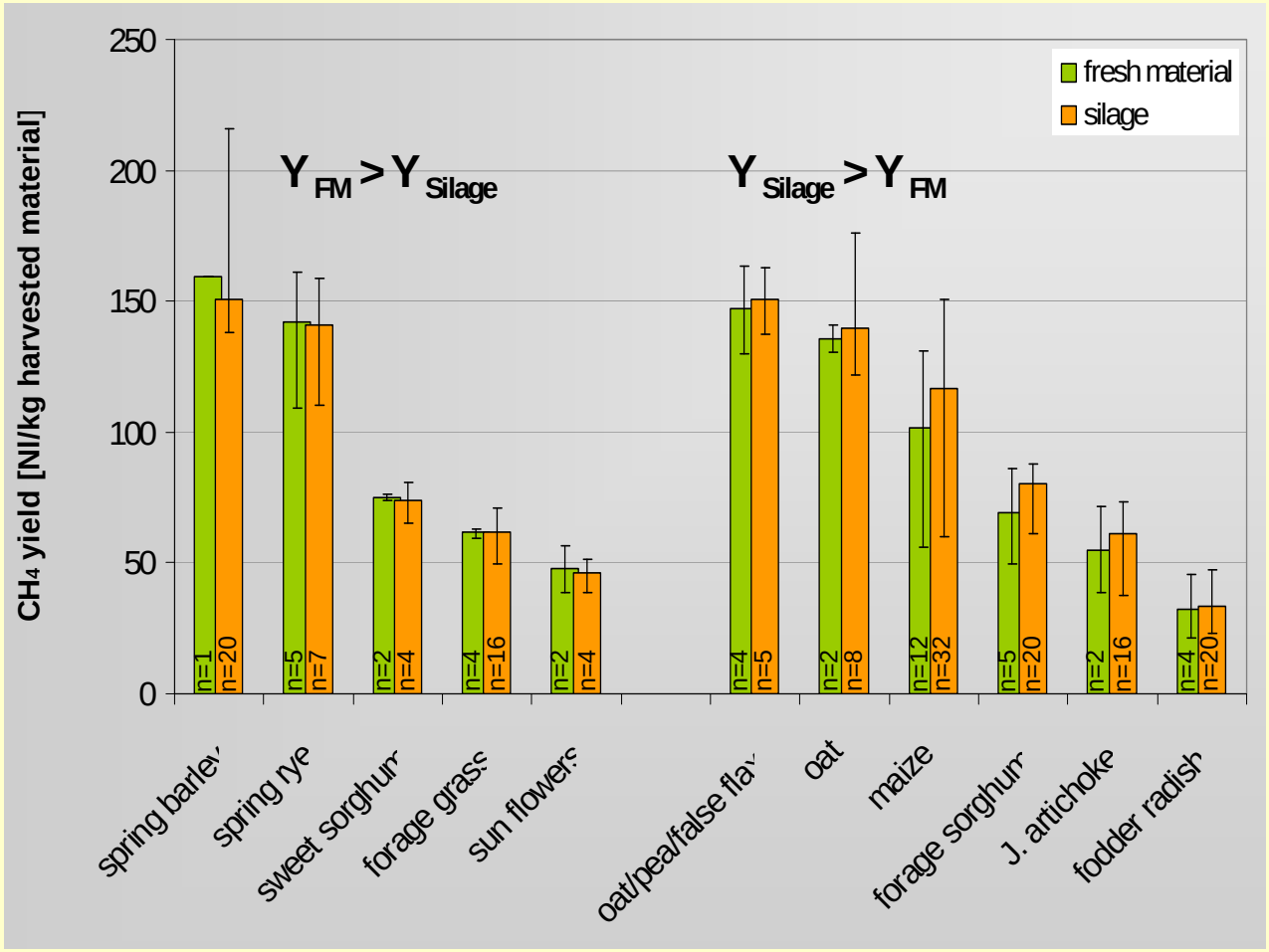
- Silages



Source: Heiermann

Impact of ensiling process

- Methane yield



Source: Heiermann

Conclusions

- We should be carefully aware of ecological risks
- But scientific evidence should set the pace
- LCA‘s are just an instrument sensitive to manipulation
- ...and we should never forget that until the early stages of the 20th century agriculture used always between 16% (Switzerland) and 21% (Austria) of the land for energy production.

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Thank you for
your attention !

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Sustainability criteria

	Biomass sustainability decree	Fuel Quality Directive	Renewable Energy Directive
GHG savings	– Proof of minimumg GHG savings: 30%/ 40% from 2011 – Otherwise no accounting on quota or tax reduction possible	– 10% GHG savings per unit of energy until 2020 (1% p.a. from 2011)	– Proof of minimum GHG savings: 35% is necessary for accounting towards biofuel targets
Sustainable cultivation	– Cross Compliance/ Good Agricultural Practices or similar regulations – Otherwise compliance with certain regulation	– n.a.	– Production according to environmental criteria of Cross Compliance (EC 1782/2003)
Protection of natural habitats	– No cultivation in high nature value areas	– n.a..	– No feedstocks from high biodiversity land, wetlands, untouched peatland, continuously forested areas
Social sustainability	– n.a.	– n.a. (is being asked for in current discussions)	– n.a. (is being asked for in current discussions)

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Sustainability criteria

	RTFO	CAL
GHG savings	– Reporting on net GHG savings is required – No threshold value	– Low carbon fuel standard in 2010. Lower carbon intensity (CO_2-equiv.) of transportation by 10% per unit of fuel by 2020
Sustainable cultivation	– Information on origin, production method and sustainability of supplied biofuel is required	– As far as relevant for GHG balance
Protection of natural habitats	– Information on origin, production method and sustainability of supplied biofuel is required	– Land use change is likely to be included in GHG calculation
Social sustainability	– Provision of biofuels without causing social harm	– n.a.

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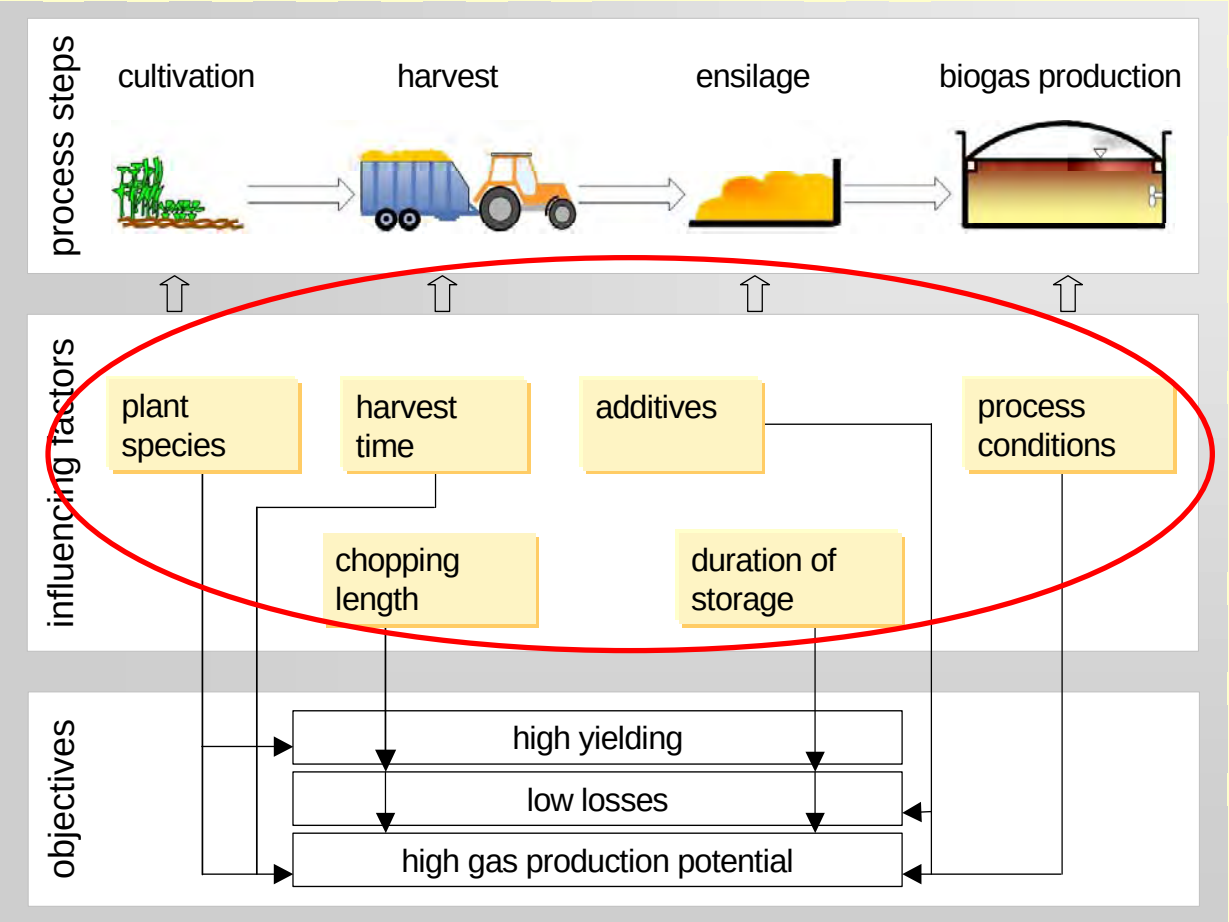
Optimising biogas production from energy crop



Source: Heiermann

Pre-Conditions of sustainable biomass production

A Commission on “Sustainable production of biomass”, developed criteria for a sustainabile biomass production [Cramer et al., 2006] :

■ Net GHG emission reduction compared with fossil fuels of at least 30%

■ No decrease in the availability of biomass for food, local energy supply, building materials or medicines (reporting obligation);

■ No deterioration of protected areas or valuable ecosystems (compliance with local requirements);

■ No possible negative effects on the regional and national economy (reporting obligation);

■ No negative effects on the social well-being of the workers and local population, including working conditions, human rights,
property rights and land-use rights (compliance and reporting obligations);

■ No negative effects on the local environment (compliance with local and national legislation and/or reporting obligation).

Pre-Conditions of sustainable biofuel production

In addition two new topics came up the last two years:

1. Biofuels production must target idle and marginal land and use of wastes and residues

2. Biofuels can only contribute GHG savings from transport if significant emissions from land-use change are avoided and appropriate production technologies are employed

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