Overview of European policies and technologies for bio energy development and greenhouses gas mitigation

Sven G. Sommer University of Aarhus
Institute of Agricultural Engineering
and
Henrik Wenzel, University of Southern Denmark,
Faculty of Engineering,

European Union

EU Policy 2007

- Increase security of supply
- Ensuring the competitiveness of European economies and the availability of affordable energy
- Promoting environmental sustainability and combating climate change

EU bio-energy policy

Support

- Support co production of fuels
- Heat and power
- Integrated bio-refineries (Use of all products)

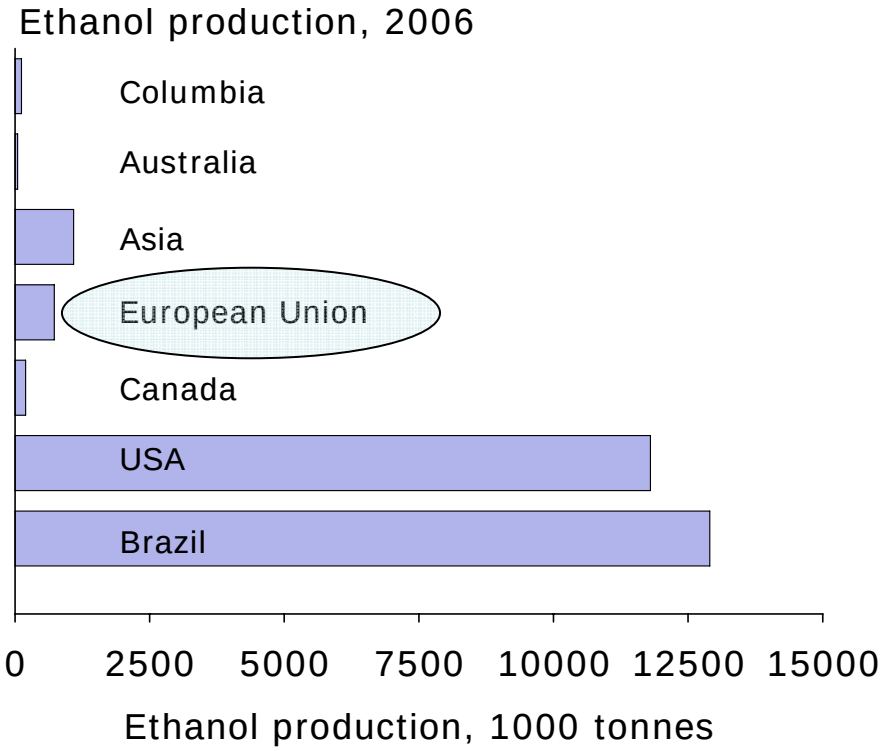
Tools for support

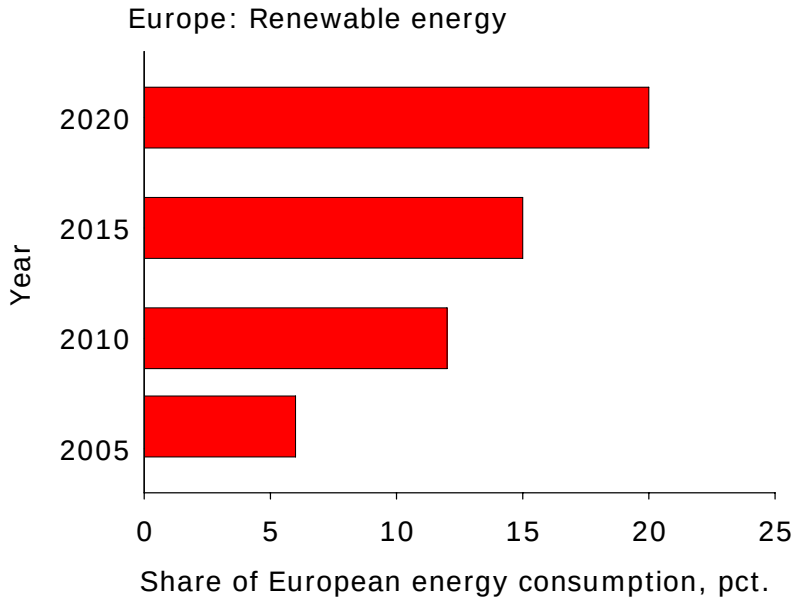
- Through regulations
- Market based support
  - Biogas
  - Energy price 0.08€/Wh in Denmark
  - Energy price 0.15 €/Wh in Germany for small plants.
  - Special EU – aid to energy crops: 45€ per ha

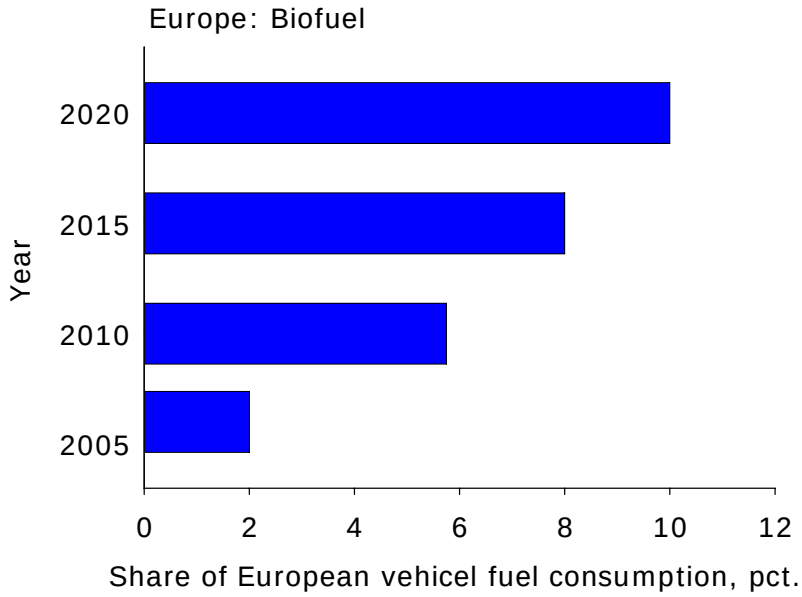
EU - Research programmes

- Funding (not including demonstration) 200 M€’
- Bio-fuels for transport 34%
- Bio-refineries 18%
- Gasification and H_2 production 23%
- Bio-residues and energy crops 5%
- Incineration 10%
- Others 10%

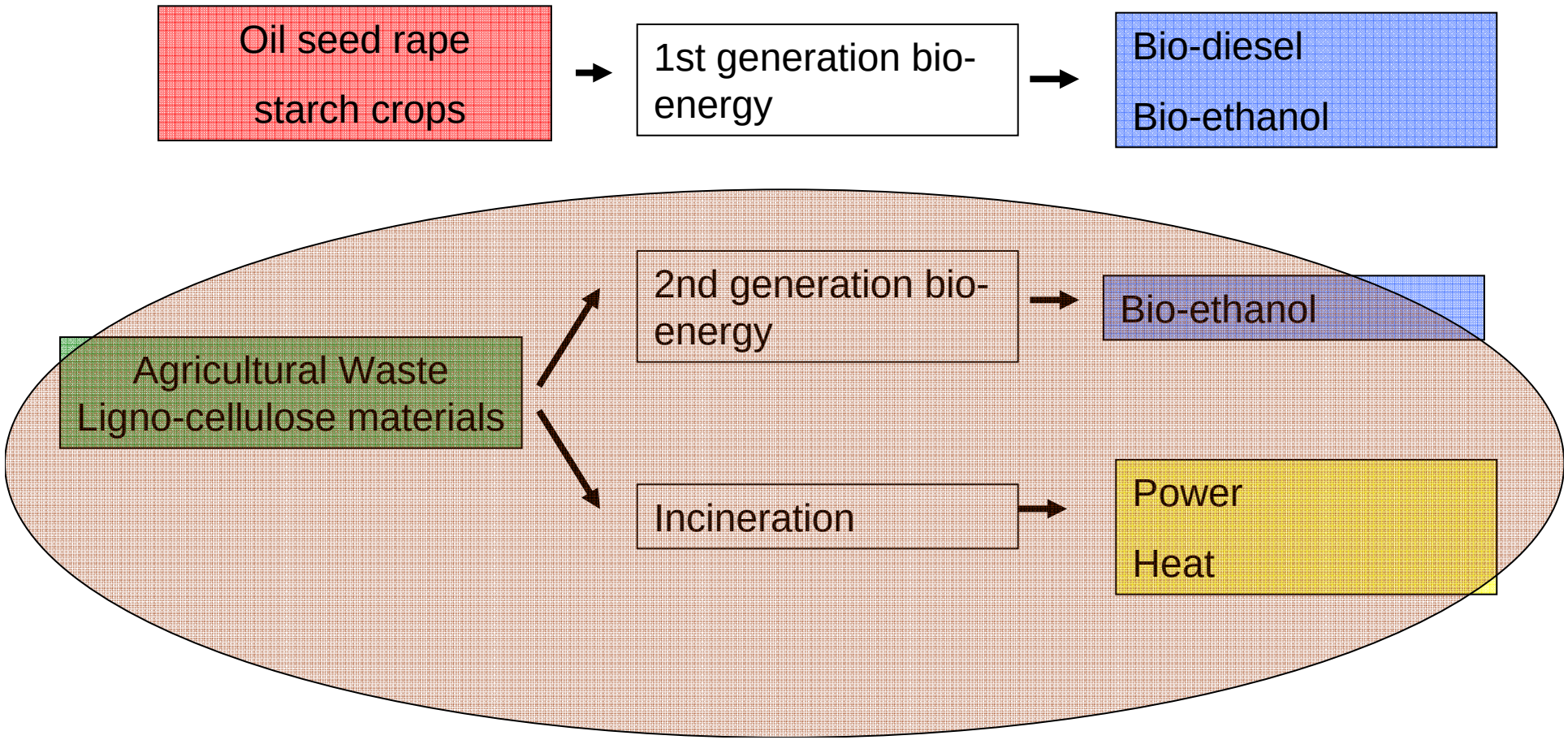
EU Policy - energy production



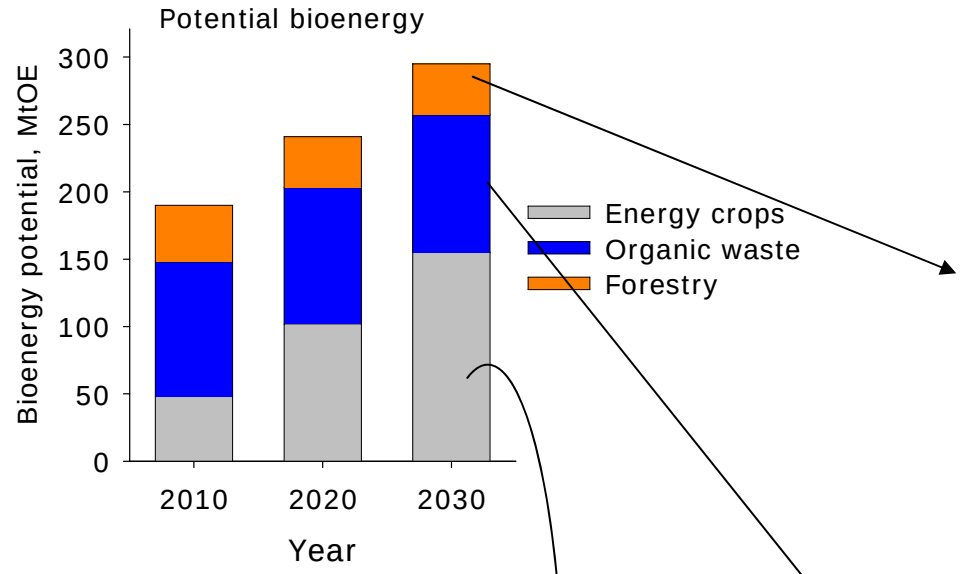


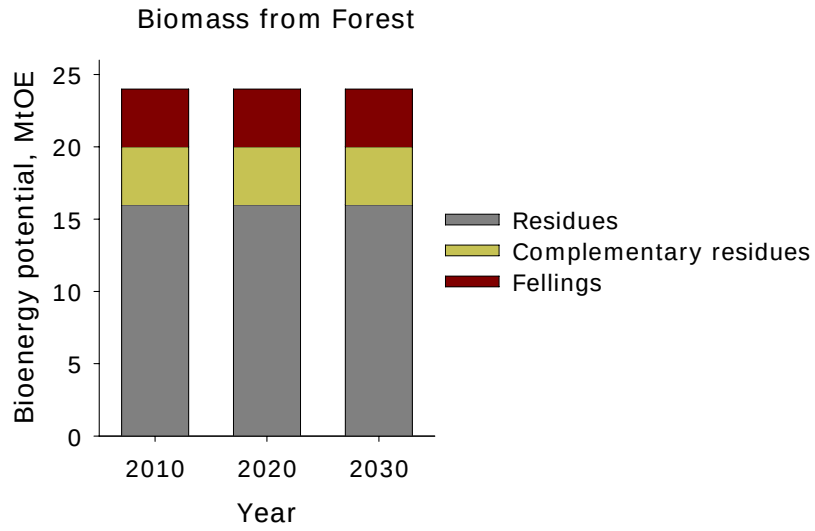


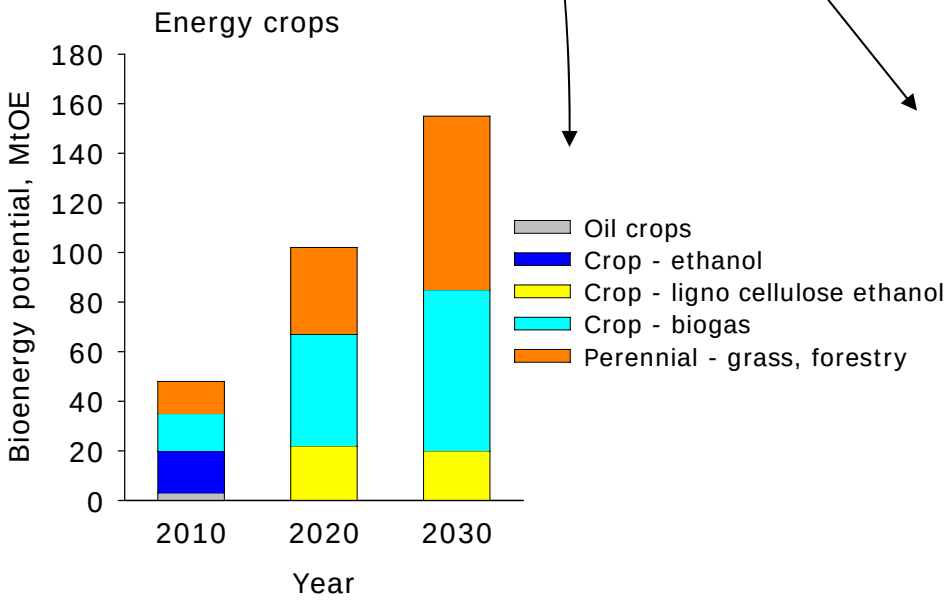
Biomass and energy conversion

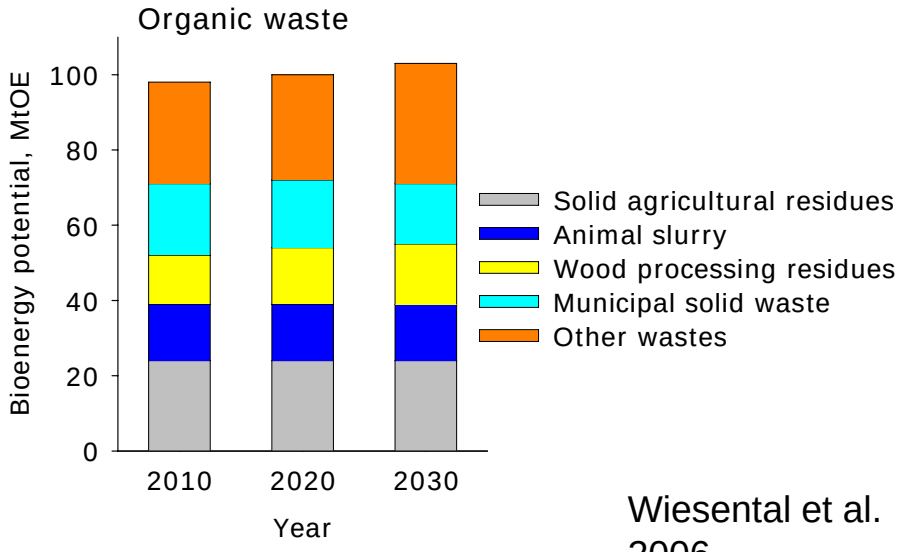


Bioenergy potential in Europe



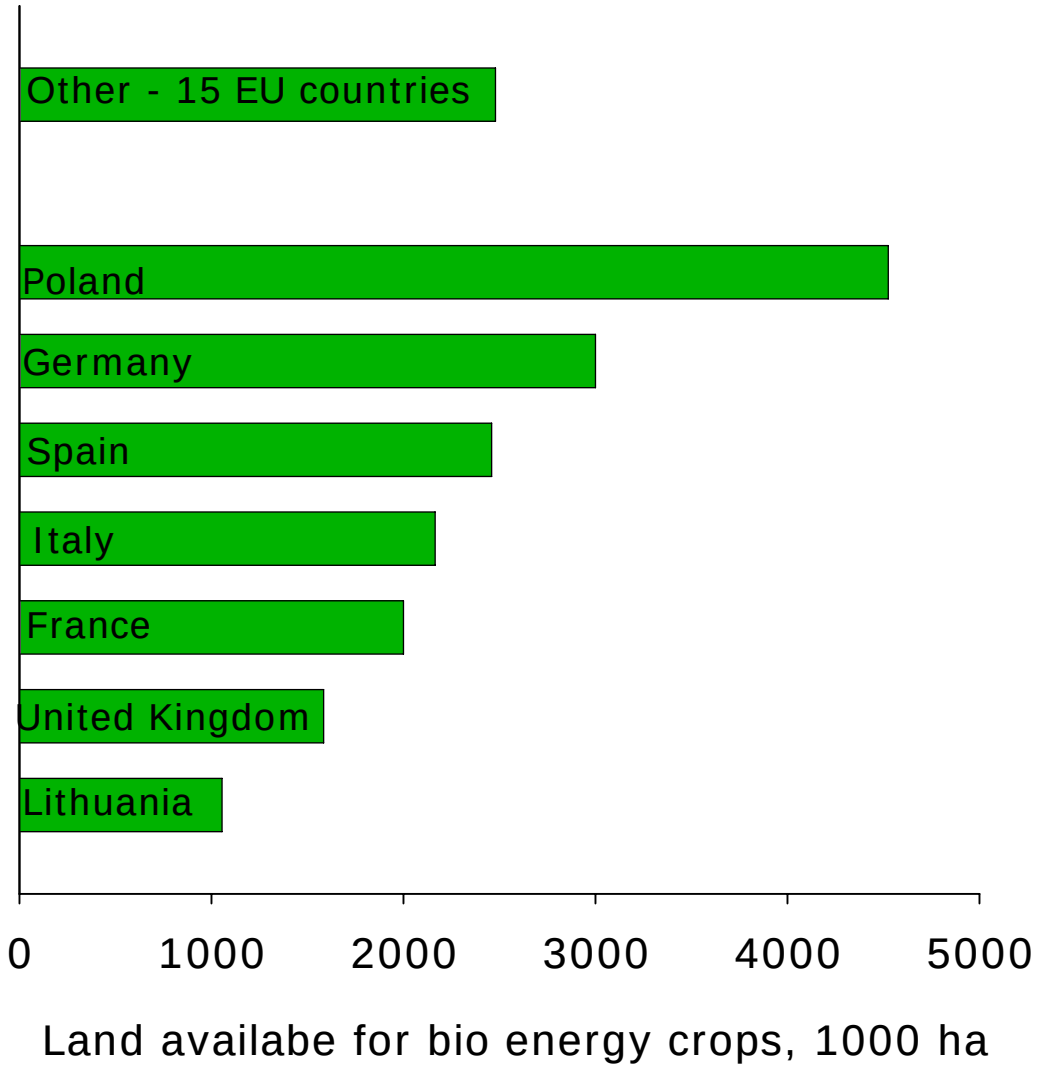






Wiesental et al. 2006

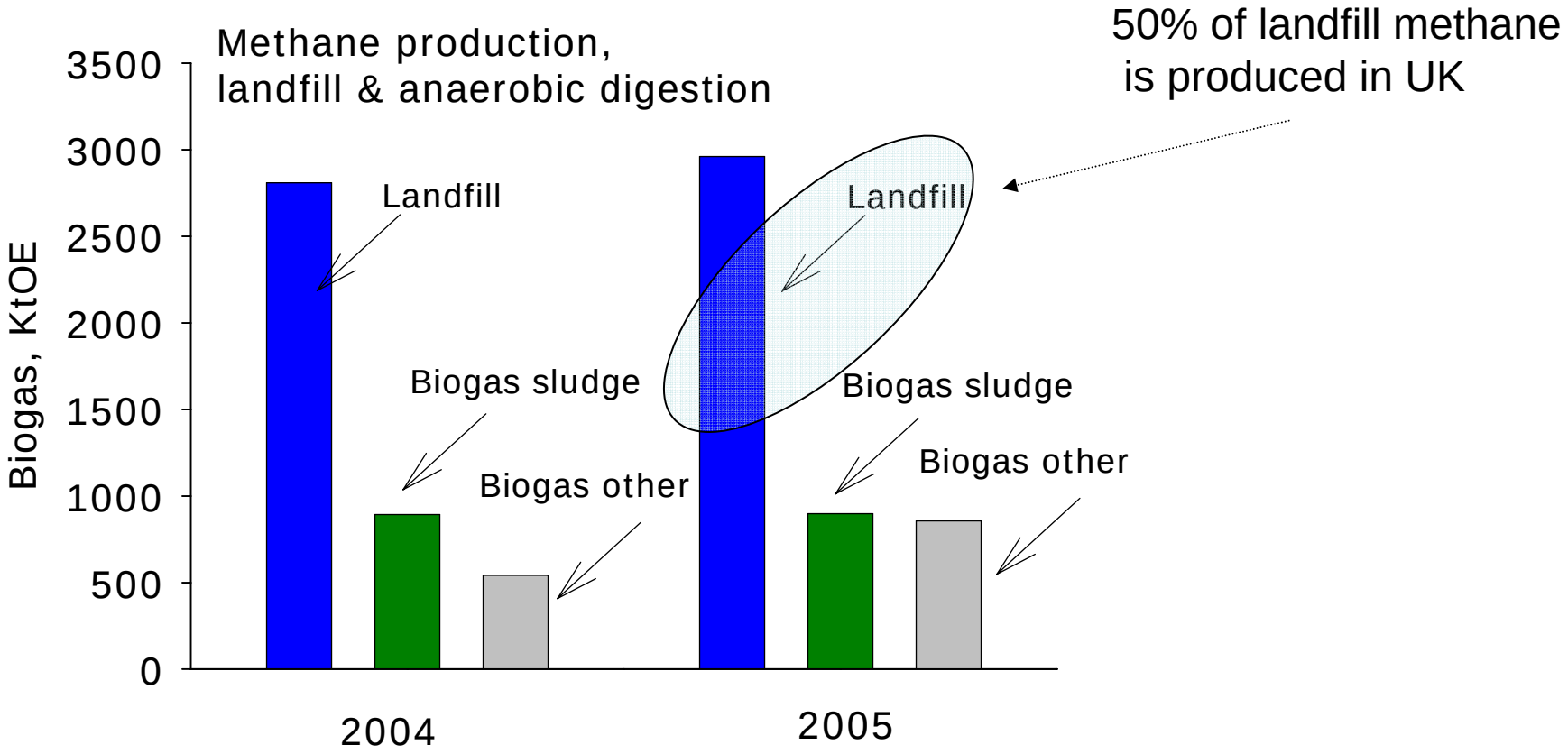
EU - Biomass for energy production



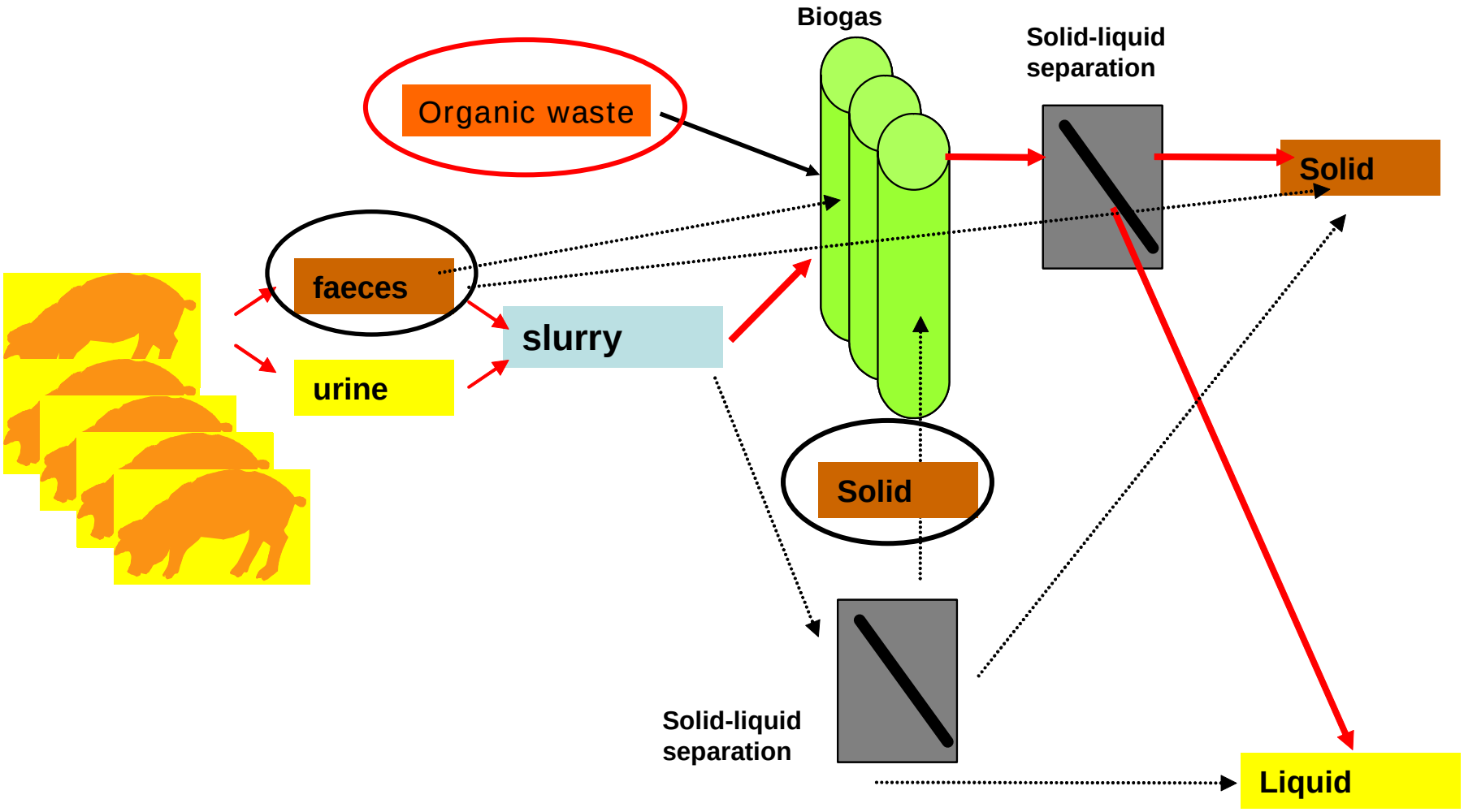
- Seven out of 25 countries provide about 80% of the land available for energy crops

Wiesental et al. 2006

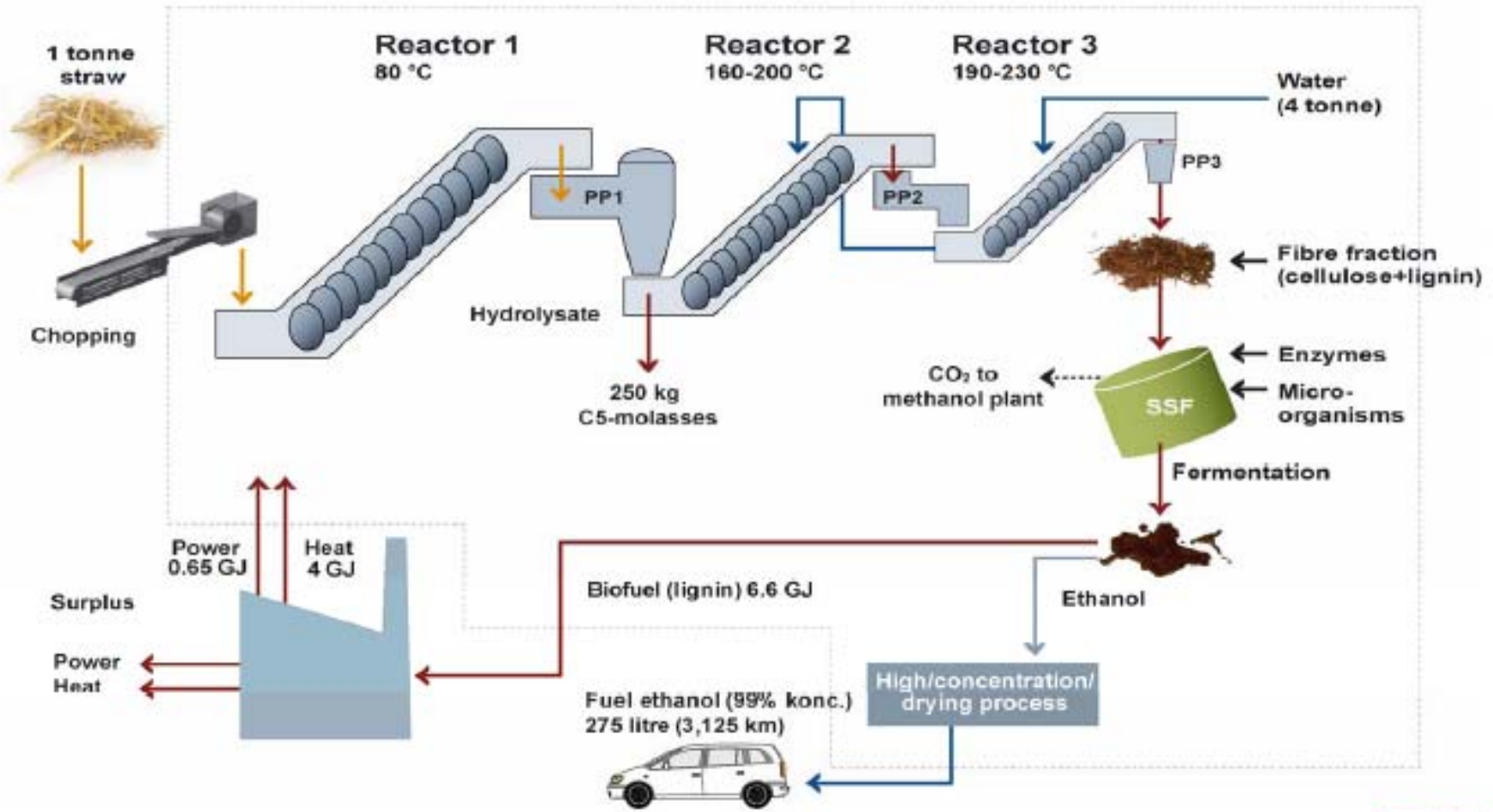
Biogas production



Manure treatment concepts
Limited amount Organic waste with digestible DM



Ethanol production from plant residues
IBUS concept



DONG energy

From Charles Nielsen

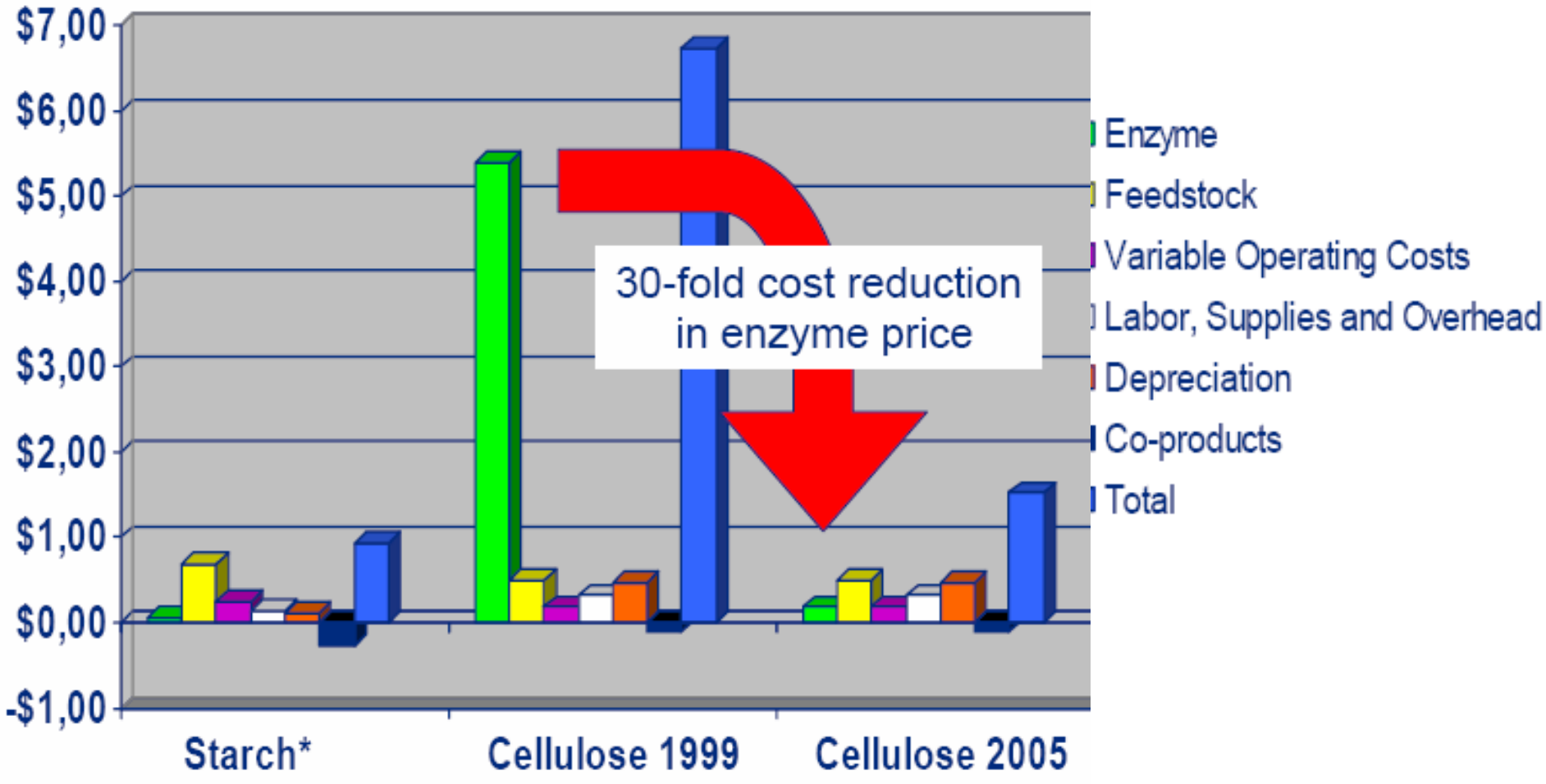
Ethanol from wheat straw

- Soaking process
- Opening of lignocelluloses by heating to cellulose and hemicelluloses
- Liquification: Enzymes transform cellulose/hemicelluloses to glucose or xylose
- Ethanol production from glucose or xylose by yeast (GMO bacteria)
- Distillation
- Recycling of residual biomass for heat and power, feed – biogas production (Maxifuel)

- Transformation of 90% of cellulose and 75% hemicelluloses
- 0.49-0.5g ethanol pr g glucose or xylose (0.42 g today)
- Conversion rate is 40% (MJ ethanol per MJ biomass input).

Cost for producing ethanol using straw compared to using grain

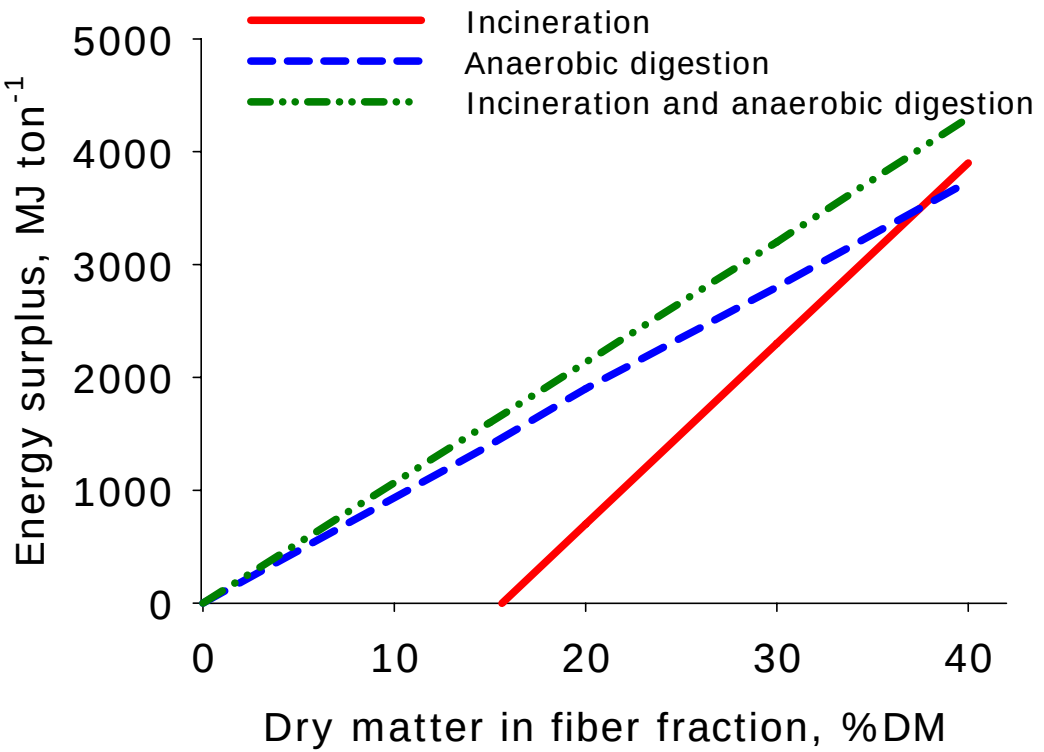
US$ pr gallon ethanol



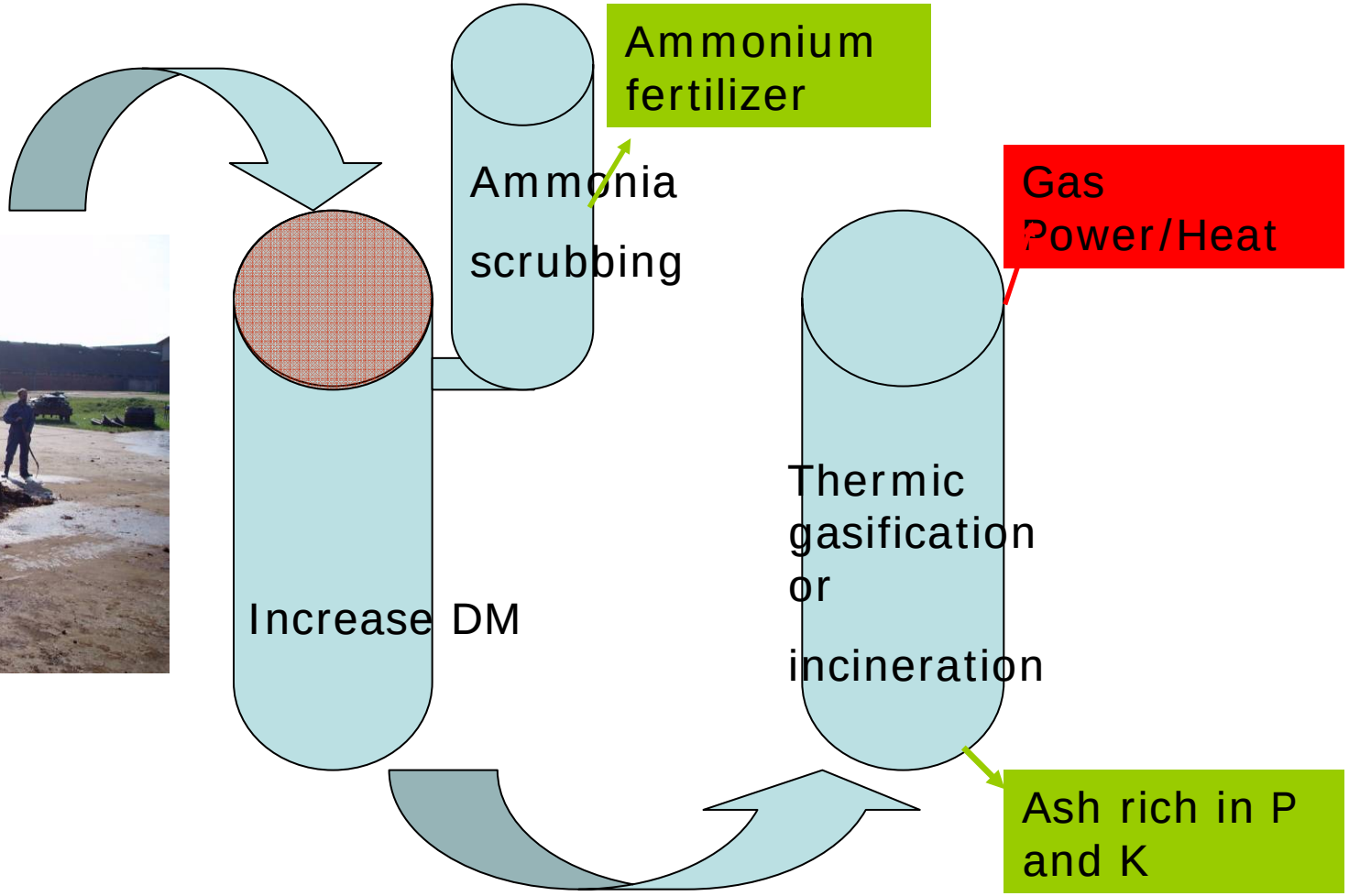
From Lange L.
Novozymes

Incineration of animal manure

- Tax: Incineration of fibre fraction of separated manure or chicken manure is in Denmark not economical sustainable due to taxation.
- No tax: Incineration of the solid fraction from separation of anaerobic treated manure, UK
- Dry matter content is the challenge for incineration or thermal gasification.

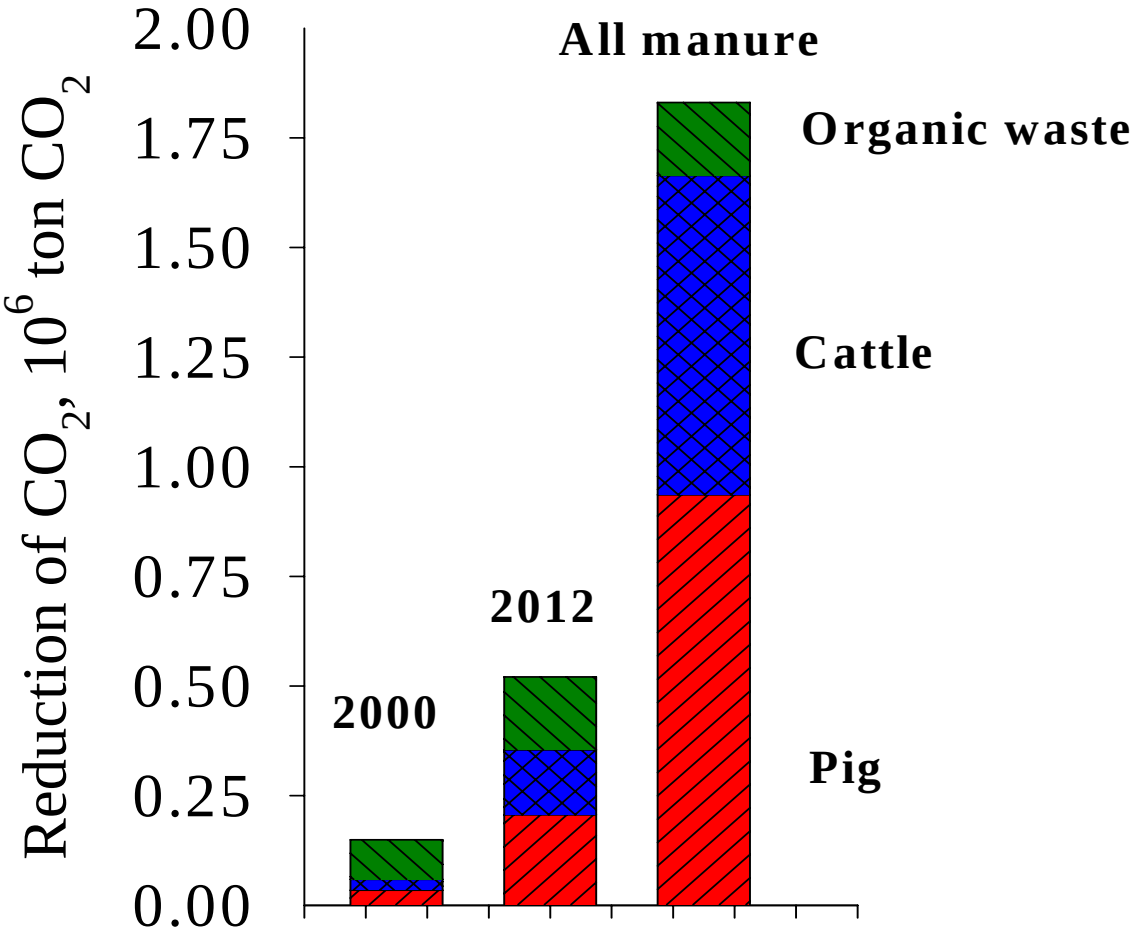


Environment friendly technologies and energy production



Climate and bio-energy example
Biogas & GHG reduction

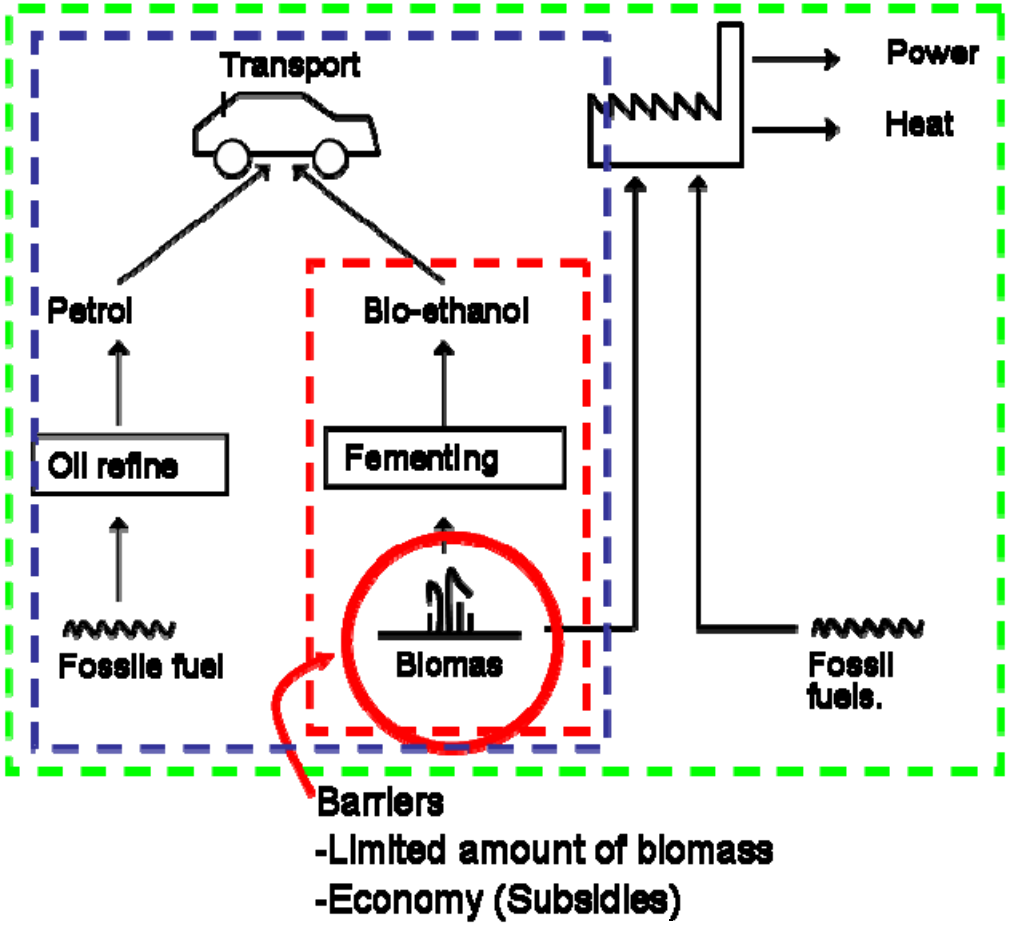
- Natural gas substitution: 2.3 mill. ton CO2 or 3% of the total CO2 emission
- Coal energy substitution: 2.9 mill ton CO2 or 4% of the total CO2 emission

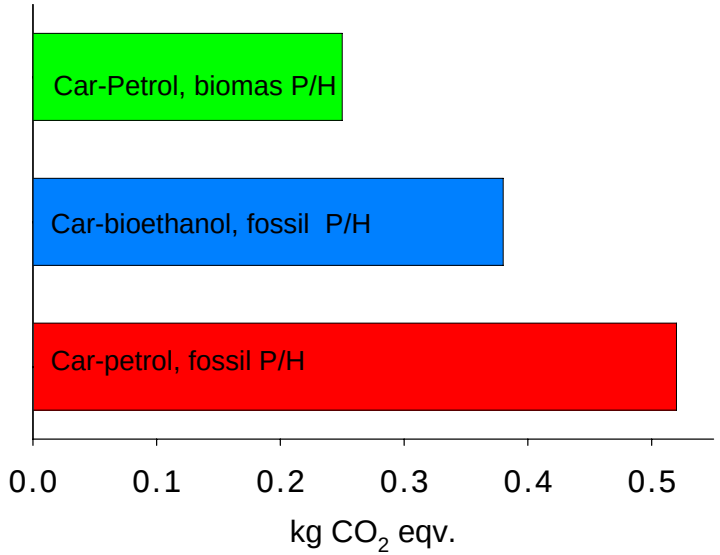


Assesment of effect on environment

Copied from presentation of

Henrik Wenzel wenzel@ipl.dtu.dk





The same amount of biomass as input to facilitate either transport (1 mile) through ethanol production or heat & power through coal substitution

Conclusion

Biomass for energy production shall contribute significantly to production of environmental technologies.

It is realised that

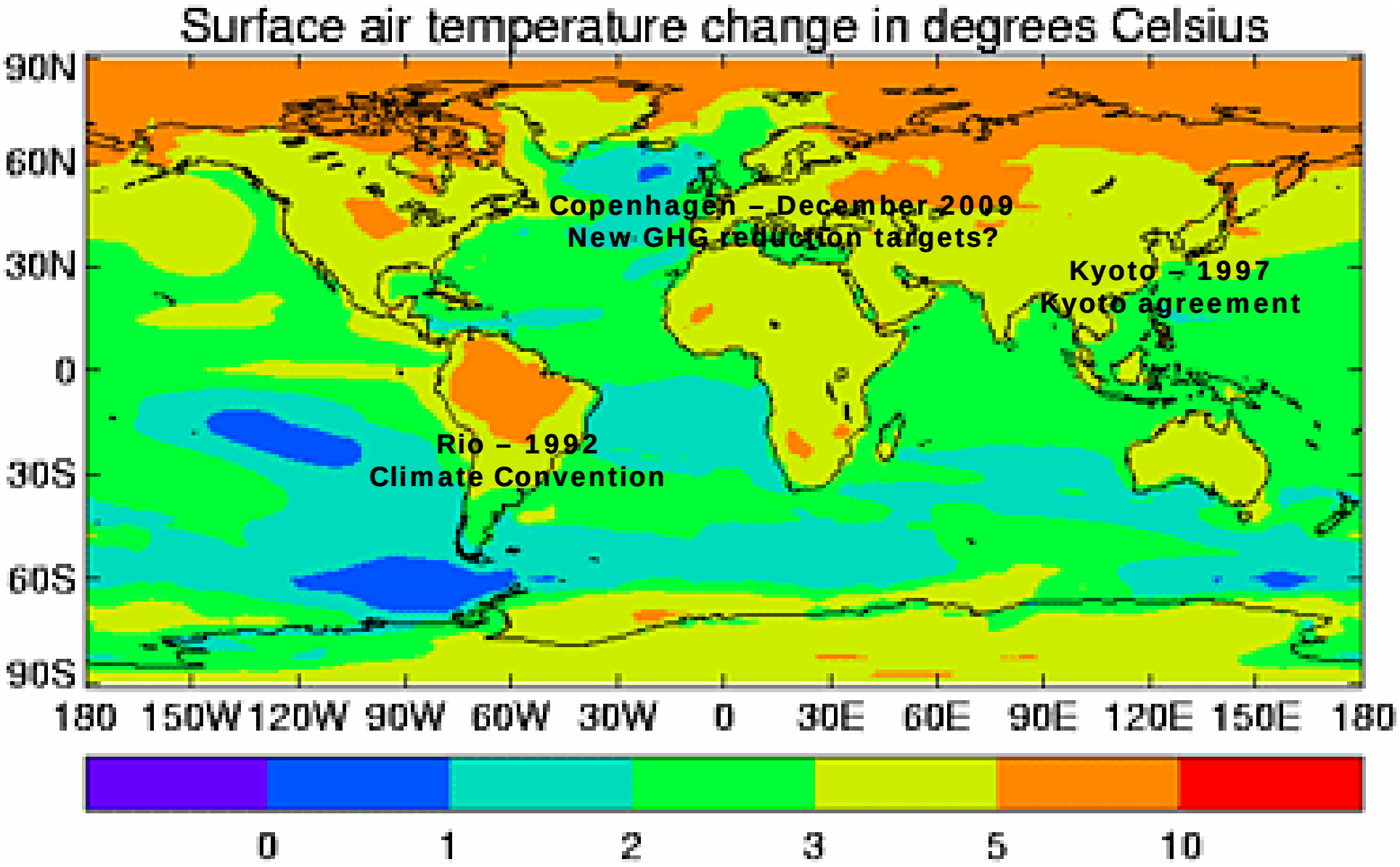
- Biomass for power generation – best for environment
- Biomass for heating is cheapest (District heating)

But bio fuels is in focus due to the urgent need for transport energy?

- The argument is that (1) biofuels Is used in a transition phase until other energy forms is available & (2) biofuel can be used in existing engines
- **BUT** the biomass resource base is limited and use for ethanol will happen at the expense of use for heat & Power. Therefore power and heat generation using the biomass is the better alternative - substitutingt fossil fuels (oil and gas) that can then be used in the transport sector.

The bio fuels in consideration

- Ethanol
- RME (Oil seed rape oil-methyl ester -´bio diesel´



Source Hadley centre