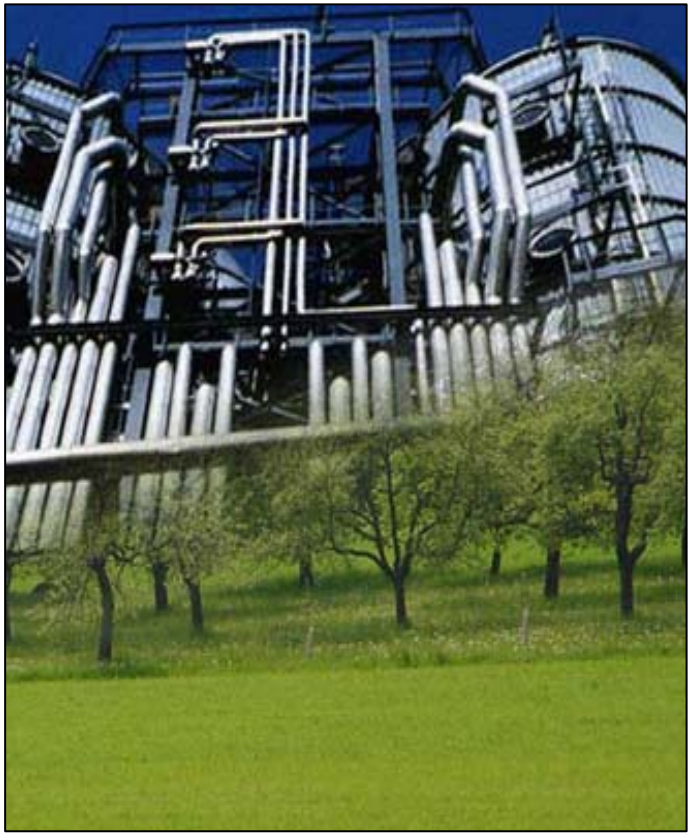
JOANNEUM RESEARCH

Institute for Sustainable Techniques and Systems

BioRefSYS® BioRefinery Systems



Green biorefinery research in Austria- an overview

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IEA Task 42 Biorefinery Workshop Vienna

INNOVATION aus TRADITION

ISO 9001 certified

Where did we start .....

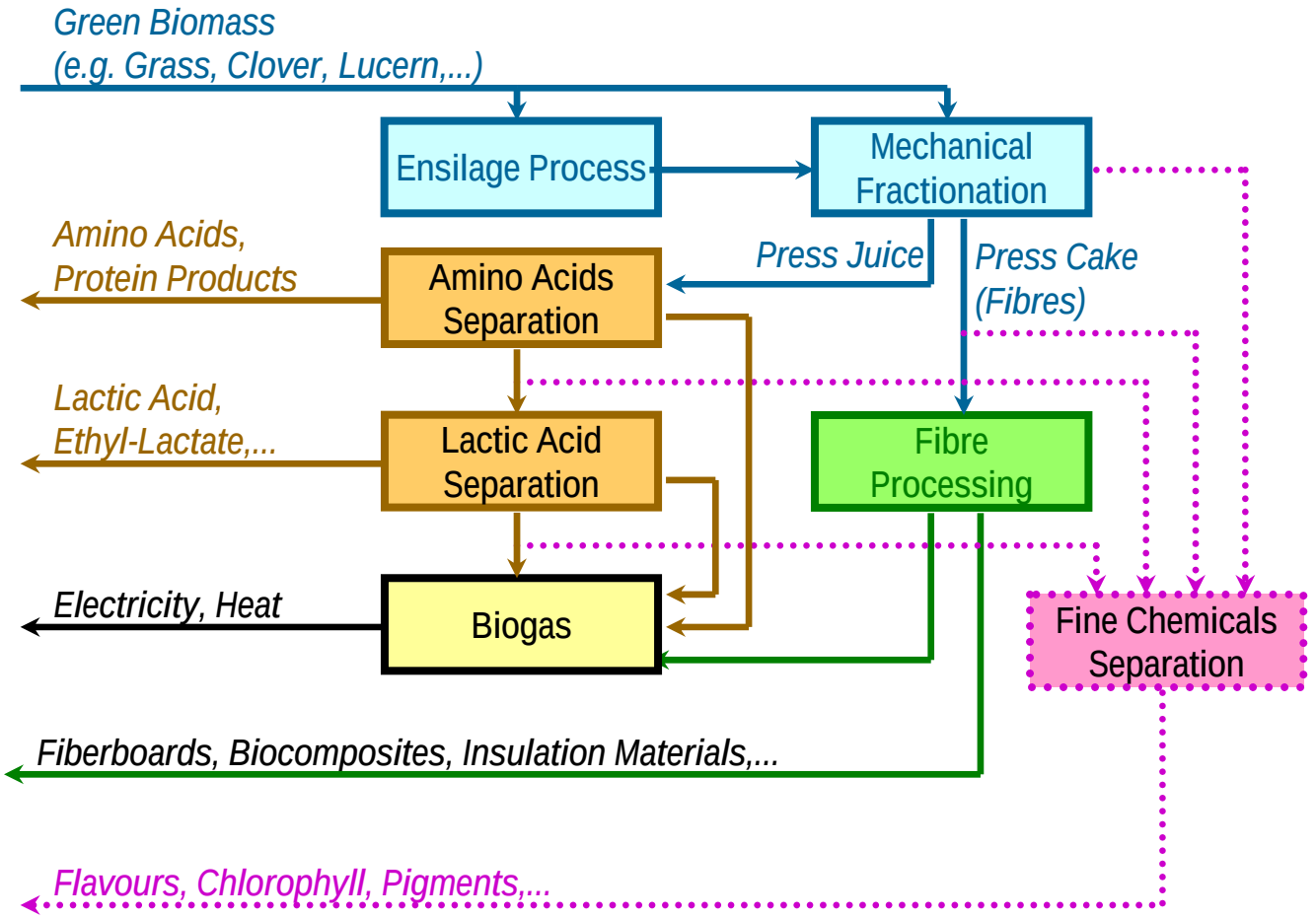
… getting hooked on an idea

The Green Biorefinery R&D work was generally performed in three stages:

- **fundamental studies,**
- **technology development and**
- **optimization of processes.**

In summary 7 R&D projects for various aspects have been performed .

Green Biorefinery Austria

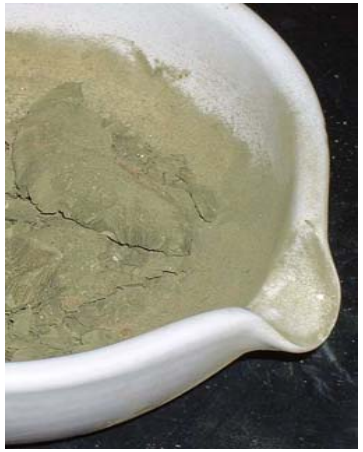


Optimizing processes

— **Mechanical fractionation (pressing procedure)**

— **Processing of juice (LA and AA separation)**

State of the Art R&D: Amino Acids

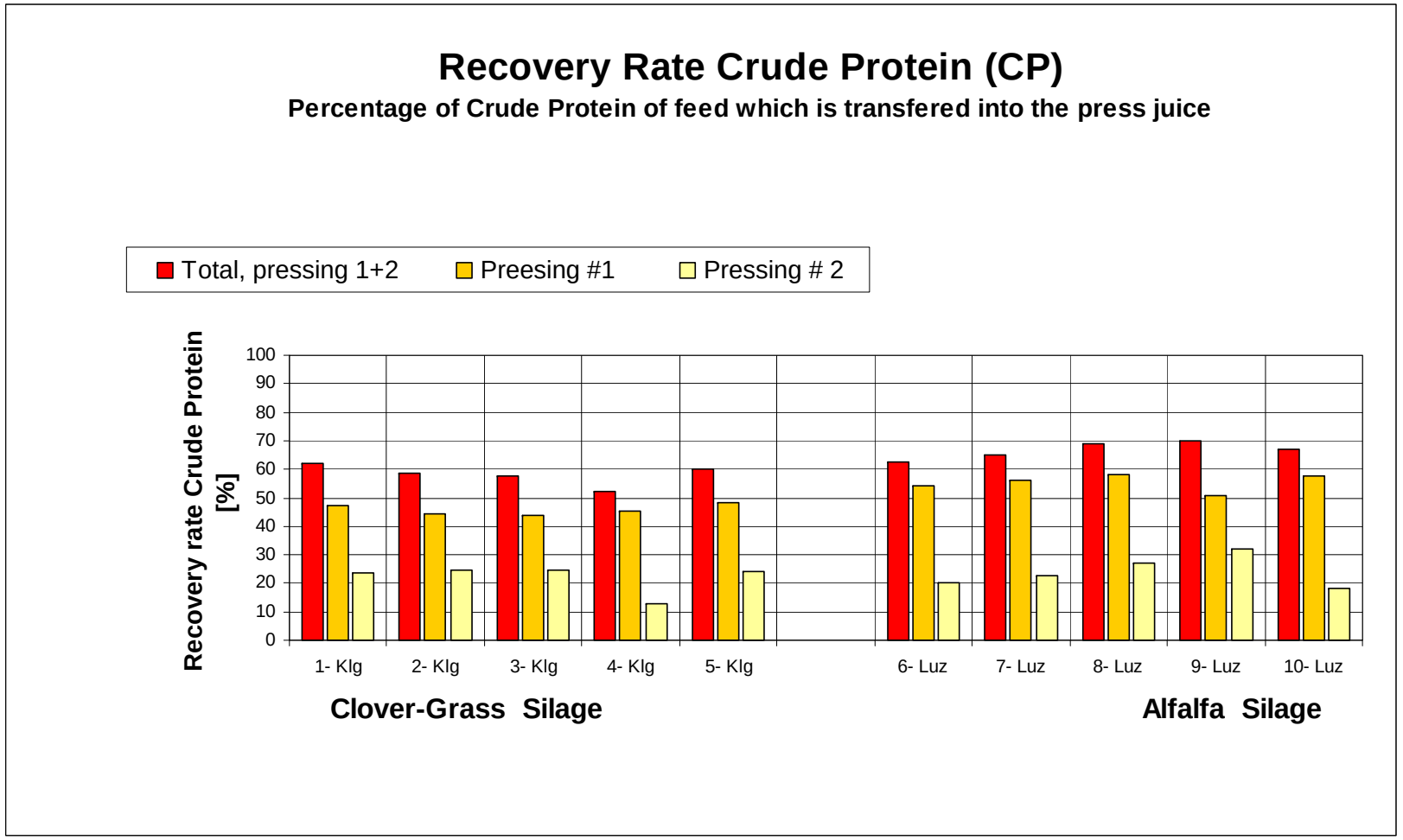


- Silage: hydrolyzed proteins
- ~60% rel. recovery rate of amino acids from Silage
- All essential amino acids are contained
- from nutrition …personal care is feasible
- Complex juice composition !

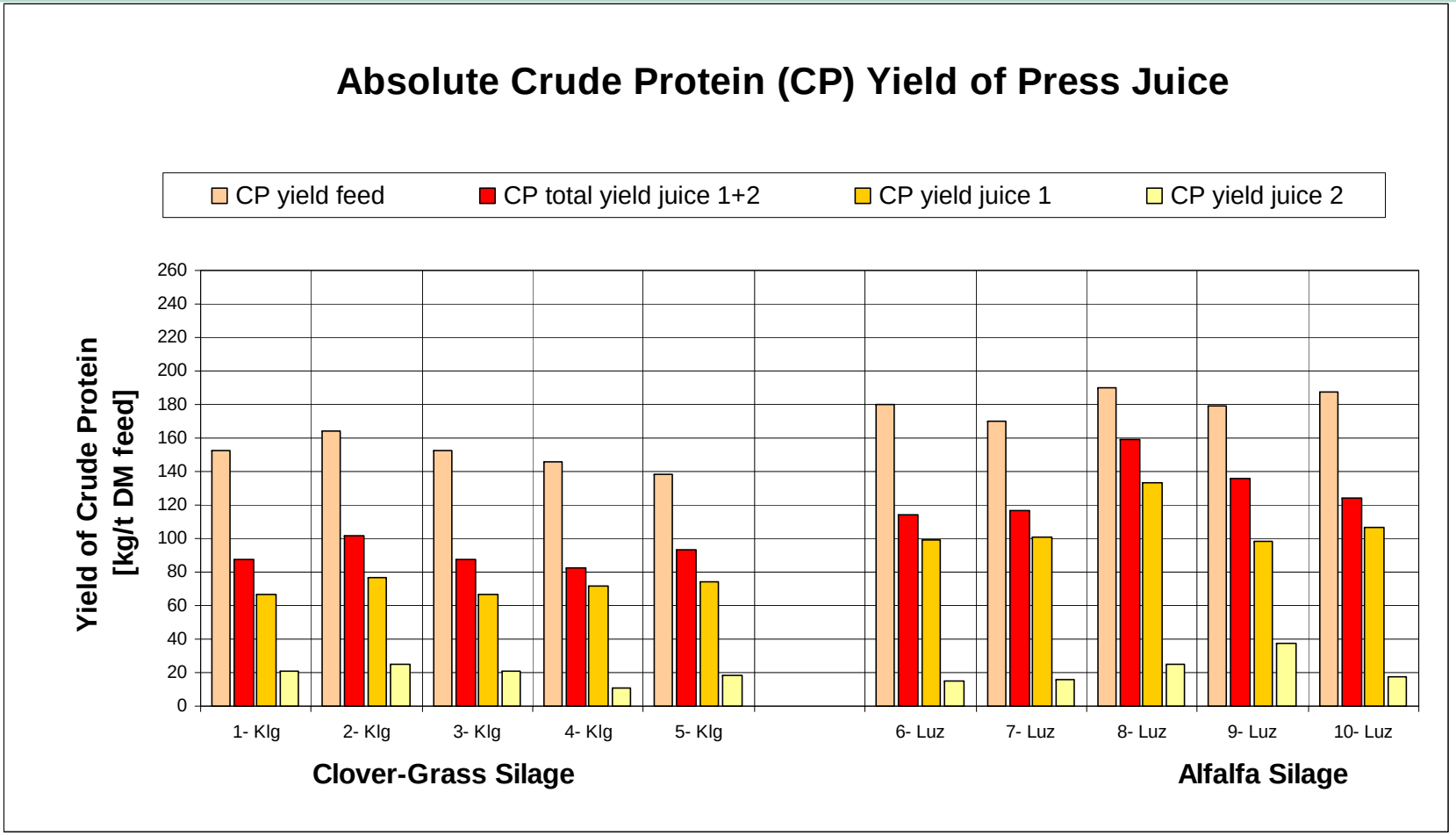
Lactic acid

- ~85% recovery of lactic acid from silage feedstock
- Application: bulk chemical, solvent, bio-polymer (PLA)
- Combination of separation technologies (patent pending)
- Market perspective for LA promising

Recovery CP / Amino Acids



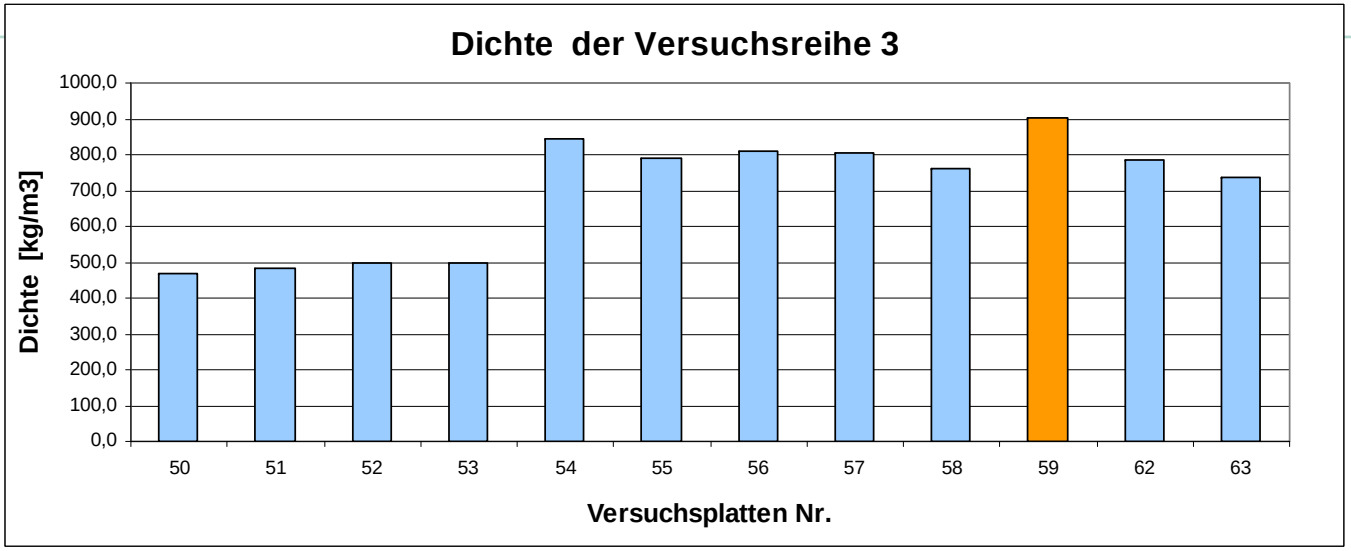
Recovery CP / Amino Acids

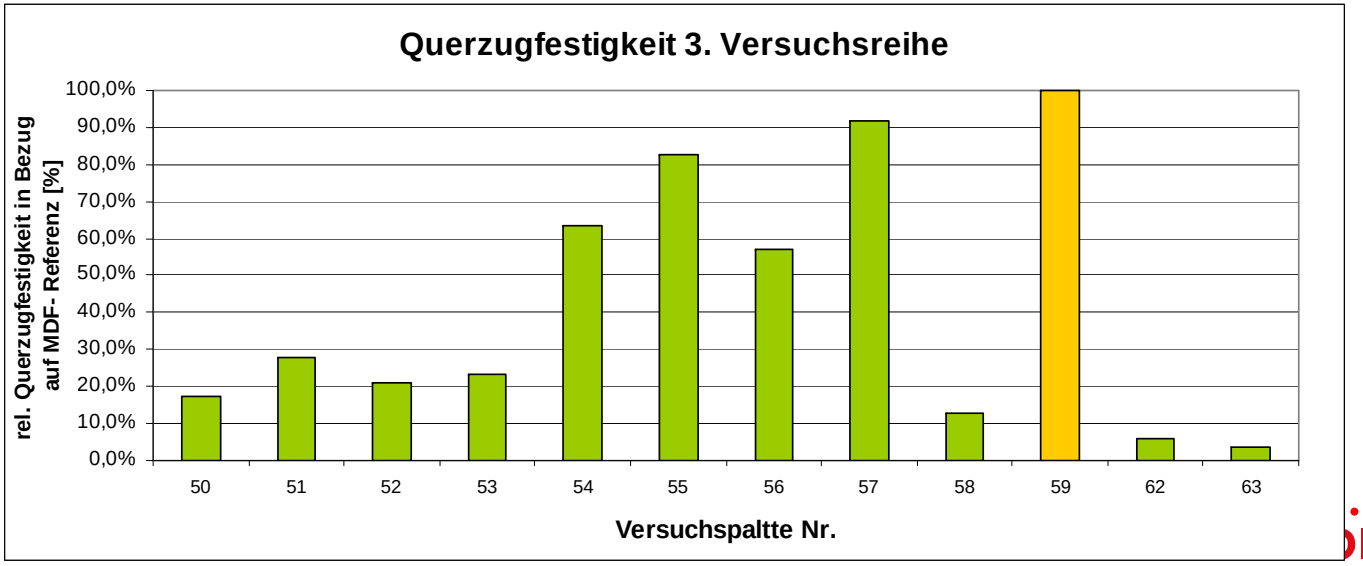


Grass fibers utilization

- **Press cake is a grass fiber fraction**
- **Fundamental characterization was done**
- **Various application have been tested**
  (fiber boards, fleeces, insulation material, building products…)
- **Grass fiber products are not known on the market (risky, economic aspects)**
- **Strategy to use press cake for biogas**

Examples Fiber boards

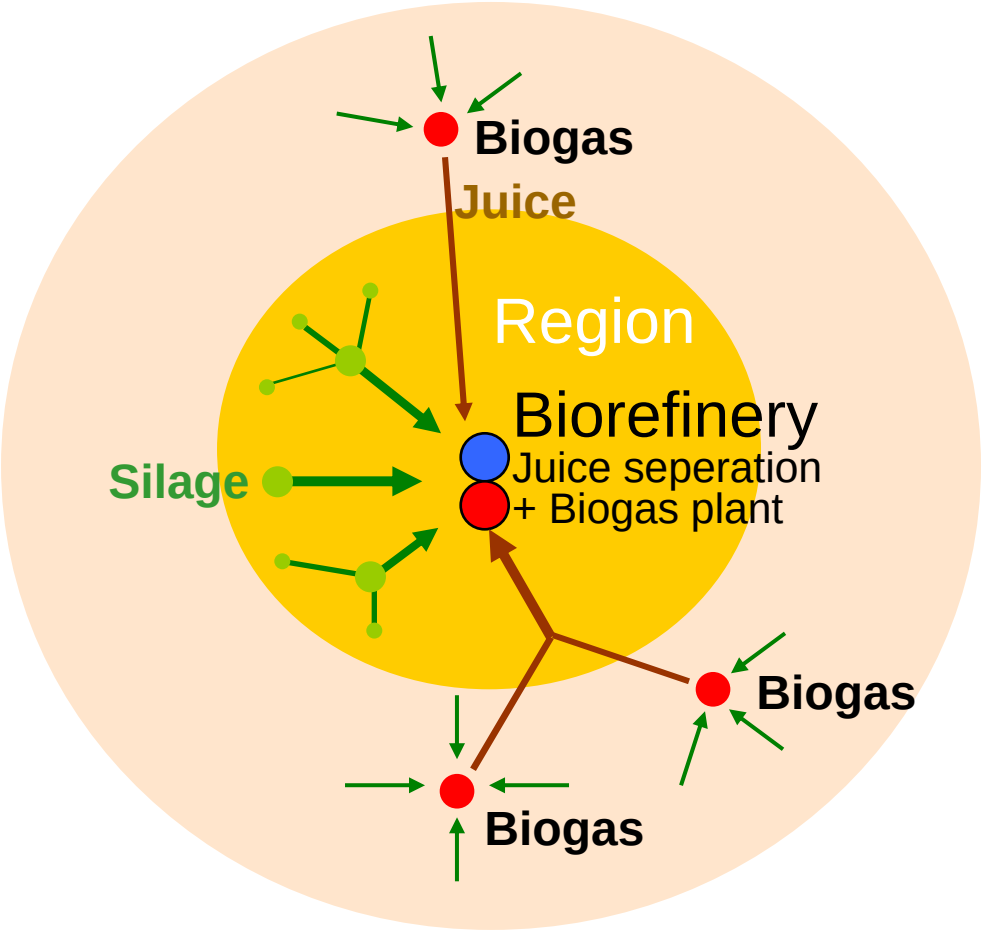




Models for Green Biorefinery operation

Biorefinery in the center of a supply area

Possible Integration of surrounding region

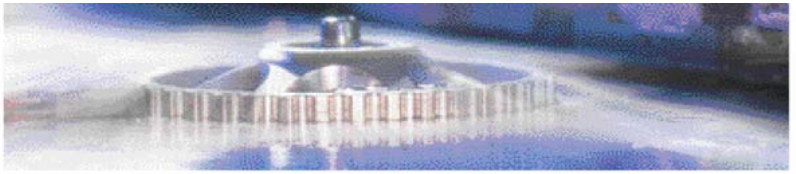


"Take home message…"

- Green Biorefinery is a technology concept for using the whole plant
- Logistics will become a part of the process; regional "embedding" of technologies
- Green Biorefinery apply future key-technologies for separating valuable substances
- Green Biorefinery can be easily linked to a biogas digester
- R&D: 5% inspiration; 95% transpiration

Acknowledgement

We kindly acknowledge the support of the funding program



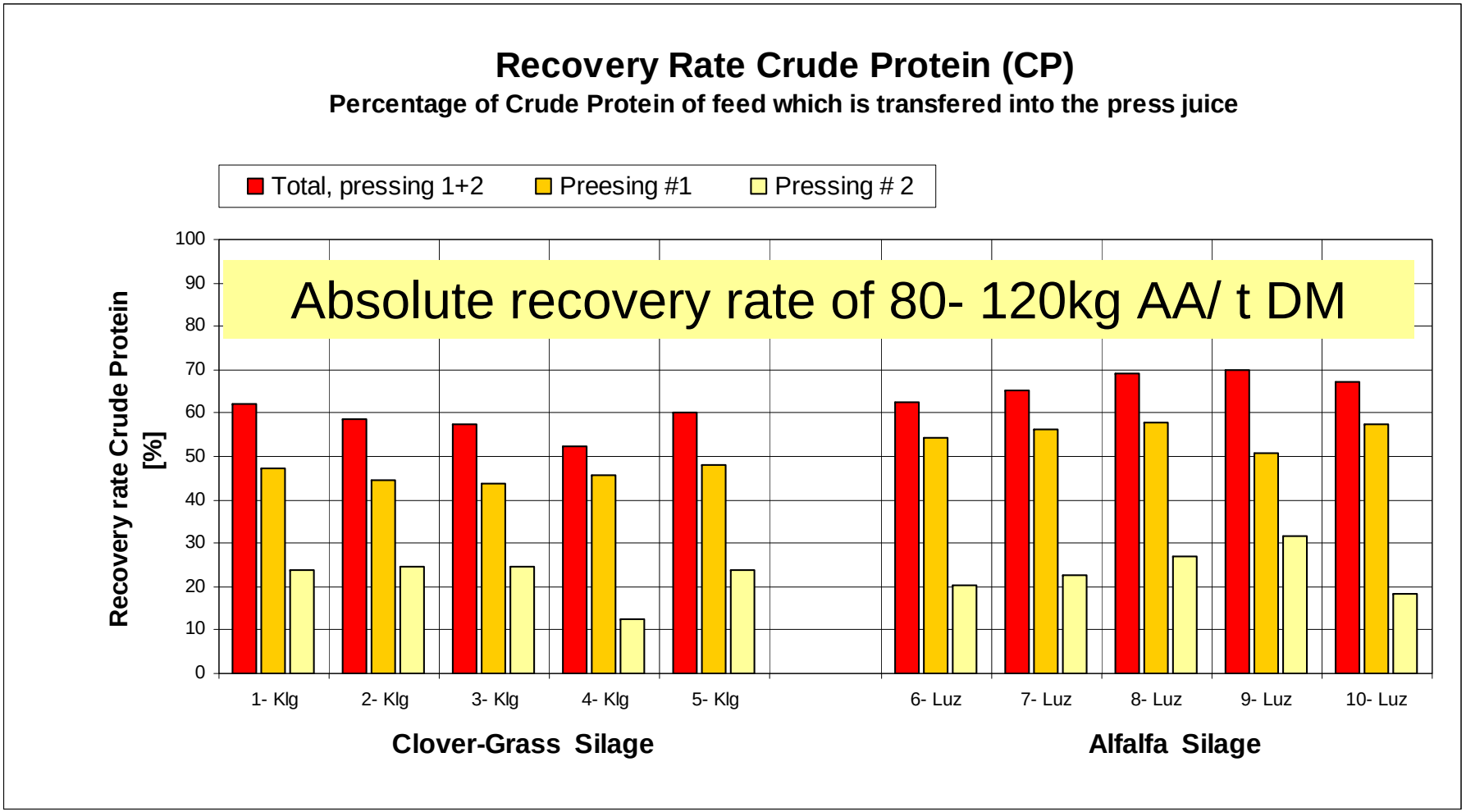
Fabrik der Zukunft

and our scientific partners

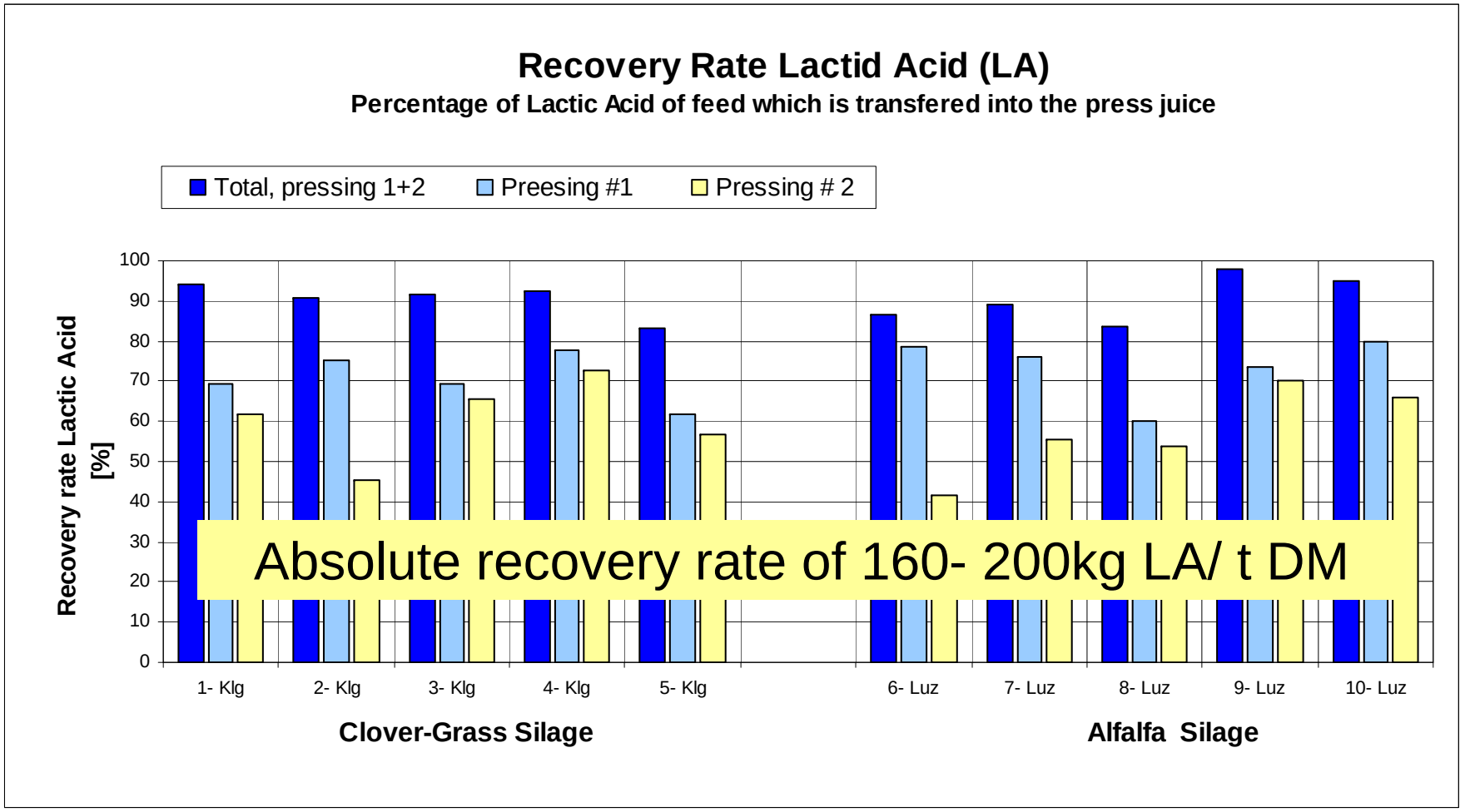
University of Natural Resources and Life Science Vienna

Institute for Resource Efficient and Sustainable Systems

Recovery of Crude Protein in Pressjuice



Recovery of Lactic acid in Pressjuice



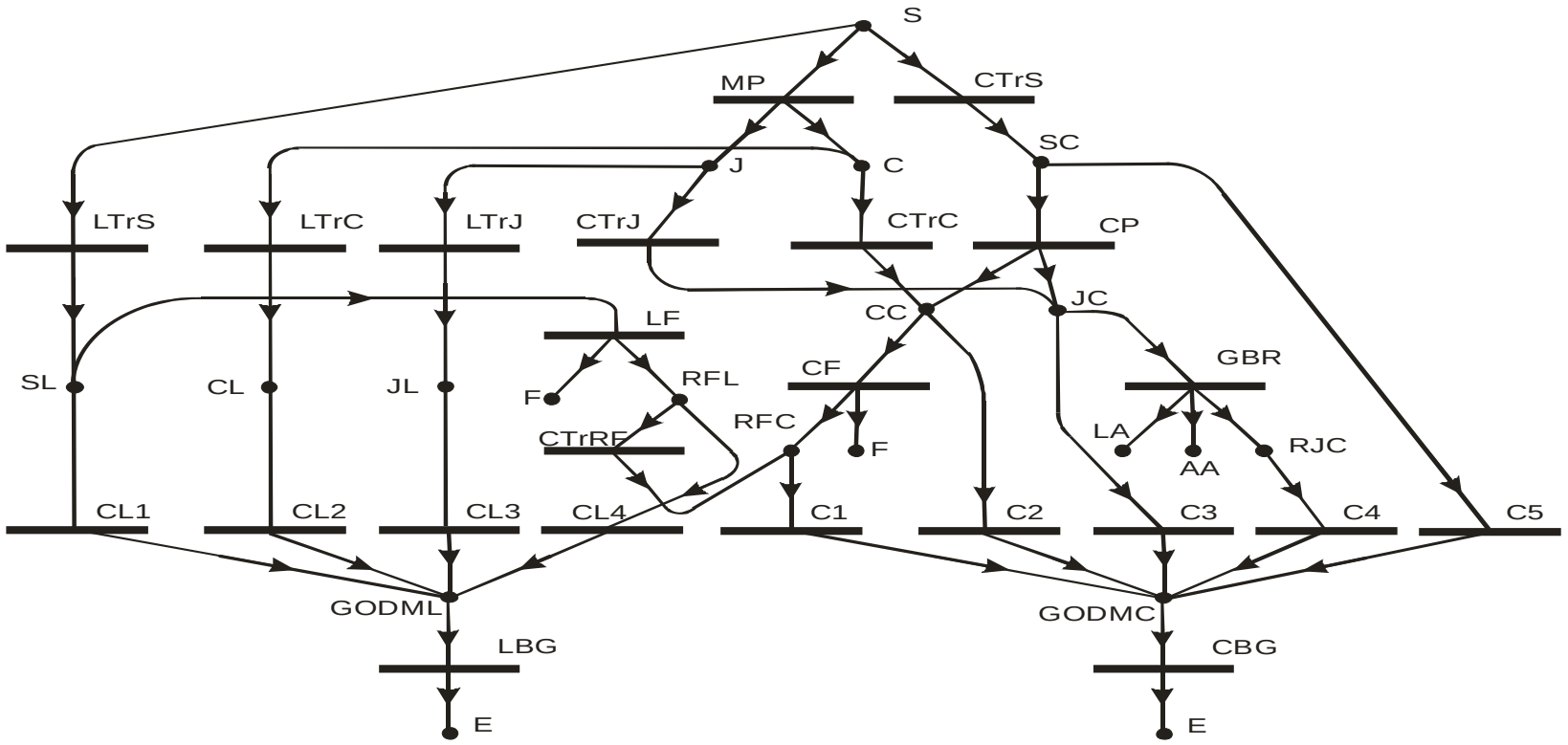
Applying process synthesis on Green Biorefinery

- How does a optimal „vaule chain“ look like?
- Shall all processes taken place in a central plant or are decentral processes an option? (storage, mobile pressing of feedstock)
- Sensitivity of the system to certain parameters (prices)
- How does the system perform generally?

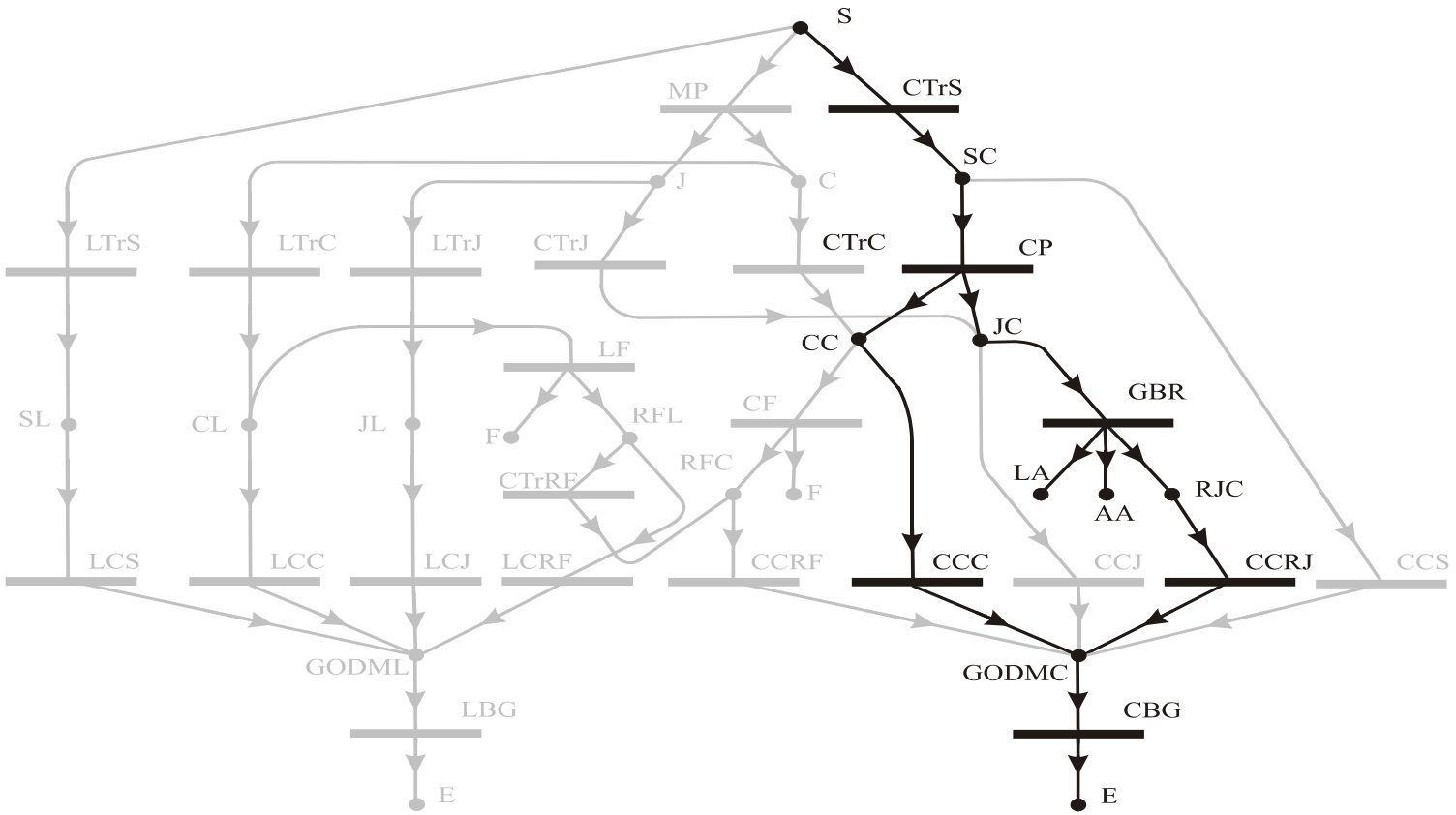
Basic assumptions

- total silage feedstock is 35.500 t/y
- local transport by tractors
  (upto 10 km, max load is 5 t, average speed is 20 km/h)
- central transport by trucks ,
  (upto 60 km ,max load is 12 t, average speed is 50 km/h)
- time limit for transportation is 2000 h/y for trucks and tractors
- there may be up to 1 “central plant” (biogas + biorefinery)
- there may be up to 5 “local plants” (biogas)
- fractionation of silage either by a mobile press or by presses in the “local” or “central” plants

The „maximal structure“...

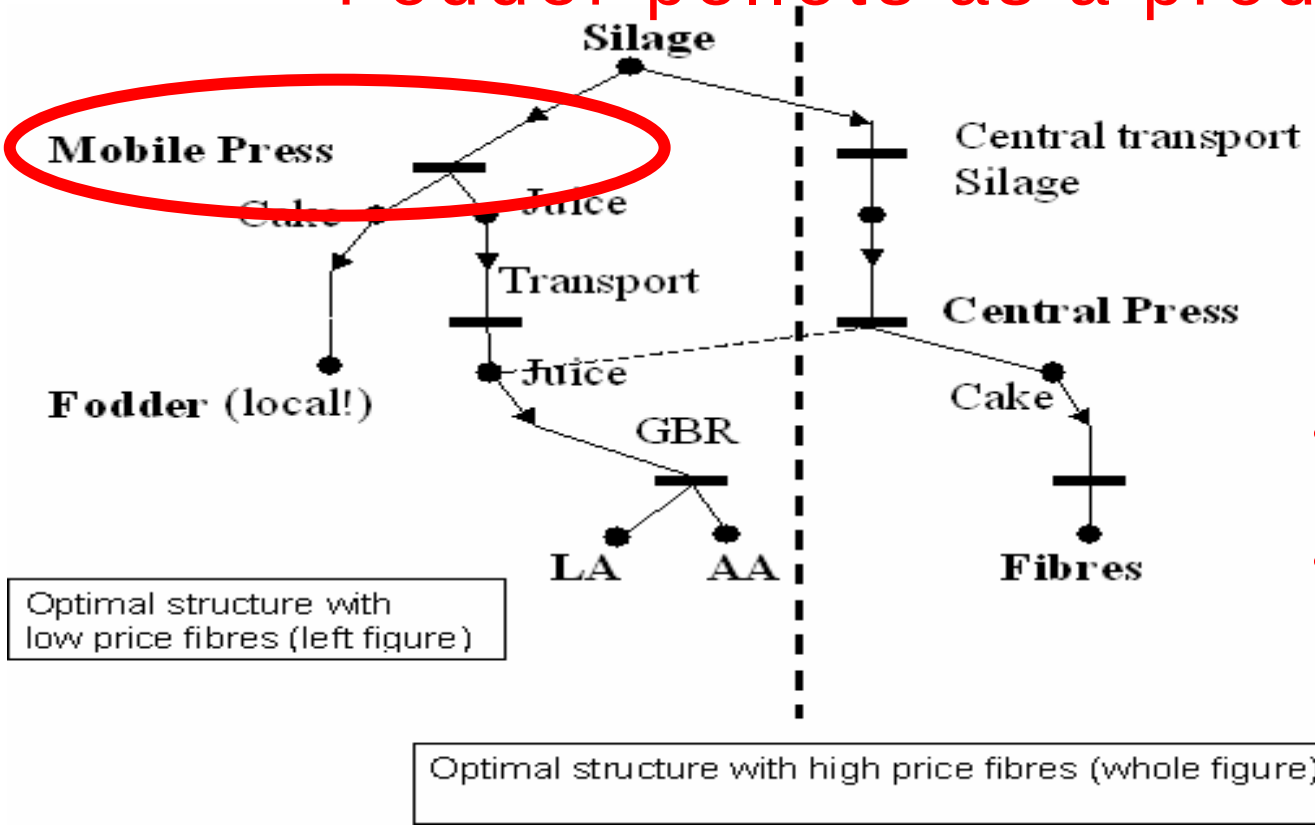


Result: optimal synthesis for the base case



Sensitivity analysis: Food sector competition

Fodder pellets as a product



Optimal structure with low price fibres (left figure)

Optimal structure with high price fibres (whole figure)

- Central and decentral units
- Split utilisation of silage

Interesting results...

- **De-central processes are not the rule**
  - Silage (storage + reaction) is de-central
  - No mobile (de-central) press
  - No de-central biorefinery, no de-central biogas unit

- **Fibres are „out“**
  - At current European market price, biogas is more feasible

- **The process is already economically viable**
  - Profits are a healthy 0,6 M€ for 35.000 t/a silage

What is different in processing renewables?

Conventional chemical processes

- Raw materials are standardised
- Raw materials are continuously available
- Raw materials have centralised sources
- Logistics play negligible role for process structure

Renewable resource processes

- Raw materials differ in quality
- Raw material availability shows strong time dependence
- Raw materials have decentral sources
- Logistics and storage have impact on process structure

…some answers

- Logistics need to be integrated in the process design from the beginning
- Finding the right size for processes is essential economy of scale vrs minimal transport
- Utilizing agricultural wastes and minor quality products to avoid competition for resources
- Local production of renewable resources is important
- Security of raw material supply requires on the long run a sustainable agriculture

What can you expect

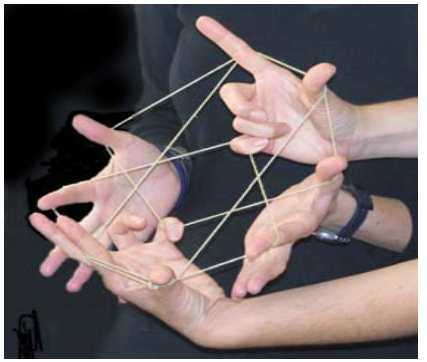
- Some basic problems on renewable resources process
- Setup of the Austrian Green Biorefinery
- Applying process synthesis to define a base case
- Optimizing processes
- Summary

The challenges

resource competition

size optimisation

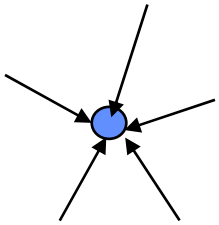
structural optimisation



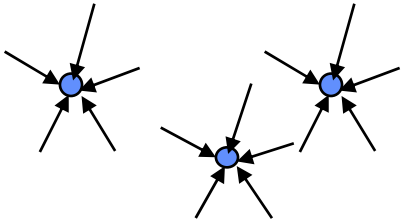
Inhaltsfolie

- **Renewables involve new questions**

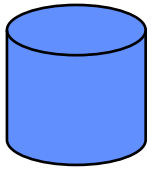
Renewables involve new questions



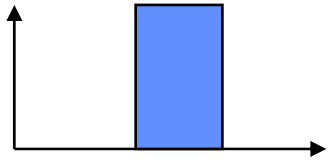
Central vs. decentral



Why not bring the process to the raw material?



Storage vs. campain



Adapt the process to the raw material?

Processes for renewables

lack of experience; unknown heuristics

Membrane technologies, chromatography, ...

Basic logistic problems of renewable resources

...transport density

...short shelf life

...decentral production