Biorefinery - integrated production system for the future

A success story of a medium enterprise

Eckhard Weidner

2nd Latin American Congress on Biorefineries: Materials and Energy

May 4th 2009, Concepcion Chile

Fraunhofer UMSICHT

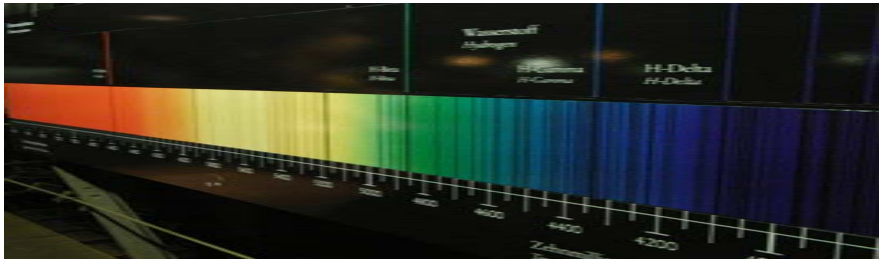
BiO-raffiniert

Joseph von Fraunhofer (1787 - 1826)

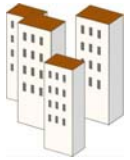
Researcher
»Fraunhofer Lines«

Inventor
New Methods of Lens Processing

Entrepreneur
Head of Royal Glass Factory



Fraunhofer Society 2008



58 institutes

1.5 billion € budget

15000 employees

Alliances and networks

- Microelectronics
- Production — Fraunhofer UMSICHT

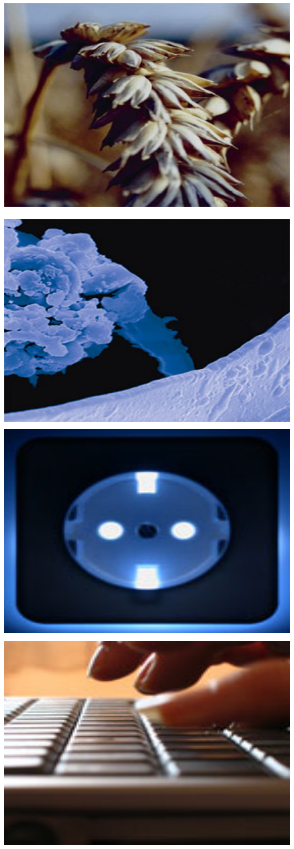
- Materials and components
- Life sciences
- Information / communication technology
- Surface technology and photonics
- Defense and security

- Networks: energy, water, nanotechnology

Keynotes about Fraunhofer UMSICHT

Foundation	1990
Member of the FhG since	1998
Sales 2008	19.7 million €
Industrial Returns 2008	9.1 million €
Permanent Staff	133
Total staff	273
Branches	Willich + Teterow

Key Research Areas



- **Biorefinery**
  Products from Renewable Resources
- **Matfunc**
  Functionalized Materials, Membranes and Particles
- **Modular Energy Technologies**
  Flexible Solutions for Sustainable Energy Systems
- **Information Networks for Process and Energy Technology**
  Utilization of Dispersed Know-how in Value Chains

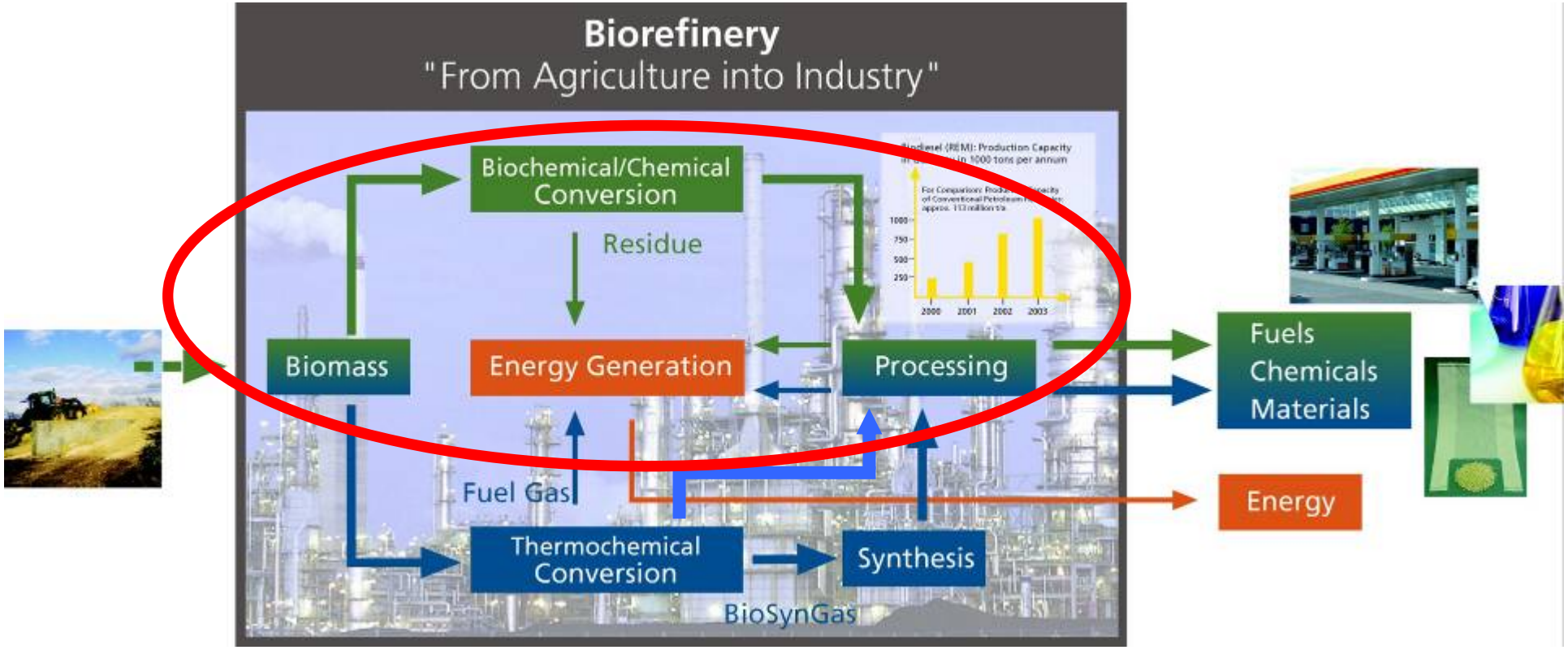
Key Research Area »Biorefinery«

Products made from Renewable Resources

Vision:

20 % of all chemicals, materials and fuels will be generated from renewable resources in biorefineries in the year 2020!

Two-Platform-Biorefinery



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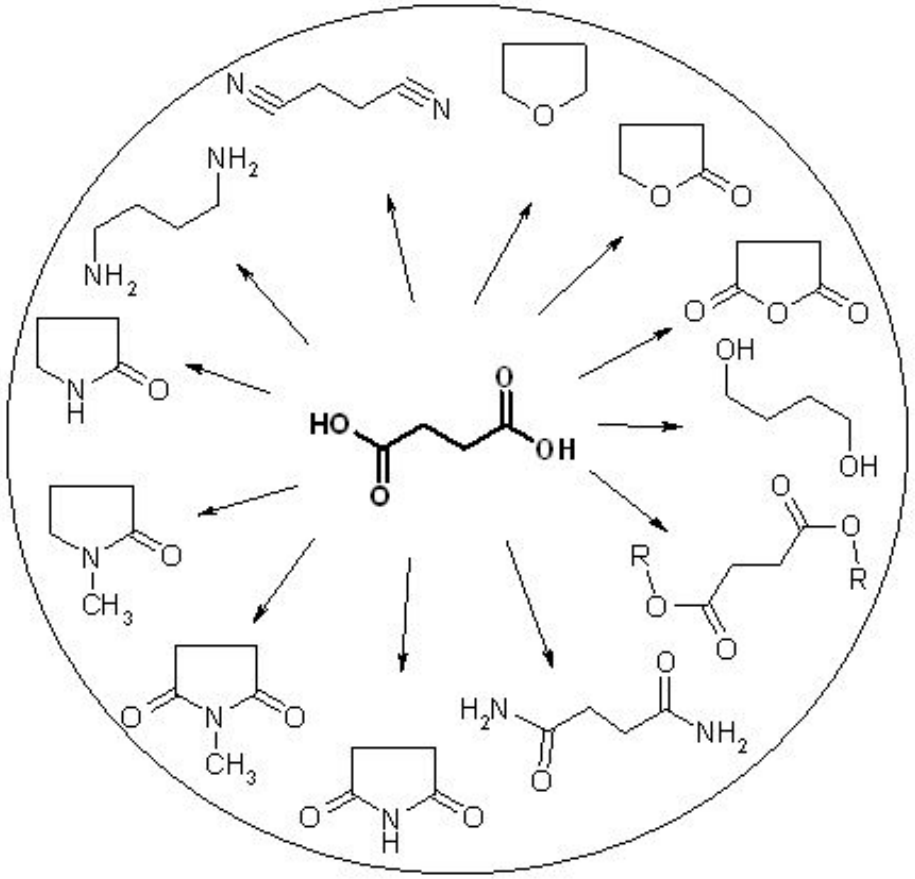
Succinic Acid as a Platform Chemical



- Succinic acid from renewable resources (sugar, starch) by anaerobic fermentation
- Fermentation consumes CO_2
- Commodities by chemical conversion (preservative, defrosting agent, solvents, monomers for esters/amides)
- Performance Plastics: Polyamide 44 (temperature resistant, impact resistant, scratch resistant – gearwheels, hard covers)

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Succinic Acid – Process Network

raw product

renewable resources

Fermentation

plattform

succinic acid

solvents

THF
γ-Butyrolactone
Diethylsuccinates

monomers

1,4-Diamino-butane
1,4-Butanediol

intermediates
Succinic acid anhydride
succinodintrile

Polyester 44

Polyamide 44

Technical polymers

From renewable materials to industrial end products

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“Biorefinery” Demonstration Plant: Energy

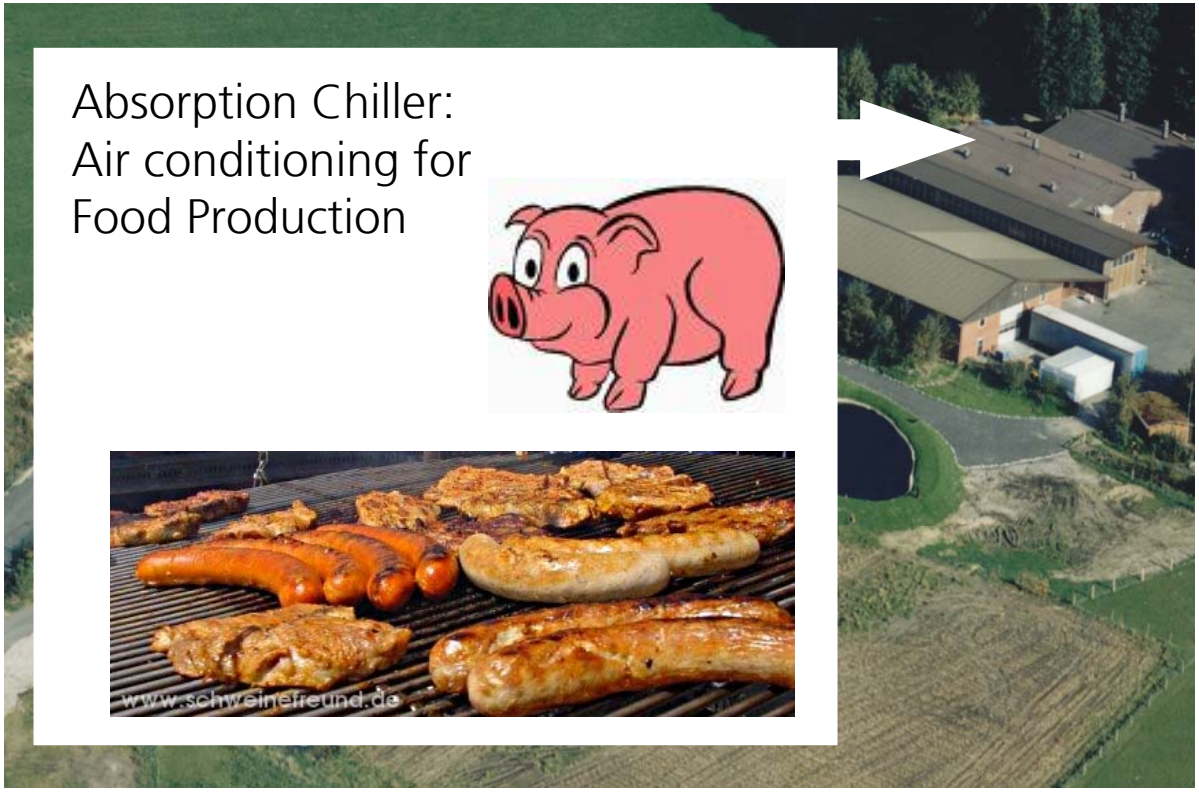
- **Input**
- manure
  4 000 m3/a
- organic
  residues
  5 000 t/a
- waste water
  1 000 m³/a
- agricultural
  products
  2 000 t/a

- **Output**
- electricity
  250 kW
  2000 MWh/a
- heat
  370 kW
  2960 MWh/a
- liquid fertiliser
  11 000 t/a

- digester size: 1 000 m³, biogas production: 120 std. m³/h

“Biorefinery” Demonstration Plant: Heat Utilization

- **Input**
- manure
  4 000 m3/a
- organic
  residues
  5 000 t/a
- agricultural
  products
  2 000 t/a
- waste water
  1 000 m³/a



- **Output**
- electricity
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  2 960
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Pilot-ORC (100 kW_{el}) for Gasengines

- Plant premounted
- approx 4000 h of operation
- efficiency under optimization

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“Biorefinery” Demonstration Plant: Materials

- **Input**
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Using Heat:
Packaging Materials

FARMfill®

- **Output**
- electricity
  250 kW
  2 000
  MWh/a
- heat
  370 kW
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  MWh/a
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FARMfill® - Technical biobased Packaging Systems

- Chips
- Blister
- Decorations
- Formed Foams

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A world of tools

- Natural tinker material - Cornbased
- Biodegradable
- Coloured with natural food colours
- Turns adhesive by contact with water

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“Biorefinery” Demonstration Plant: Energy & Materials

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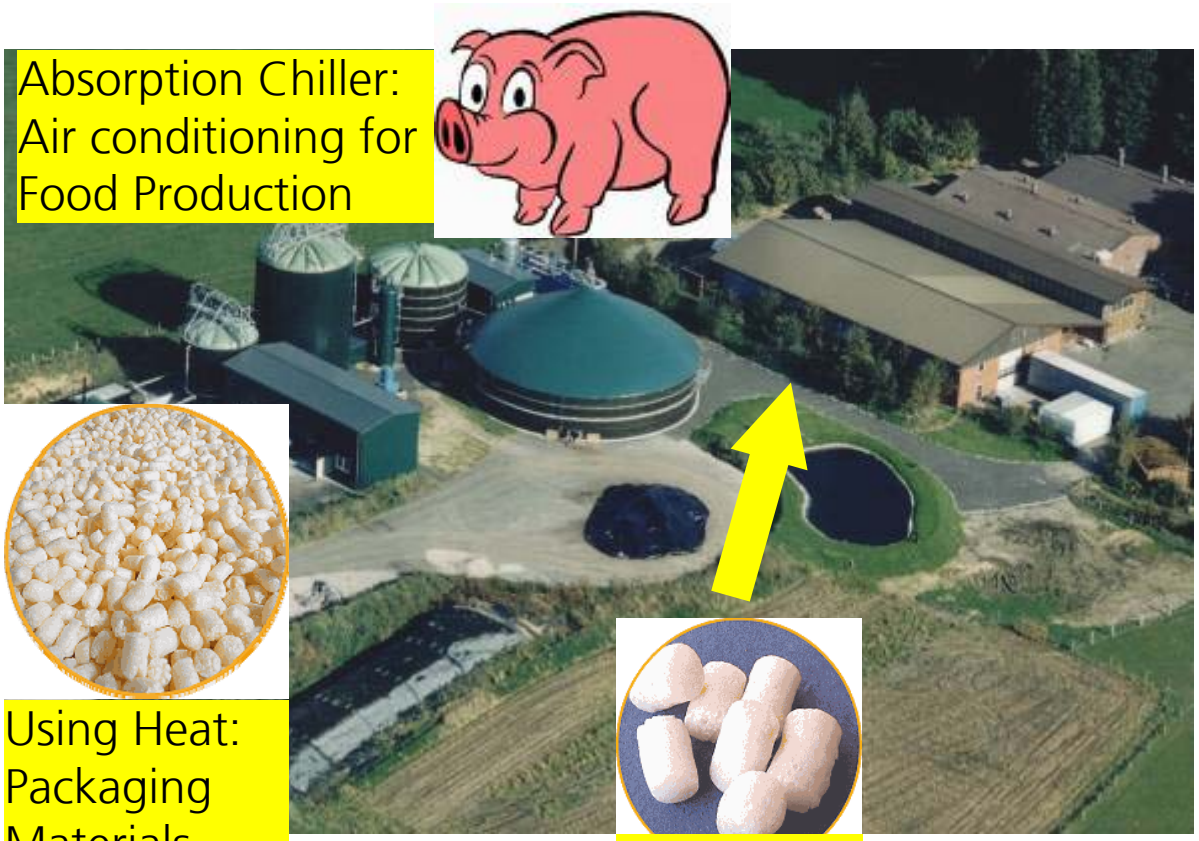

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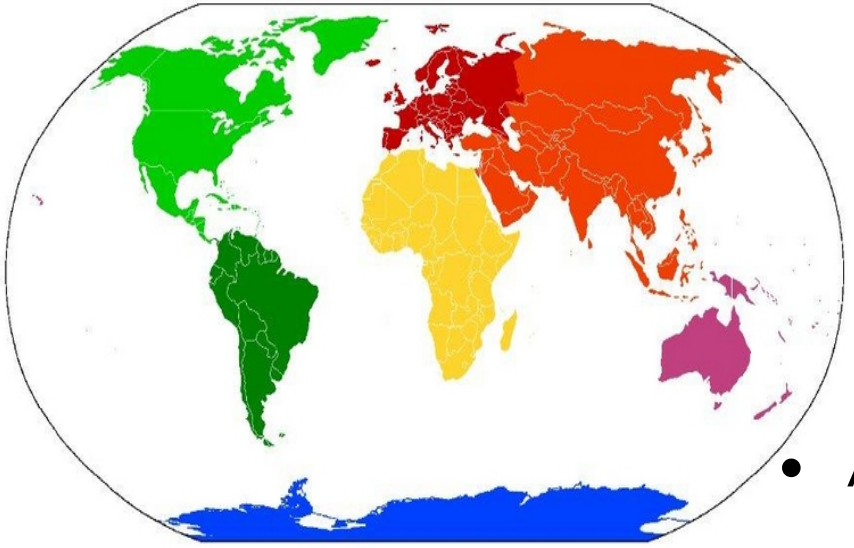
On the use of land for biomass production



- World uses 1400 Mio ha for crop production
  - About 100 Mio ha for non-food/feed
    - Rubber 8 Mio , Coffee 10 Mio , Cotton 35 Mio, Tobacco 3,8 Mio, Fuels 25 Mio
    - And many others (tea, cocoa, sisal, hemp, ornamental plants)
- About 3000 Mio ha used for pastures
  - More land for 2 Mio t of wool than for 700 Mio t of corn

Data from Willy de Greef, Secretary General, Europa Bio

Priority list on the use of land

Food Feed Biodiversity Materials Energy

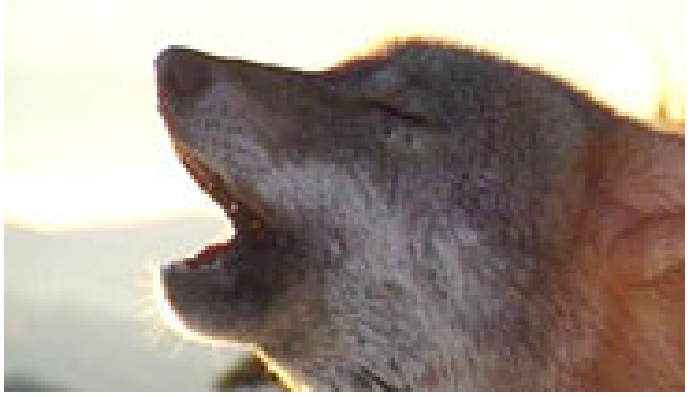
Complex interdependencies require new agricultural, technical and social approaches

- Byproducts from food/feed as chemical raw materials
- Energy use of biobased products at the end of their life cycle

Summary and Concluding Remarks

- Integration of energy production, fuel and chemical production
- Production of different products for different markets
- Creating and production of first marketable Products
- Solving problems in key-technologies (catalysis, biotechnology, downstream processing, process integration…)
- Agricultural production system and logistics have to be considered
- New concepts have to be examined by LCA

Closing Remark



Biorefining is
not a topic for Lonely Wolves

but
cooperation is needed

THANK YOU FOR YOUR ATTENTION !