THE AUSTRIAN GREEN BIOREFINERY

Presentation on the 4rd October 2007

Dipl.-Ing. Dr. Horst Steinmüller

Energieinstitut at the Johannes Kepler Universität Linz

ENERGIE INSTITUT
an der Johannes Kepler Universität Linz

JOHANNES KEPLER UNIVERSITÄT LINZ
Netzwerk für Forschung, Lehre und Praxis

DRIVING FORCE GREEN BIOREFINERY

„In Austria approx. 100.000 to 150.000 ha of pasture land will be not used for milk production any more in **2010**“

Estimation BAL Gumpenstein Doz. Dr. Buchgraber



DRIVING FORCE GREEN BIOREFINERY

- Structural changes in agriculture
- Sustainable technologies are new opportunities for farmers
- Conservation of characteristic landscape

Utilisation of grassland

for the production of

energy & renewable raw materials



THE AUSTRIAN GREEN BIOREFINERY

The Austrian Green Biorefinery concept utilizes solid state fermentation (ensilaging) to meet two goals:

- to generate a storable raw material for a continuous industrial process
- to convert green biomass into valuable substances such as lactic acid and amino acids as valuable products

Functional Diagram of the Austrian Green Biorefinery

GRASSLAND BIOMASS
e.g. Grass, Clover, Lucerne

Ensiling
(Solids Fermentation)

Mechanical Fractionation
(Pressing)

PRESS-CAKE

PRESS-JUICE

Fiber Separation

Separation of Amino Acids

Amino Acids
Protein Products

Separation of Lactic Acid

Lactic Acid
Ethyl Lactate, ...

Fiber Boards, Biocomposites, Insulation Materials

Biogas Plant

Electricity/Power
Heat

Separation of Fine Chemicals

Flavors, Chlorophyll, Pigments

Source: Joanneum Research

Stoffströme Übersicht

ca.
0,1ha

Silage
3330 kg
(1000 kg TS)

Fraktionierung

Presskuchen
1250 kg
(700 kg TS)

optional
Trocknung
Aufbereitung

BIOGAS

Presssaft 2083 kg (300 kg TS)

Aminosäuren

60 - 120 kg
AS Gemisch

Milchsäure

120 – 160 kg

Fasern

Rohstoff für
Platten,
Vliese
Dämmstoff etc.

Biogene Reststoffe ca. 1850kg (40-120kg TS)

Source: Joanneum Research

PROCESS TECHNOLOGY & PRODUCTS

Loading the silage mixer with raw material

Set-up of screw press

Product separation

Source: Joanneum Research

R & D STATUS

- Development of process technology in lab scale finished – proof of concept
- At present up-scaling and design of pilot plant
- Test phase of 2 to 3 years for data collection and gaining long term experience
- Adoption of products for market requirements
- Large scale implementation

The Concept in Upper Austria

Grassland

Silage

Fractionation

Juice treatment

Lactic acid

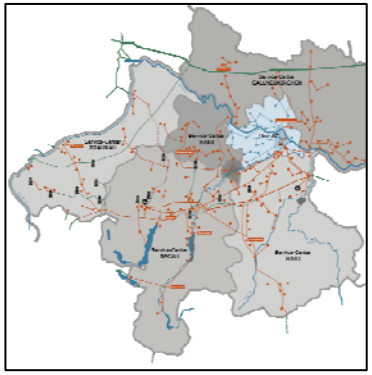
Aminoacids

Biogas plant

Gas engine

Heat & Power

Power plant



Gasnet

Gas purification

Gas burner

Bio-CNG

DEMONSTRATION PLANT

Reasons for the site selected

- New existing biogas plant (500 KWe)
- Full production capacity reached after 3 months
- Running power production with an average of 39 % conversation rate
- Free reactor capacity up to additional 150 m^3 biogas
- Gas pipelines nearby

DEMONSTRATION PLANT

Increasing of the biogas capacity from 200 to 350 m³

Fractionation of one ton silage per hour

Liquid purification up to 400 l liquid per hour

- **micro-filtration**
- **ultra-filtration**
- **electro dialysis**
- **chromatography**

DEMONSTRATION PLANT

Involved partners

Federal ministry of traffic, infrastructure and technology

Three State ministries of Upper Austria (energy and environment, agriculture, economy)

Three Austrian energy companies (EAG, Oö. Ferngas AG, RAG)

Three R&D institutions
(Joanneum Research, BioRefSys, Energy-Institute at the JKU Linz)

DEMONSTRATION PLANT

Cost for investment and three years R&D without gas purification

Storage	100.000 Euro
Fractionation	200.000 Euro
Liquid purification	900.000 Euro
Analytic and Infrastructure	500.000 Euro
Running cost	500.000 Euro per year

DEMONSTRATION PLANT

- Location: Uztenaich in Upper Austria
- Existing biogas plant with 500 kW
- Planned capacity to process silage from
  100 ha per year
- Investment without gas purification of 1,7 million Euro
- Running cost in the next 3 years 1,5 million Euro
- Start up 2008

DEMONSTRATION PLANT