Commercializing
Liquid Biofuels from Biomass

Task 39
IEA Bioenergy

Bioenergy and Biofuels in Austria

Manfred Woergetter
FJ-BLT and Bioenergy2020+
http://blt.josephinum.at; www.bioenergy2020.eu

BBEST

1st Brazilian BioEnergy Science and Technology Conference

14 – 19 August 2011

Campos do Jordao, Brazil

iea Energy Technology Network

Content

- Introducing myself: BLT, b20
- Brazil and Austria
- Renewable energy in Austria, Overview
- R,D&D in Austria
  - Basic research
  - Pre-competitive research
  - Accompanying research
  - Enterprises

Introducing myself:
37 Years in Transport Biofuels Research

1974	Wood gasifier for farm tractors
1976	Vegetable oil as Diesel fuel
1980	Methyl ester as Diesel fuel
1987	Biodiesel pilot project
1995	**IEA Bioenergy Liquid Biofuels**
2005	Key Researcher in the Austrian Bioenergy Competence Centre bioenergy2020+

Now working for:

F | J BLT

an Institute of the Federal Ministry for Agriculture, Forestry, Water and the Environment http://blt.josephinum.at/

bioenergy2020+

an privately organized Center of Competence www.bioenergy2020.eu

Brazil and Austria I

Area and population

		Brazil	Austria	EU 27
Area	Mio. km^2	8.52	0.084	4. 33
Inhabitants	Mio.	191	8.4	502
	per km^2	22	99	116
in urban	%	86	67	
under 15 years	%	26	15	
GDP	$/capita	11 239	41 979	30 388

Brazil and Austria II

Energy and CO_2 emissions

		Brazil	Austria	EU 27	World
Primary energy supply	Mio. t OE	249	33	1 751	12 267
per capita	t OE/c	1.3	3.9	3.5	1.8
CO_2 emissions	Mio. t	365	69	3 850	29 381
per capita	t CO_2/c	1.9	8.3	7.7	4.4

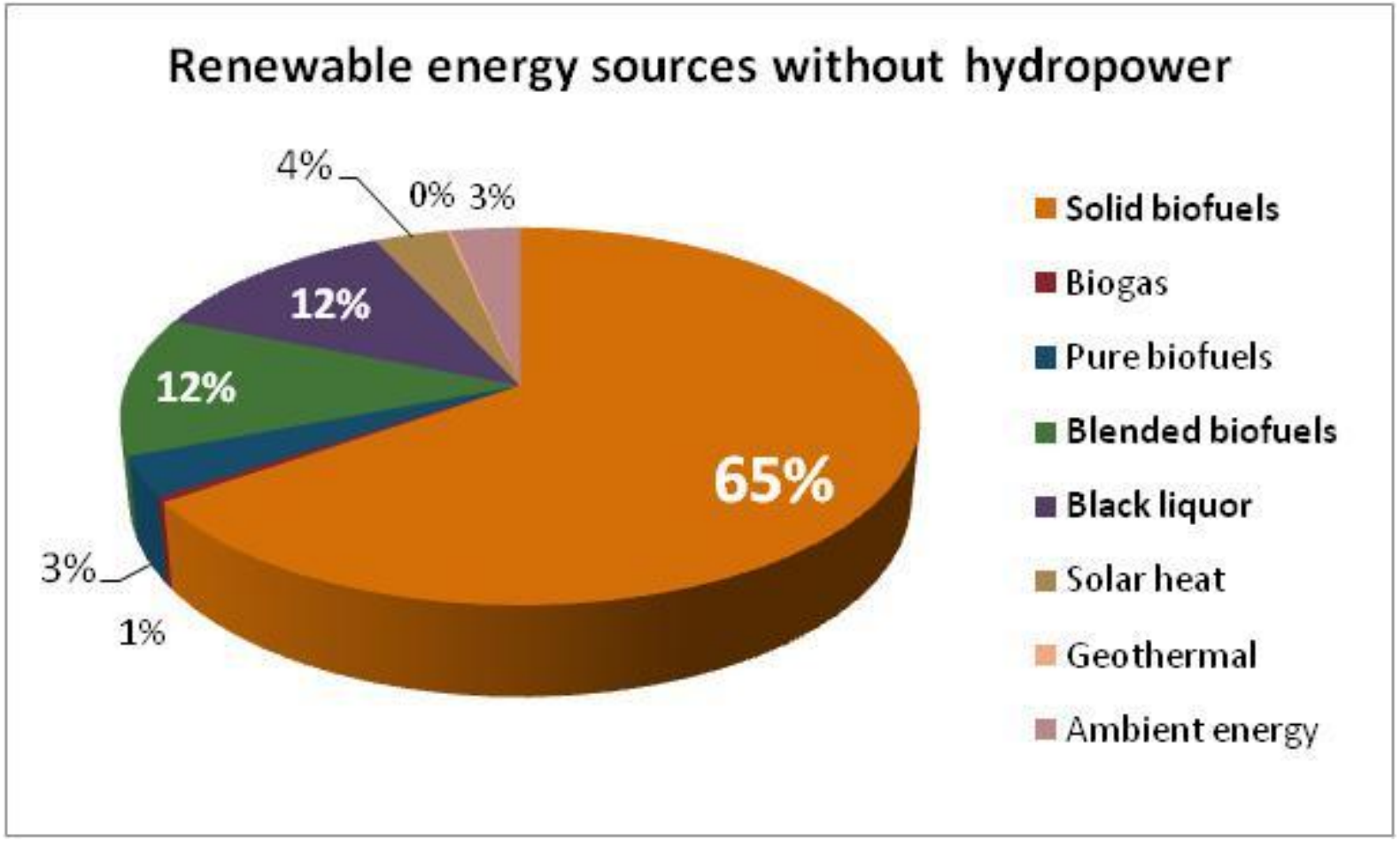
Brazil and Austria III

Agricultural production			
		Brazil	Austria
cereals	ha/c	0.11	0,10
oil crops	ha/c	0.12	0.016
starchy roots	ha/c	0.015	0.0026
sugar crops	ha/c	0.045	0.0052
Total area harvested	ha/c	0.28	0.12
Percent of total area	%	6.3	12.4

Renewable energy in Austria

- RE is widely accepted by the citizens,
- Pushed by the policy since the eighties.
- Strong efforts by the state and private enterprises have resulted in advanced technologies:
  - solar heat
  - biomass for power, heat and transport fuel
  - wind an PV for power production

Austria: Renewable Energy Shares 2009



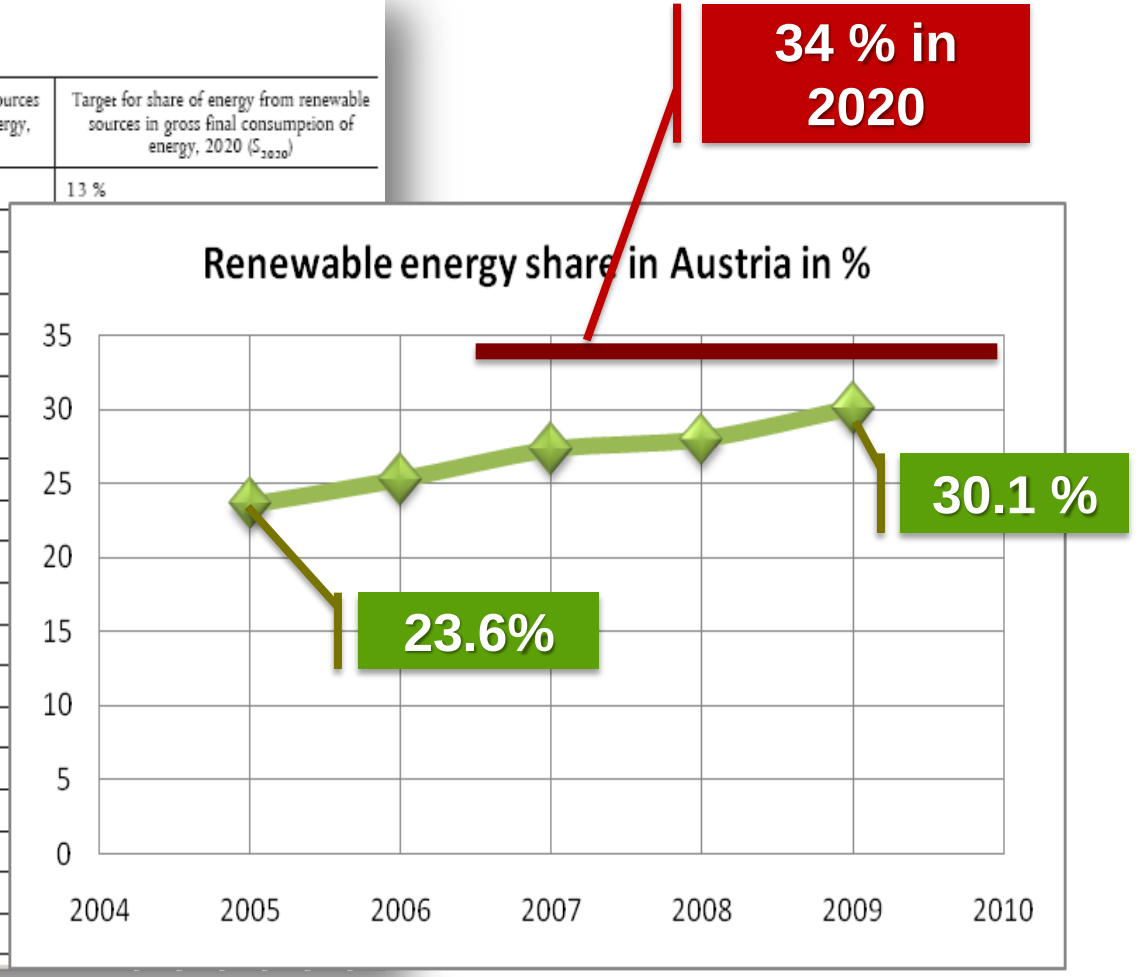
Austria: National Renewable Energy Action Plan

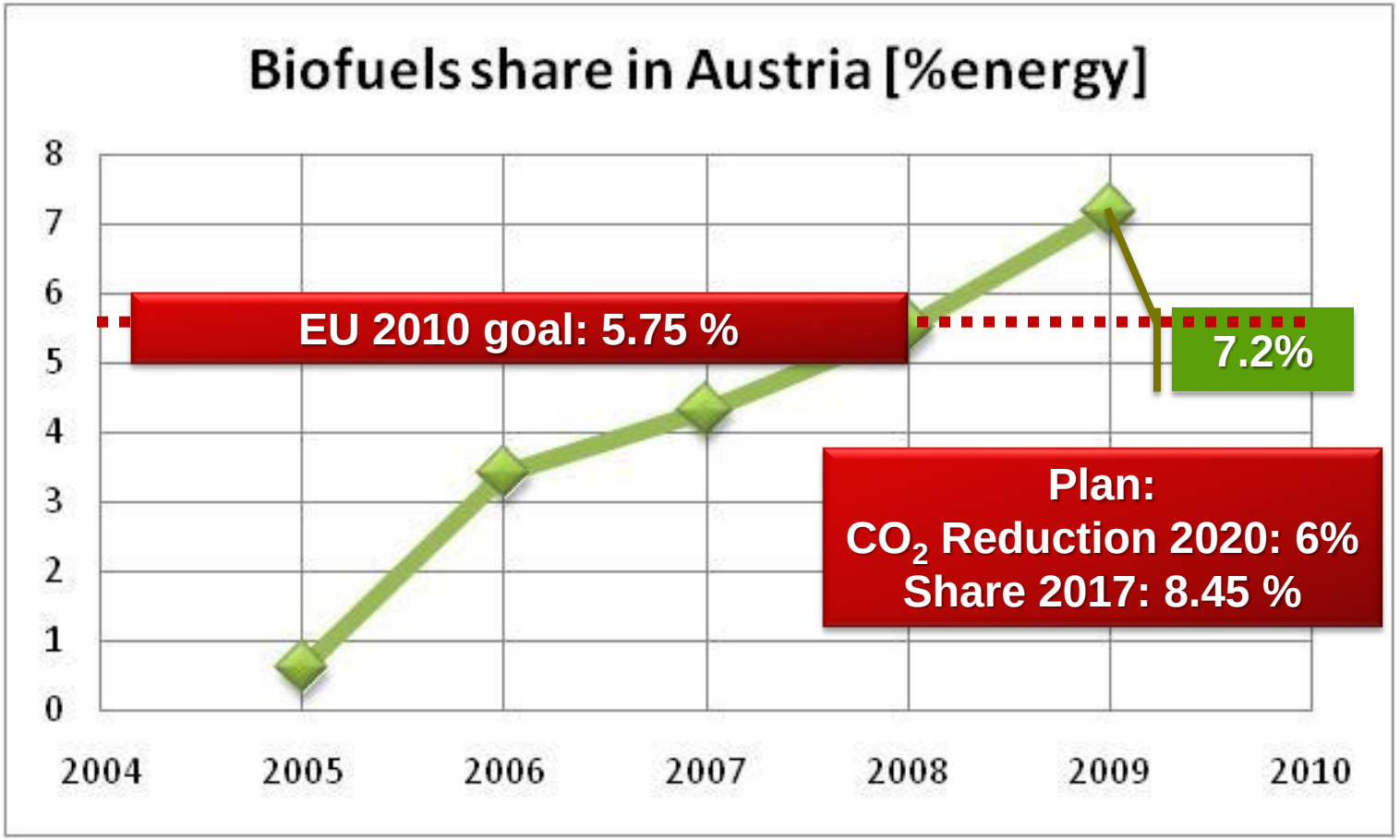
- Stabilize the end use energy consumption:
  - ⇒ **In 2020 the same as in 2005: 1 100 PJ**
  - ⇒ - 22 % in the traffic sector
  - ⇒ - 12 % heating and cooling
  - ⇒ - 6 % in electricity
- More renewable energy: from 328 PJ in 2008 to 388 PJ in 2020: + 20 %
- Renewable energy share in 2020:
  - ⇒ **51 % Bioenergy**
  - ⇒ 41.2 % Hydropower
  - ⇒ 4.5 % Wind
  - ⇒ 0.3 % Photovoltaik

Reaching European RE Targets

A. *National overall targets*

	Share of energy from renewable sources in gross final consumption of energy, 2005 (S_{2005})	Target for share of energy from renewable sources in gross final consumption of energy, 2020 (S_{2020})
Belgium	2,2 %	13 %
Bulgaria	9,4 %	
Czech Republic	6,1 %	
Denmark	17,0 %	
Germany	5,8 %	
Estonia	18,0 %	
Ireland	3,1 %	
Greece	6,9 %	
Spain	8,7 %	
France	10,3 %	
Italy	5,2 %	
Cyprus	2,9 %	
Latvia	32,6 %	
Lithuania	15,0 %	
Luxembourg	0,9 %	
Hungary	4,3 %	
Malta	0,0 %	
Netherlands	2,4 %	
Austria	23,3 %	




Biofuels share in Austria [%energy]
8
7
6
5
4
3
2
1
0
2004
2005
2006
2007
2008
2009
2010
EU 2010 goal: 5.75 %
7.2%
Plan:
CO_2 Reduction 2020: 6%
Share 2017: 8.45 %

R,D&D in Austria

Networking

Goals of the government

Commercializing
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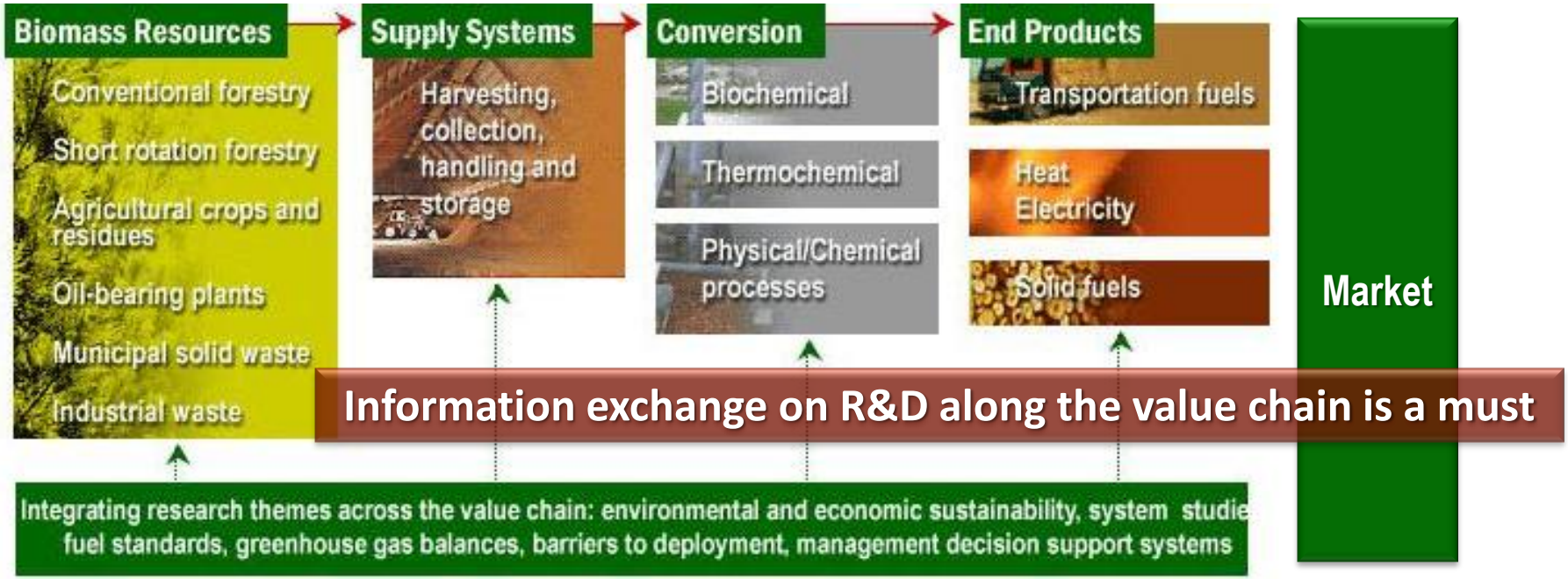
IEA Bioenergy

Task 39
IEA Bioenergy

IEA Bioenergy's vision is **to achieve a substantial bioenergy contribution to future global energy demands** by accelerating the production and use of environmentally sound, socially accepted and cost-competitive bioenergy on a sustainable basis, thus providing increased security of supply whilst reducing greenhouse gas emissions from energy use.



www.ieabioenergy.com

Next slides:

Results of the Austrian Conference "Highlights of Bioenergy Research" including basic research, pre-competitive R&D as well as information on related industries

Courtesy to the authors

Download: www.nachhaltigwirtschaften.at/results.html/id6296

www.task39.org/Publications/TransportationBiofuelsResearchinAustria2011.aspx

The Government's R&D Strategy

Michael Paula, Federal Ministry for Traffic, Innovation an Technology

- From Innovation Follower to an Innovation Leader
- The challenges
  - Climate change
  - Limited ressources
  - Demografic change

„Making the Zero Carbon Society Possible“

European Industrial Bioenergy Initiative

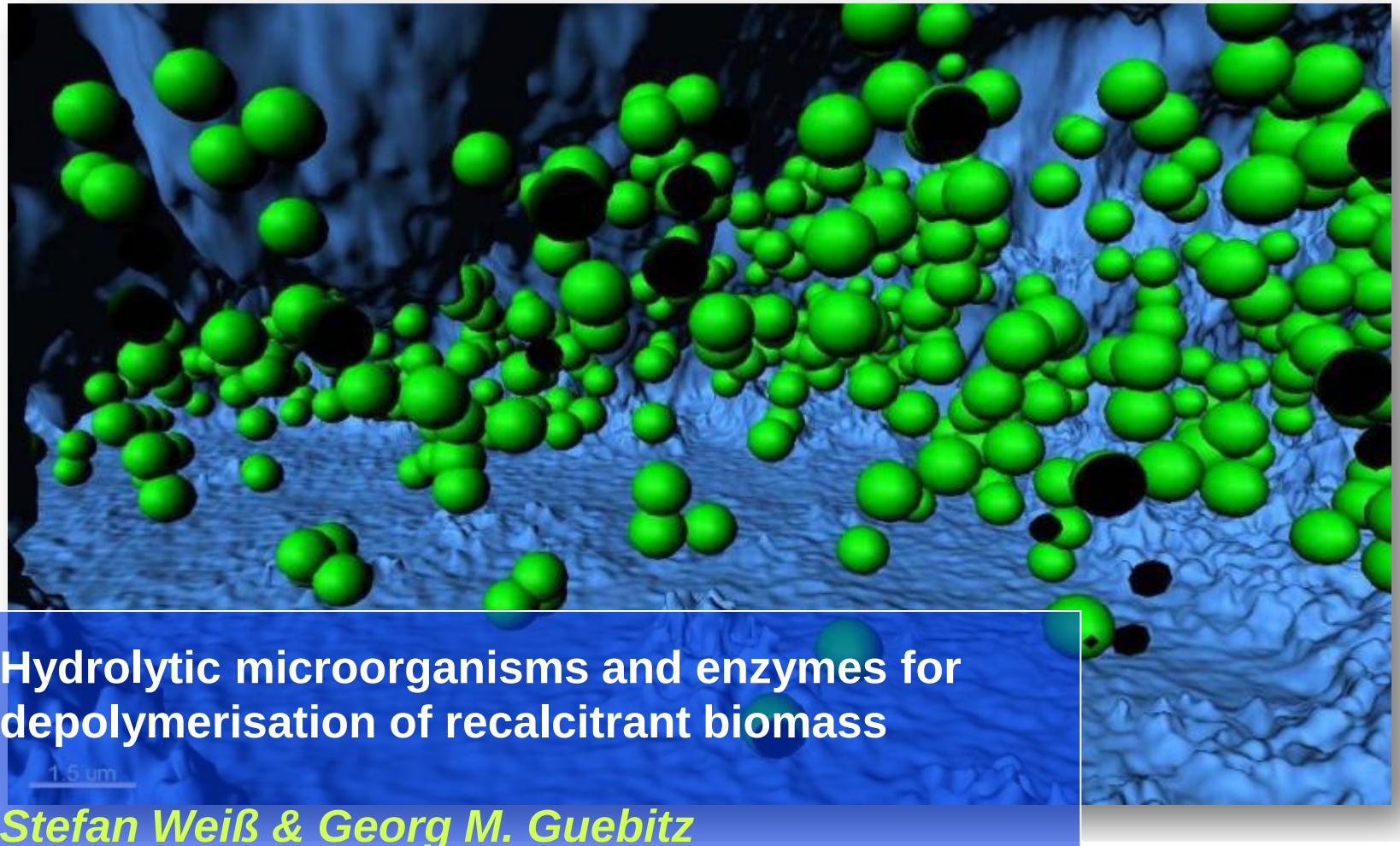
Should be financed by SET plan funds:
70 billion € in total, 9 billion € for biofuels

Thermochemical pathways	
1	Synthetic liquid fuels and/or hydrocarbons (e.g. gasoline, naphtha, kerosene or diesel fuels) and blending components
2	Bio-methane and other bio-synthetic gaseous fuels through gasification
3	High efficiency heat & power generation through thermochemical conversion
4	Intermediate bioenergy carriers production such as pyrolysis and torrefaction

Biochemical pathways	
5	Ethanol & higher alcohols from ligno-cellulosics/ chemical/ biological processes
6	Bio.hydrocarbons (diesel, jet fuel) - biological and/or chemical synthesis
7	Bioenergy carriers by micro-organisms (algae, bateria) from CO_2 and sunlight
Complementary measures and activities	
8	Biomass feedstock for bioenergy
9	Activities on longer term RDD on emerging// innovative bioenergy value chains


R,D&D in Austria
Basic research

Improved biogas production: zeolite particle+bacteria



Hydrolytic microorganisms and enzymes for depolymerisation of recalcitrant biomass

Stefan Weiß & Georg M. Guebitz
Graz University of Technology

Sexual recombination in *Trichoderma reesei*

T. reesei is a heterothallic species, sexual recombination a fungal strain with the opposite mating type is required. The crossing technique was already sucessfully applied to currently biotechnologically applied *T. reesei* strains.

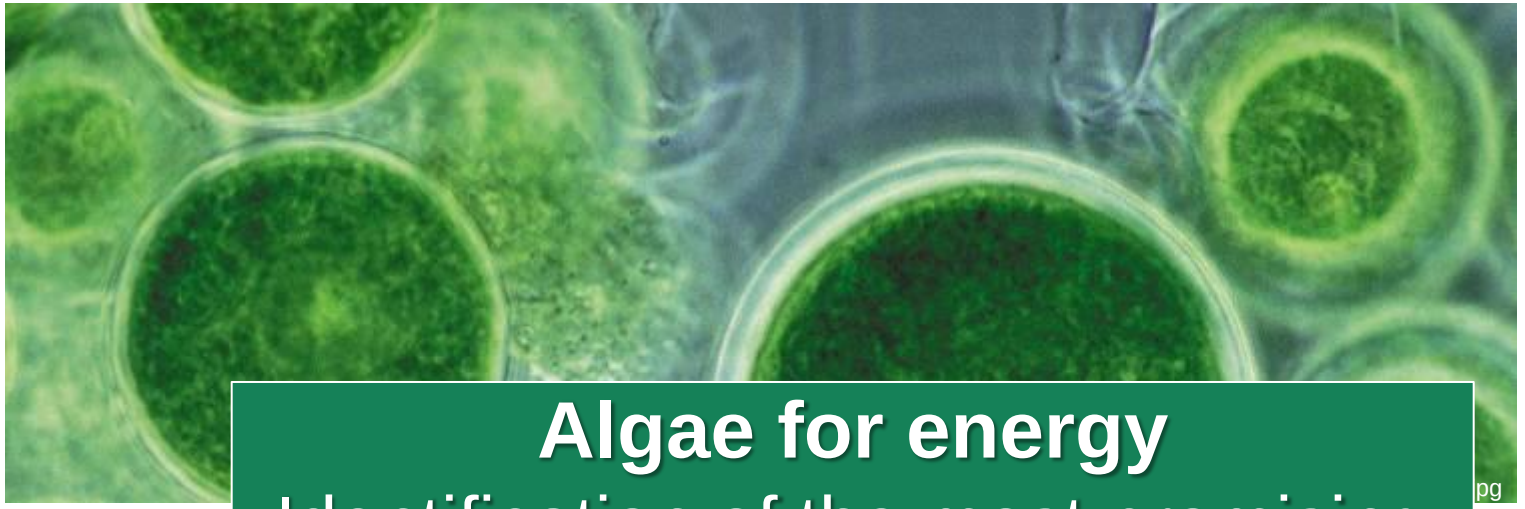
T. reesei on agar plate

T. reesei strains with opposite mating types produce fruiting bodies.

No production of fruiting bodies in *T. reesei* strains with the same mating type.

New avenues for fungal strain improvement towards enzymatic degradation of cellulosic biomass
Dr. Verena Seidl -Seiboth

JOANNEUM RESEARCH Forschungsgesellschaft mbH



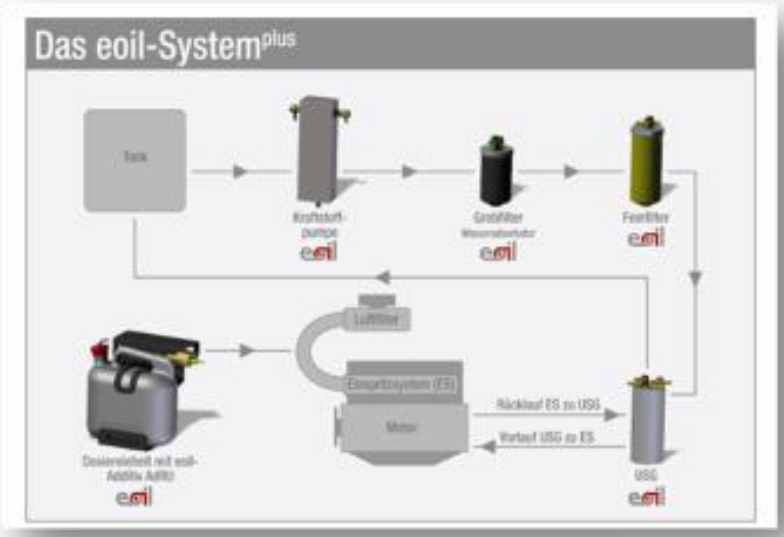
Algae for energy

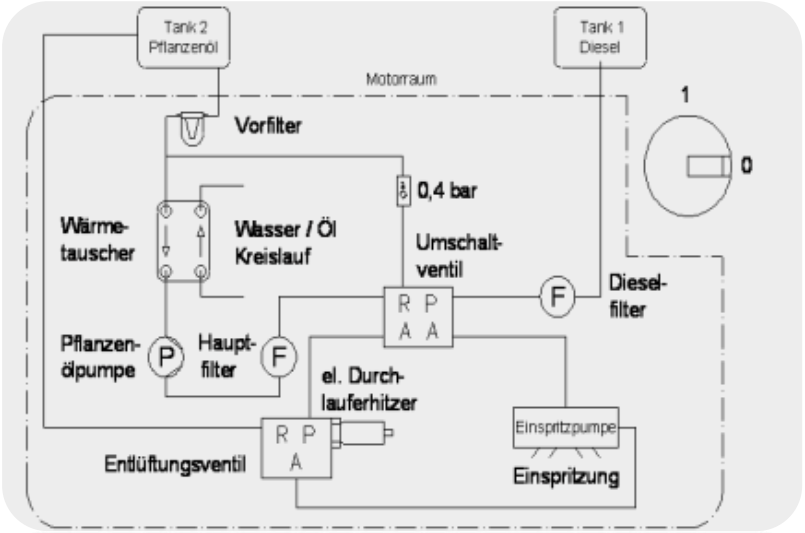
Identification of the most promising algal-based pathways in Austria

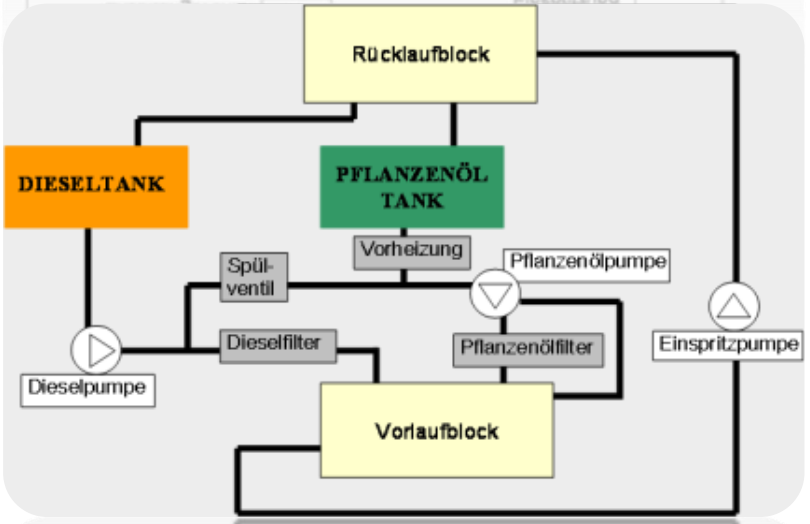
www.joanneum.at

Pure plant oil as transport fuel

Engine adaption: Which system is best?









Biomass Logistic

Franz Handler, FJ BLT Wieselburg

Franz.Handler@Josephinum.at




R,D&D in Austria

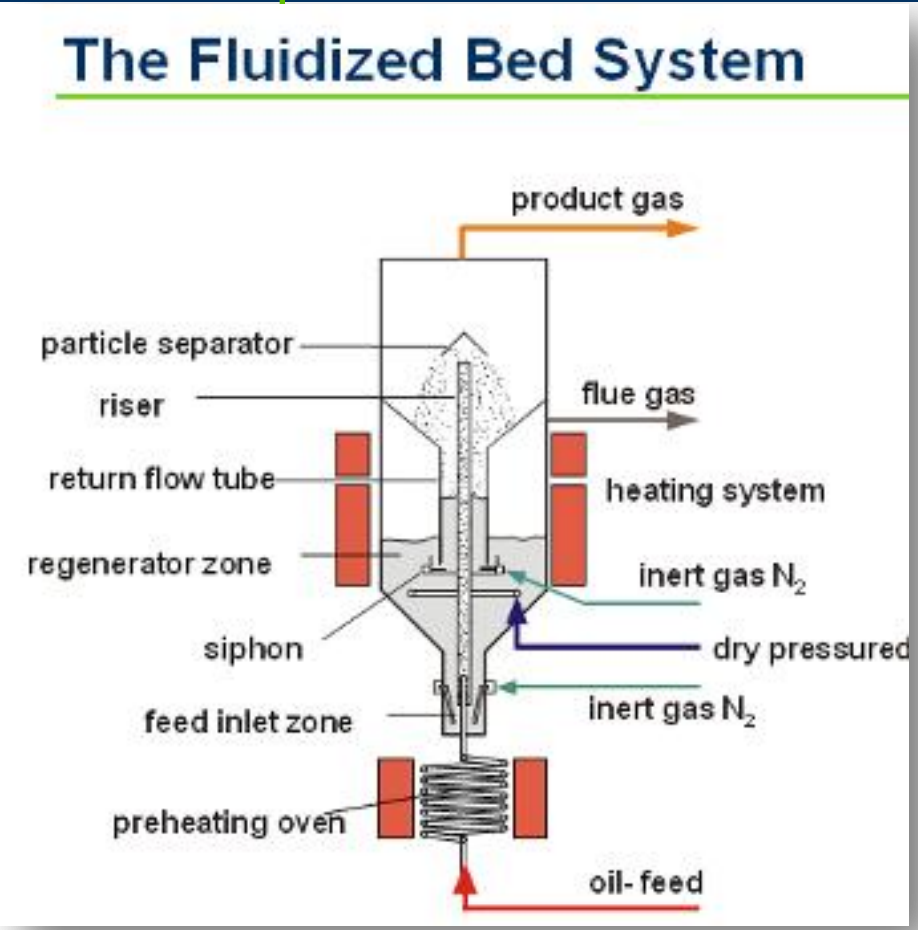
Pre-competitiv research

Vienna University of Technology
Institute of Chemical Engineering

Fluidized bed catalytic cracking of plant oil

Dr. A. Reichhold
DI H. Schablitzky
DI P. Bielansky
DI A. Weinert

Research Group:
Fluidized Bed Systems and Refinery Technology



TU WIEN
Technische Universität Wien
Vienna University of Technology

TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

bioenergy2020+

R. Rauch: Thermochemical Biorefinery R&D at the Guessing biomass gasification platform

Based on a commercial gasification technology
Engineering by REPOTEC www.repotec.at

Location	CHP technology	Fuel/electr. MW, MWel	Start up	Status
Güssing, AT	Gas engine	8.0 / 2.0	2002	Operational
Oberwart, AT	Gas engine&ORC	8.5 / 2.8	2008	Operational
Villach, AT	Gas engine	15 / 3.7	2010	Commissioning
Klagenfurt, AT	Gas engine	25 / 5.5	2011	Planning
Ulm, DE	Gas engine&ORC	14 / 5	2011	Construction
Götheburg, SW	BioSNG	32/20	2012	Planning

Reinhard Rauch, TU Vienna

RDD&D on Guessing: thermochemical plattform

- CHP
- Bio-SNG
- Bio-FT
- Bio-Mixed Alcohols
- Bio-H_2

Gasifier

BioSNG PDU

Technikum

Fuelling Station

Mixed alcohols: first experiments are done

Reformer

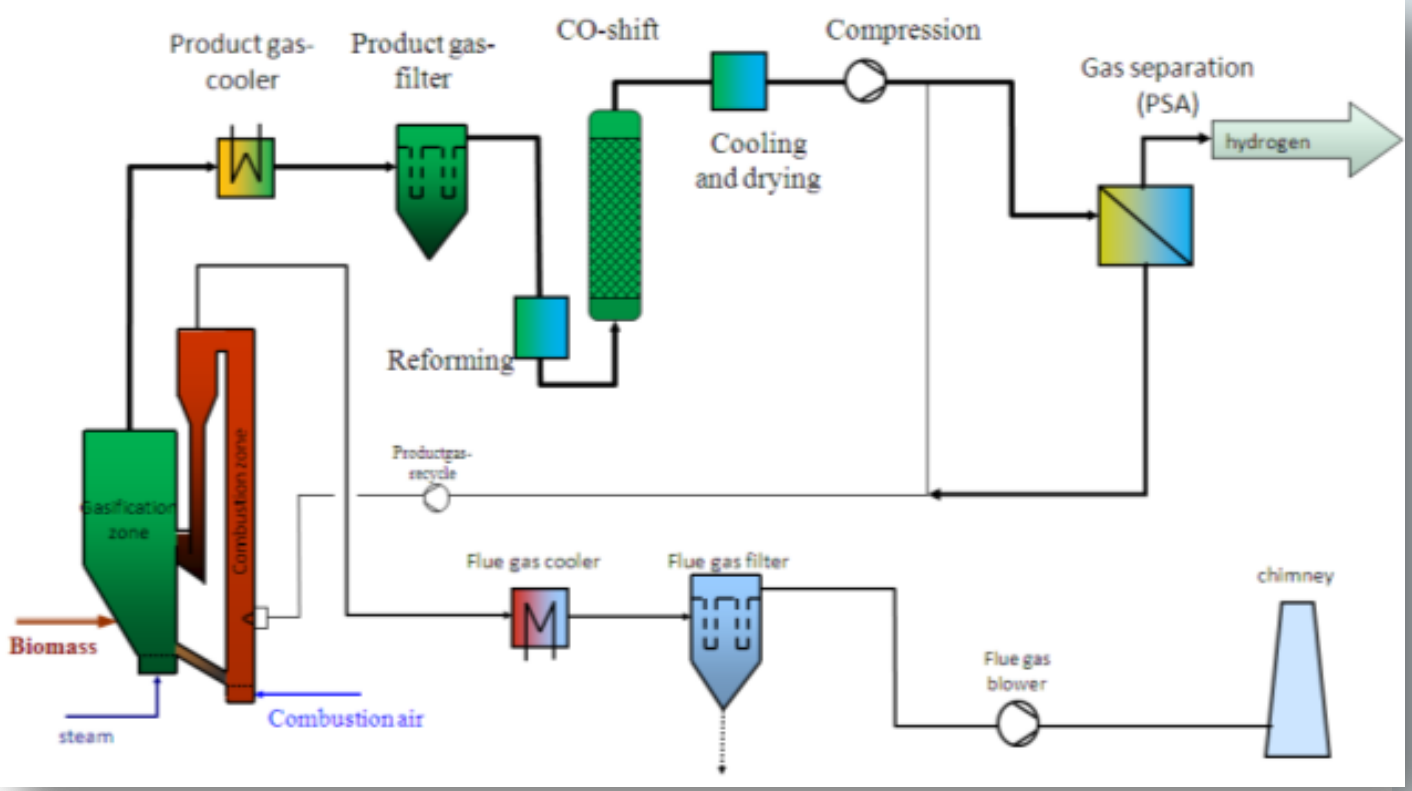
Drying
(glycol-scrubber)

Compressor
(5-7 Nm^3/h;
90-300 bar)

Reactor

BioH$_2$- for refineries

- 50 MW fuel plant to replace fossil hydrogen
- Biomass resources
- Basic engineering
- Evaluation



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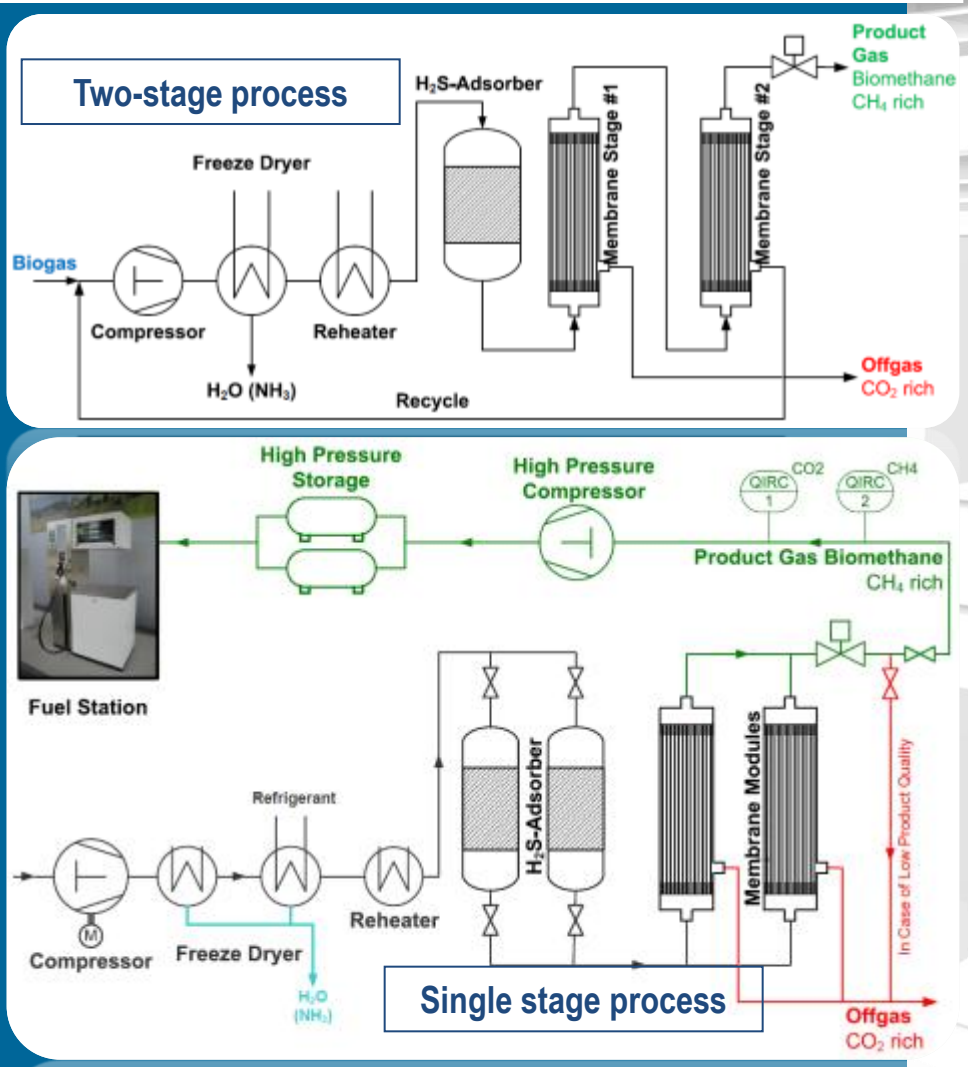
Vienna University of Technology

Biomethane for Grid Injection using Membrane Processes

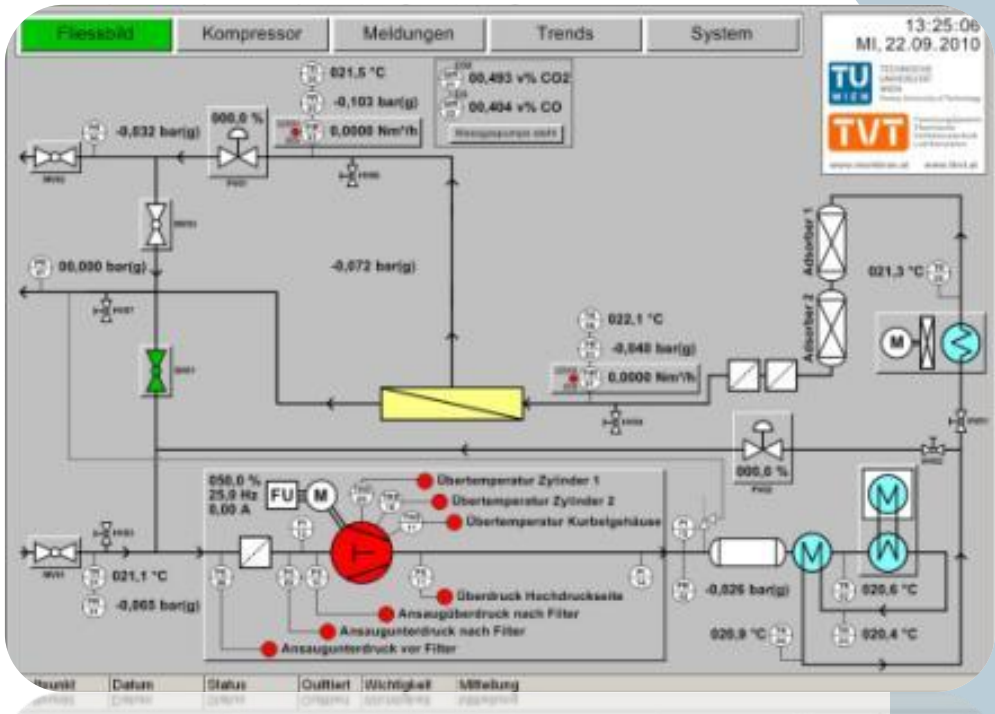
michael.harasek@tuwien.ac.at, Institute of Chemical Engineering

Why biogas upgrading?

- Compatible with CNG
- For conventional gas engines
- New markets
- Automotive utilization



Pilot Test Equipment at TU Wien



- Mobile pilot plant for flexible treatment of many gas mixtures
- piston compressor (up to 15 bar, 0-6 m³/h)
- Fully automated upgrading plant for remote operation
  - 3 adsorber fillings in series
  - Cryo condenser
  - Reheater
  - membrane separation with/without gas recycling
  - NDIR online continuous gas

Reference Plants

In operation:

- since 2004: Pilot plants (up to 6 m³/h biogas, Vienna University of Technology)
- 2007: Bruck an der Leitha (180 m³/h biogas, 100 m³/h biomethane)
- 2007: Margarethen am Moos (80 m³/h biogas, 35 m³/h bio-CNG)
- Start-up 05/2010: Kißlegg / Baden-Württemberg, Germany (500 m³/h biogas)

Start-up:

- Feed-in operation starts in 03/2011: Wiener Neustadt (220 m³/h biogas)

Supplier: axiom

R,D&D in Austria

Social responsibility

Katharina Zwiauer
Biofuel Production in Africa – Case Studies

Tozzi Group (Italy)

- 50.000 ha Jatropha

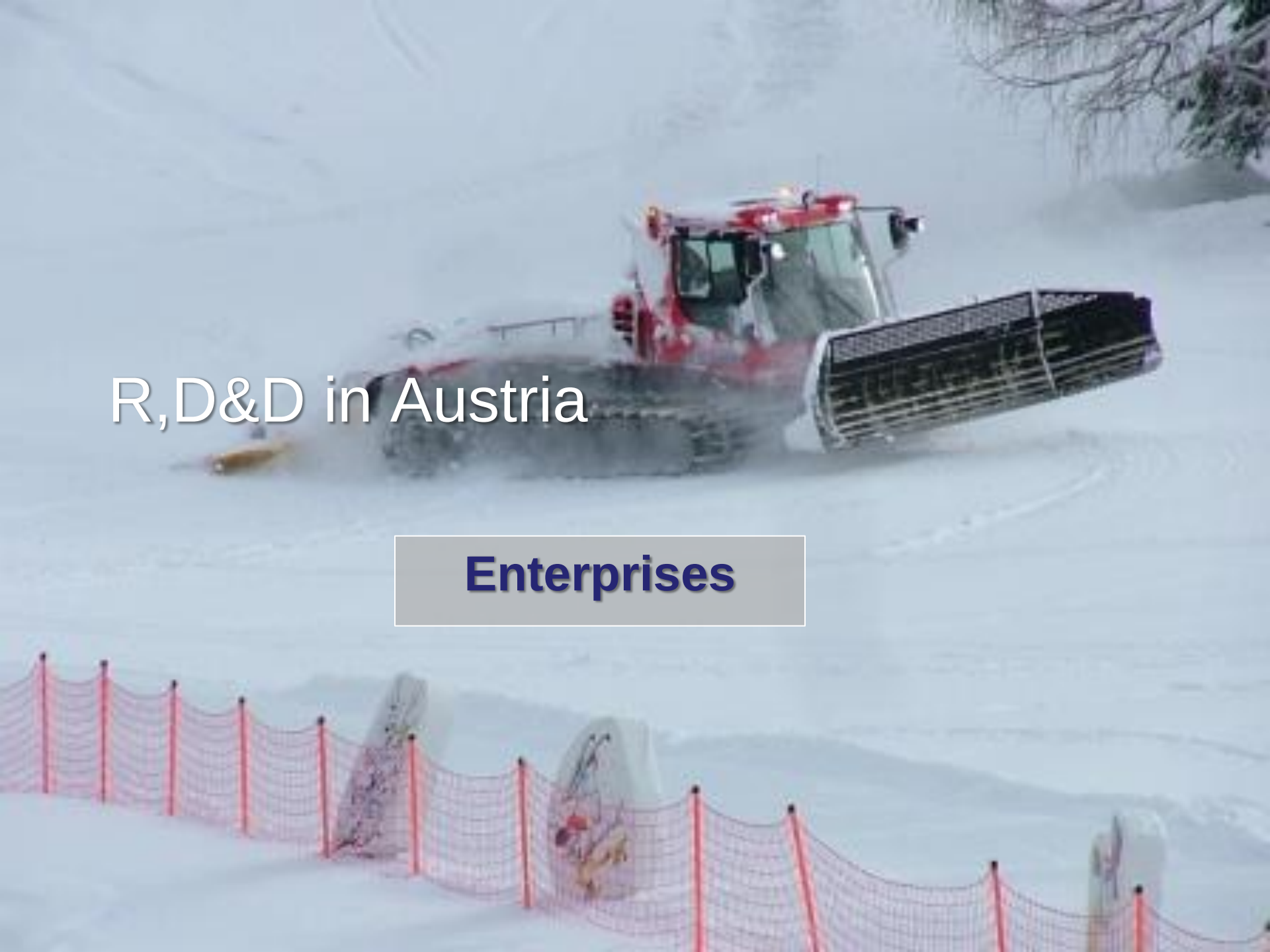
Negative impacts:

- Damage of natural forests
- Loss of land tenure rights

Compagnie Sucrière Sénégalaise

- 8.700 ha sugar cane, 60 m^3/d ethanol
- Positive : 3000 permanent employees, 4000 seasonal workers
- Negative: water pollution

More Information:
katharina.zwiauer@aon.at



R,D&D in Austria

Enterprises

VOGELBUSCH Biocommodities GmbH

| Makes biotechnology work

Complementing client's 2G process with proven first generation bioethanol technology

- Process design for pilot and demonstration plants
- Assist in developing fermentation and separation strategies
- Equipment supply for separation, distillation and dehydration
- Examples
  - pilot plant ABENGOA BIOENERGY | US
  - demo plant of MITSUI/ SIME DARBY | MY
  - IOGEN | CD
  - INBICON | DK

VOGELBUSCH Biocommodities

www.vogelbusch-biocommodities.com

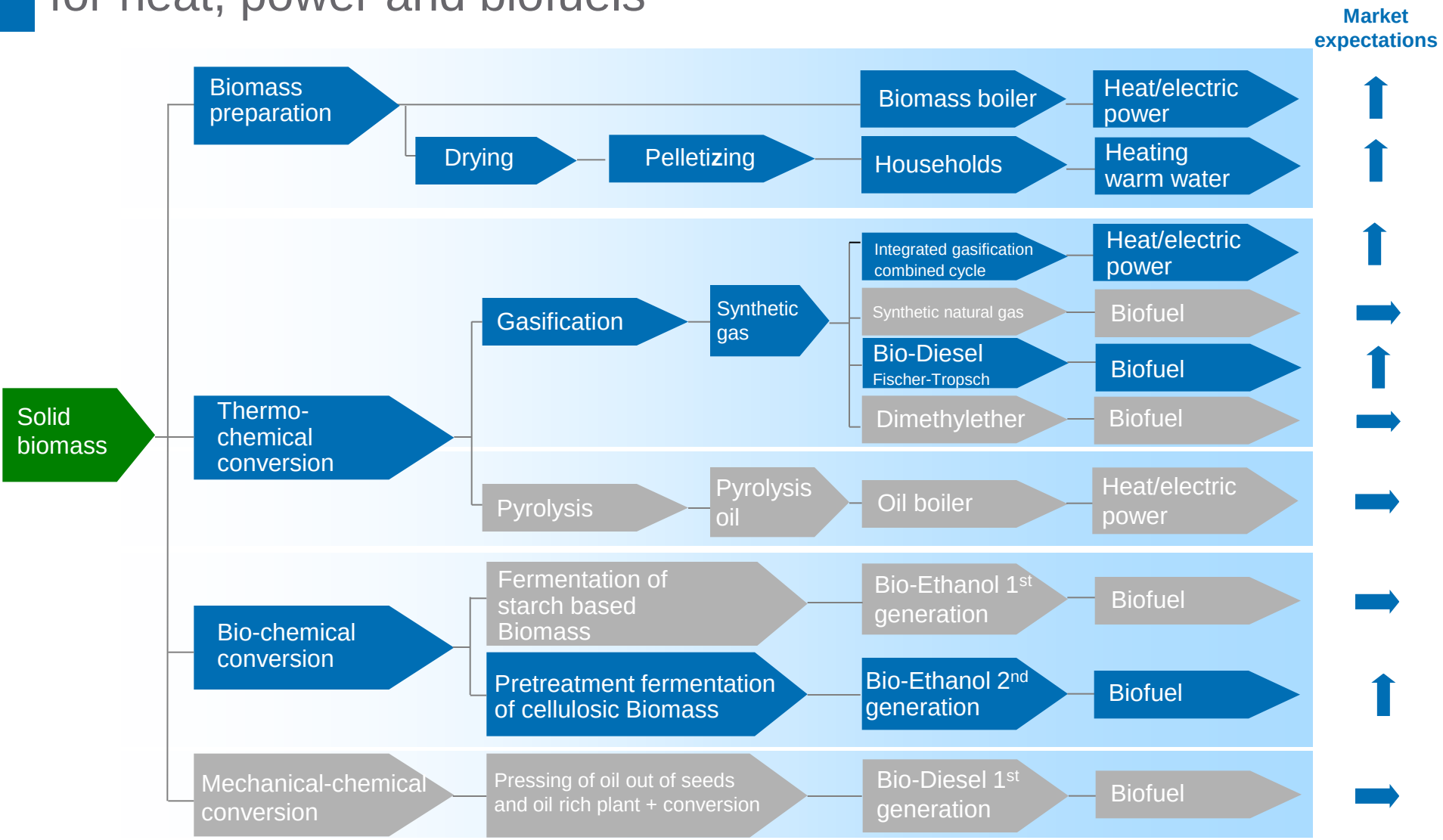
BDI‘s integriertes waste-to-biofuels Konzept

BDI - BioEnergy International AG
www.bdi-bioenergy.com

ANDRITZ Technologies

for heat, power and biofuels

Process offered by ANDRITZ

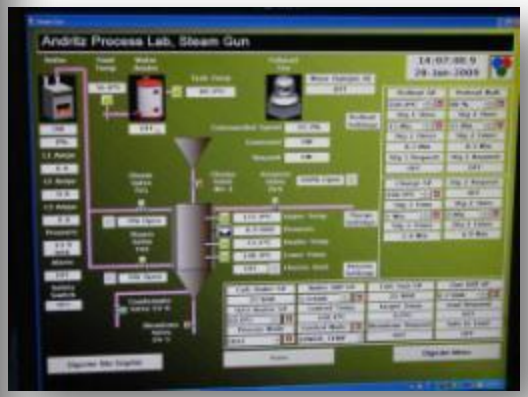


ANDRITZ Pulp & Paper

Pilot & Demo Systems

ANDRITZ
Pulp & Paper

Pretreatment: Auto- and Acid Hydrolysis, Steam Explosion



- 27.5 bar / 400 PSI
- 8” dia x 6’ tall
- Made. in Hastalloy
- BlowTank

Glens Falls: “Steam gun”

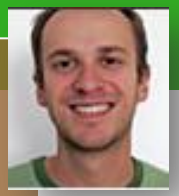
ANDRITZ Pulp & Paper

Take home messages

- **Austria: small, but rich,**
- **with a „clean and green“ society**
- **a government interested in sustainable development,**
- well organized renewable energy research, managed by the Ministry for Traffic, Innovation and Technology
- Bioenergy research guided by the principles of IEA Bioenergy
- a highly developed “green” industry

- **Interested in cooperation with Brazil**

Student exchange



Dissertation outline Nikolaus Ludwicek

„EU regulation of imported biofuel with a case study of Brazil”

Research questions:

- Are sustainable supply chains possible and which country will be most important?
- How will EU manage agreements with those countries?
- What is the producers country´s view?

Planned work for Brazil:

- Brazils´s biofuel policy and economy
- Stake holders view (interviews)


Thanks for your attention!