

## Conclusions of the Four Breakout Sessions

The conference closed with the following conclusions of the four breakout sessions:

### Session 1: Biomass Feedstock and Production

#### Challenges

- Supply diverse markets & consumer needs
- Expand feedstock supplies incl. sustainable, trade
- Meet the quality requirements of the processes
- Maximize yield per unit area by minimizing
  - negative environmental impacts
    - Whole crop use

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>▪ Highly competent RTD background</li> </ul>	<ul style="list-style-type: none"> <li>▪ Complex matrix of feedstocks with different characteristics &amp; requirements</li> </ul>
<ul style="list-style-type: none"> <li>▪ Good partnerships (EU- USA)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Seasonality (harvest window)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Critical mass is there</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ Demand is getting stronger</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ Research - Industry already working closely</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

Opportunities	Threats
<ul style="list-style-type: none"> <li>▪ Favorable political floor           <ul style="list-style-type: none"> <li>- Biofuels Directive</li> <li>- Biomass Action Plan</li> <li>- Biofuels Strategy</li> <li>- Biofuels Vision 2030</li> <li>- Energy Crops Scheme</li> <li>- etc.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Time: genetics &amp; agronomy needs to speed up</li> </ul>
<ul style="list-style-type: none"> <li>▪ High oil prices</li> </ul>	<ul style="list-style-type: none"> <li>▪ Myths: biotechnology &amp; GM products</li> </ul>
<ul style="list-style-type: none"> <li>▪ Industrial interest</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sustainability environmental impacts</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Links: crop logistics to target multi-functionality</li> </ul>

#### Conclusions

- Multi-crop systems
  - Agri & Forestry residues, wastes
  - Annuals & perennials
  - Herbaceous, grasses & trees
- New member states increase feedstock base
- From traditional to multifunctional agriculture
- Mixed cropping solutions
  - Soil-climate
  - Agricultural systems
  - Socio-economic conditions
- Land use strategies (tradition, markets and subsidy frames)
- Work close with the farming/ forestry community
- Synergies with all platforms (cross-cutting issue)

#### Research topics

- Field & Lab

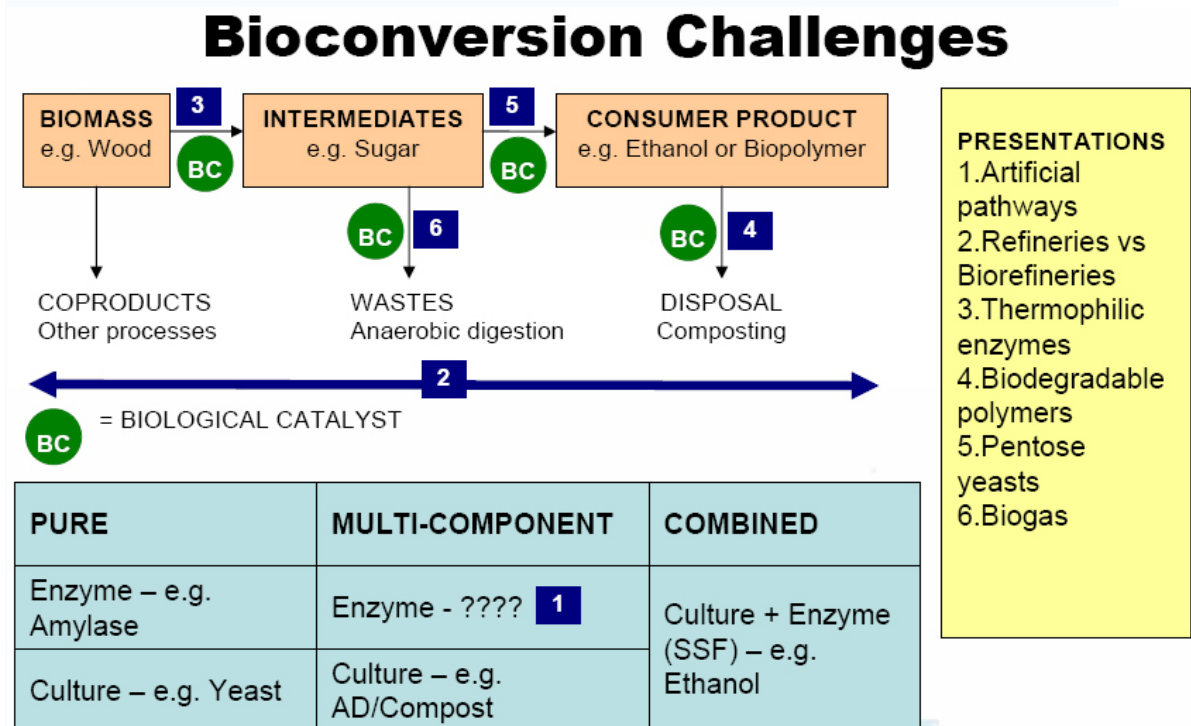
- Genetics: efficiency of lignocellulosic biomass conversion to biofuel through plant biology & enzymes
- Agronomy: species, yields, water use efficiency etc.
- Sustainability (biodiversity, soil erosion etc.)
- Logistics
  - Harvest
  - Pre-processing based on product requirements
  - Storage for wet & dry conditions – Bulk storage
- Acceptability
  - Demonstration fields for farmers in selected regions in order to improve perception and speed up learning process

## Session 2: Advances in biochemical conversion

### Five points to be addressed

- a) Challenges and technical bottlenecks – what was presented and discussed
- b) R&D within EU and Member States – [www.biomatnet.org](http://www.biomatnet.org) (1000+ projects)
- c) R&D needs not covered by existing programmes – [www.epobio.net](http://www.epobio.net) and [www.biofuelstp.eu](http://www.biofuelstp.eu)
- d) Potential for cooperation at EU level and beyond – [www.epobio.net](http://www.epobio.net)
- e) Non-technological barriers  
EU legislation and public opinion on GMOs  
See Attitudes Survey on [www.epobio.net](http://www.epobio.net)

### Bioconversion Challenges



## Lessons Learnt

Overcome increase cost due to:

ISSUE	Problem	
Poor yield	Unused substrate (waste)	1/4
Low specificity	Byproducts	6
Rate limitations (Q10)	Larger reactor/ Longer time	3
Inhibition	Poor performance	5
Death and decay	Need for replacement	1
Non-technological barriers	Need for clusters, partnerships & integration	2

## Session 3: Advances on thermochemical conversion

### Existing technical bottlenecks and challenges related to the topic of the session

- upgrading of pyrolysis oils to a refinery feed and chemicals in laboratory, PDU and pilot scale (Solantausta)
- gas cleaning of black liquor gasification, scale up and long term demonstration to DME transportation fuels (Landälv)
- scale down of Fischer-Tropsch technology to European biomass market conditions, biomass based SNG production, polygeneration road maps (Rauch)
- transfer the fundamental studies of novel zeolite and restructured clays catalyst results to practical biomass concepts and practices (Tomlinson)
- bio-based polyurethane foams attractive bio-oils based products, challenges mainly to commercialize and market-consumer acceptance (Sleeckx)

### The current R&D focus at EU level and in different EU countries

- 2nd generation biofuels is the key biomass RTD focus in the 7.FWP and several national programmes due to the targets given by the Biofuels Directive (in addition to electricity and heat generation from biomass)
- What is a constructive EU level and national balance of allocation of the public and private funds to applied research – piloting – demonstrations – commercial scale activities in production and use of biofuels for transport ?
- Materials and chemicals are attractive when giving additional revenue compared to next generation biofuels boosted by the Directive, what is the effective contribution ?

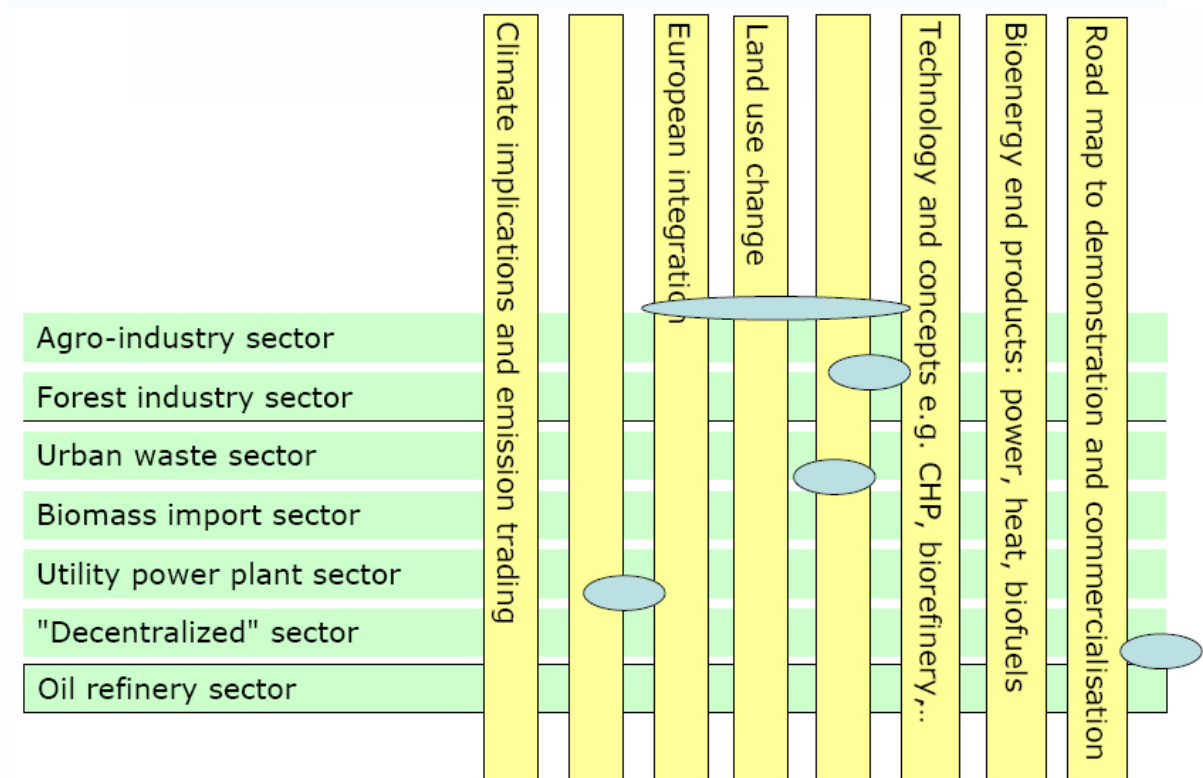
### R&D needs not covered by existing EC and MS programmes

- reliable feed stock supply will be crucial for the future large scale biorefinery industries. Additional system and cost studies. RTDD in the fuel supply is needed
- sustainability criteria's and investigations should be done on EU level, global and national levels. Transparent and convincing methods, alternatives, results and recommendations needed
- Additional cost of biofuels and externalities of fossil fuels, transparent results to citizens, stakeholders and policy makers
- scenarios needed to combine various RES-options, For example how large portion the Biofuels - Hydrogen fuels cells – Non conventional fossil sources can cover in the future European transport road maps ? 20 % alternative fuels vs. Vision reports.

### Non-technological barriers for the development of biorefineries

- the interaction and co-ordination between the four platforms presented in this conference ? On EU and national level ?
- the roadmaps to new RTD and demonstration projects co-funded by various EC Directorate generals and national programmes ?
- stronger connection needed to integrate market demand and industry commitment to demonstration and RTD, Focusing of PTDD actives in order to shorten the time to market penetration
- how to interact with the biofuels targets on short term 2010 and visions by 2030 and the targets of green chemistry, pulp and paper industry and white biotechnology markets ?
- is there a risk for a hype without a good focus setting to numerous biorefinery options ?
- will this lead to a "internal" competition for biomass ?

### Challenges of Biorefinery at various industrial Sectors



### Session 4: Techno-economic and environmental analysis

#### Techno-economic aspects

- Production of bulk chemicals from biomass saves more fossil energy than producing just energy from biomass
- Non-food products from biomass have to compete with subsidised bioenergy production
- The road to bio-based bulk chemicals is long because of both the cost and the state of technology
- Bio-based chemicals would better be produced for niche markets Instead

- The sum of the value of the parts is higher than the value of the whole (e.g. grass, vegetable oil)
- Small-scale (pre)processing can give advantages over large scale processing (transportation cost, process integrations unsuitable for large scale)
- Taking new and innovative products to the markets is more difficult than the production itself (Death Valley Syndrome)
- Will there be enough raw material available – also for food and feed – if the use of biomass gains momentum in the energy and industrial sector?

#### **Environmental aspects**

- Low-quality (and uncultivated) land has significant potential for energy plantations (e.g. up to 30% in Eastern and Central Europe)
- Greenhouse gas reduction through substituting biofuels for fossil fuels:
  - Heat: 70-90%
  - Electricity & heat: 55-95%
  - Transportation: 55-80%
- The promise of biorefineries: advanced (2nd generation) biofuels have substantially lower GHG emission than conventional biofuels