

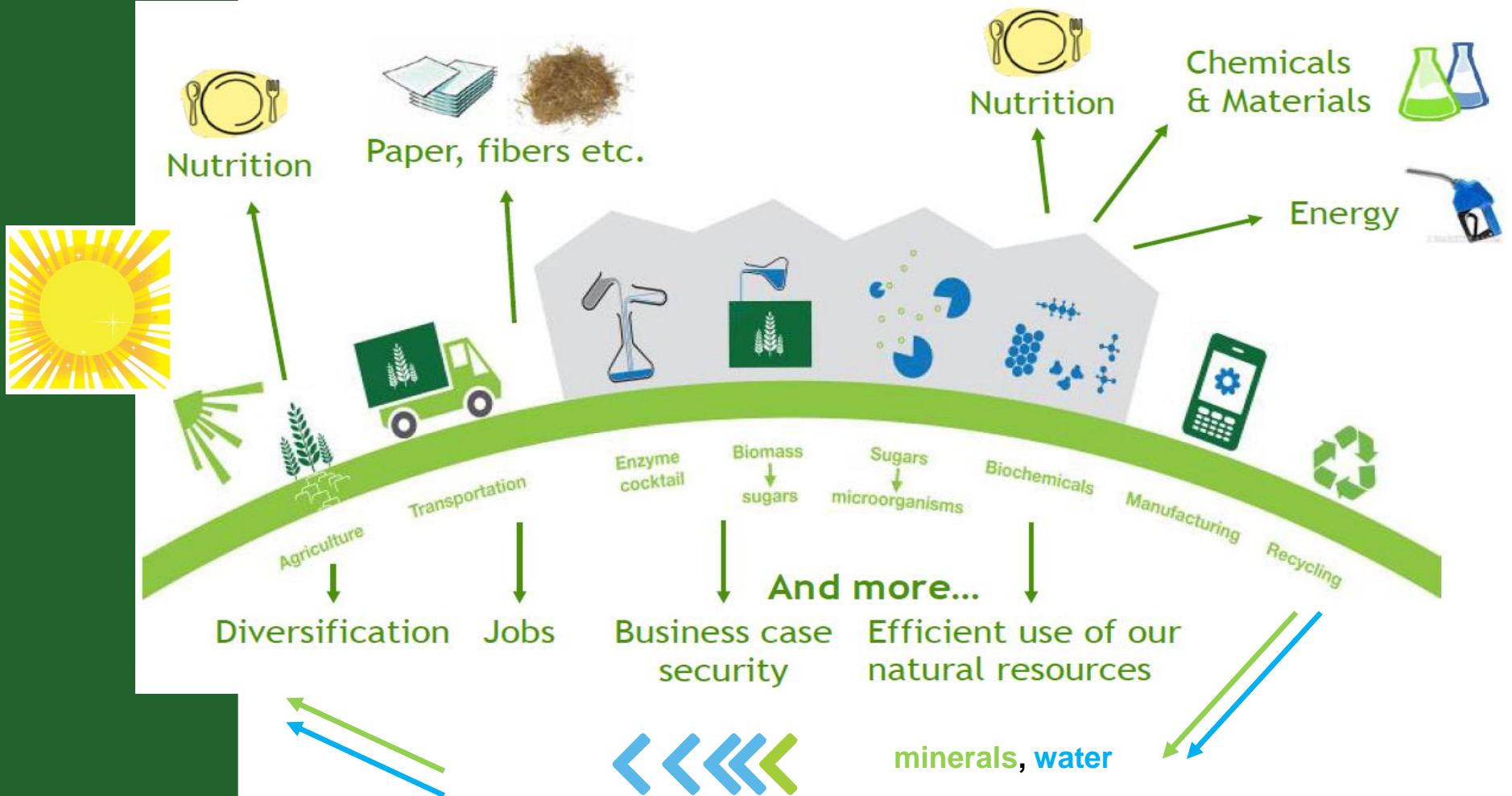


The role of industry in a transition towards the BioEconomy (BE) in relation to biorefinery

i-SUP2014, Antwerp, Belgium,
Wednesday afternoon 3 September 2014

Task 42 Biorefining

Circular BioEconomy



Major Questions

What are the changing roles of the different industrial stakeholders (agro, energy, chemical, feed/food industry) in the transition to a BE?

- From a distinct market player to a link in a full multi-product sustainable value chain?
- Co-operation?
- Who will take the lead?

What are the opportunities for upgrading existing industrial infrastructures to sustainable biorefineries?

- Using existing industrial infrastructures as flying start for BR deployment?
- Which infrastructures are most promising?
- Up-/downstream technology integration options?

Programme

Intro workshop	René van Ree (IEA-T42/WageningenUR)	5 min
Intro IEA Bioenergy Task42 Biorefining	René van Ree	15 min
The role of the energy sector in the transition to a BE	Benjamin Tromp (RWE/Essent)	30 min
Approach integration biorefineries in existing industrial infrastructures	Gerfried Jungmeier (IEA-T42/Joanneum Research)	30 min
	Coffee break	30 min
Questionnaire based public consultation	Henning Jørgensen (IEA-T42/DTU)	40 min
Concluding remarks	René van Ree	5 min

IEA Bioenergy Task42 BIOREFINING

*Sustainable processing of biomass for marketable
food & feed ingredients, chemicals & materials,
fuels & energy*



René van Ree

Co-ordinator IEA Bioenergy Task42

i-SUP2014, Antwerp, Belgium, Wednesday afternoon 3 September 2014

www.IEA-Bioenergy.Task42-Biorefineries.com

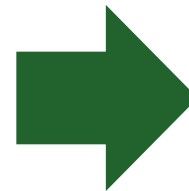
Framework T42 = Circular BioEconomy

Sustainable & Synergetic Production and Valorisation of Biomass to Food AND Non-food

=>

Biorefinery-based value chain development and implementation

Raw materials
Agro-cultural crops / Wood
Aquatic biomass
Primary (agro) residues
Secondary (process) residues
Tertiary (post consumer) residues

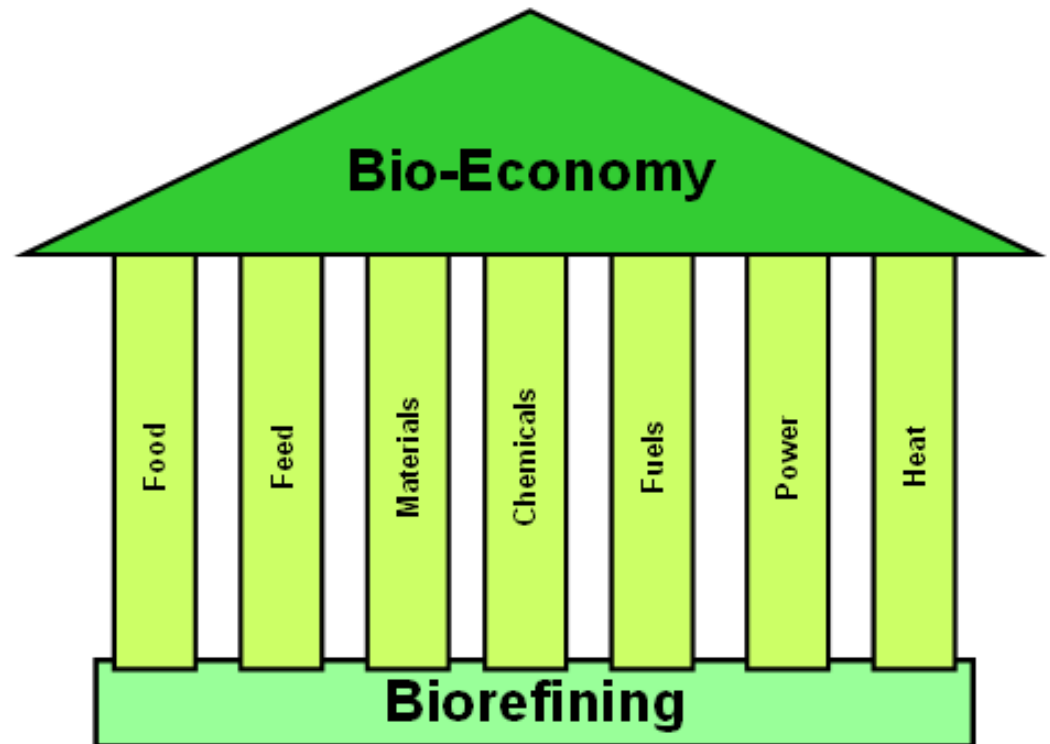


**Food/Feed Ingredients,
Bio-based products &
Bioenergy**
Pharmaceuticals / Cosmetics
Chemicals / Materials
Fuels
Energy
Heat

Circular BioEconomy

- Based on full sustainable value chains
- Relatively scarce raw materials availability
- Need for high-efficient zero waste conversion processes

Biorefinery approach is main driver for large-scale biomass implementation in the future BioEconomy



- **Energy (fuel) driven BRs**
- + Infrastructure (value chains) exists (power plants, digestion plants, biofuel plants)
- Profitability questionable (often financial governmental support necessary and/or regulated market)

Upgrading of existing plants / value chains to multi-product BRs to improve full value chain sustainability

- **Product (food/feed ingredients, chemicals, materials) driven BRs**

- Only limited BBPs facilities in operation yet
- Chain composing key technologies often still at R&D-phase
- + High potential (interested stakeholders, advanced properties)

Deploying new high efficient sustainable biorefinery-based value chains co-producing BBPs & BE

Bioenergy will be the lubricating oil in a future Circular BioEconomy !!!

Partnering countries (11)

and national contacts

Australia – Geoff Bell

Austria – Gerfried Jungmeier

Canada – Maria Wellisch

Denmark – Claus Felby/Henning Jorgensen

Germany – Heinz Stichnothe

Ireland – Matthew Clancy

Italy – Isabella De Bari

Japan – Shinya Kimura

Netherlands – René van Ree/Ed de Jong

New Zealand – Kirk Torr

U.S. – Jim Spaeth



Results so far

- Biorefinery definition
- Biorefinery classification system ...
“a <sum platforms> biorefinery for the production of <sum products> from <sum raw materials>”
- Biorefinery Fact Sheets
- Bi-annual Task Progress Meetings in participating countries coupled to industrial stakeholder events and excursions
- Task reports
 - Country reports
 - Bio-based Chemicals (Feb 2012)
 - Biofuel-driven Biorefineries (Feb 2013)
 - Green Building Blocks for Bio-based Plastics (March 2013)
 - IEA Bioenergy Task42 Brochure (August 2014)
- Biorefinery Training Courses (Amsterdam 2010, Paris 2011, Wageningen 2012, Budapest 2014)
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Task 42 Biorefining

This report, that was prepared on behalf of IEA Bioenergy Task 42 Biorefining, addresses the main bio-based chemicals that potentially could be co-produced with secondary energy carriers in integrated biorefinery facilities. Biorefining, i.e. the sustainable processing of biomass into a spectrum of marketable Bio-based Products (Chemicals, Materials) and Bioenergy (Heat, power) has generally been seen as the optimal strategy to sustainably convert biomass into a portfolio of bio-based intermediates and products that will form the base for the future Bio-based Economy. The report deals with the current production of bio-based chemicals, chemicals that eventually could be produced from major biorefinery platforms (Lignin, Biogas, Methane, Ethanol, Cellulosic Ethanol, Lignin, Glycerol, etc.) and market growth projections for the production of bio-based chemicals, economic benefits of co-producing bioenergy and bio-based chemicals, and an overview of commercial and near-market bio-based chemicals (EG, CA, CH₂O). The purpose of this report is to provide an updated, authoritative assessment aimed at stakeholders from the agro-sector, industry, SMEs, policy makers, and NGOs.

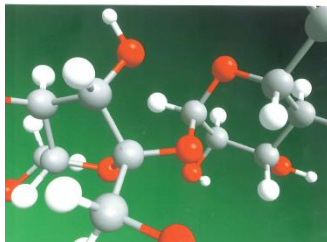
Bio-based Chemicals



Value Added Products from Biorefineries

Green building blocks for biobased plastics

PAULIEN HARKSEN AND MARTIN HAQSSAANI



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Biofuel-driven Biorefineries



A Selection of the Most Promising Biorefinery Concepts to Produce Large Volumes of Road Transportation Biofuels by 2025

IEA Bioenergy
33 Boulevard de la Woluwe
1200 Brussels, Belgium
www.iea-bioenergy.org

Task42 Biorefining
Sustainable processing of biomass into a spectrum of marketable Bio-based Products and Bioenergy
www.iea-bioenergy.org/task42-biorefining.com

Key Challenges to be Addressed:

- Biomass supply (feedstocks) and its availability
- Feedstock conversion efficiency
- Process integration and optimization
- Energy efficiency and optimization
- Environmental impact and sustainability
- Policy and regulatory framework
- Market and economic viability
- Social and stakeholder engagement

Key Objectives:

1. Support of bio-based products and services
2. Support of bio-based products and services
3. Support of bio-based products and services
4. Support of bio-based products and services
5. Support of bio-based products and services

IEA Bioenergy is an international collaboration set-up in 1974 by the International Energy Agency (IEA) to improve international co-operation and information exchange between national bioenergy R&D programmes. Its Vision is that bioenergy is, and will continue to be a substantial part of the sustainable use of biomass in the BioEconomy. By accelerating the sustainable production and use of biomass, particularly in a Biorefining approach, the economic and environmental impacts will be optimized, resulting in more cost-competitive bioenergy and reduced greenhouse gas emissions. Its Mission is facilitating the commercialisation and market deployment of environmentally sound, socially acceptable, and cost-competitive bioenergy systems and technologies, and to advise policy and industrial decision makers accordingly. Its Strategy is to provide platforms for international collaboration and information exchange, including the development of networks, dissemination of information, and provision of science-based technology analysis, as well as support and advice to policy makers, involvement of industry, and encouragement of membership by countries with a strong bioenergy infrastructure and appropriate policies. Gaps and barriers to deployment will be addressed to successfully promote sustainable bioenergy systems. The purpose of this brochure is to provide an unbiased, authoritative statement on bioenergy in general, and of the specific activities dealt with within IEA Bioenergy Task42 on Biorefining, aimed at stakeholders from the agro-sector, industry, SMEs, policy makers, and NGOs.

IEA Bioenergy
Task42 Biorefining

IEA BIOENERGY Task42 BIOREFINING



Sustainable and synergetic processing of biomass into marketable food & feed ingredients, chemicals, materials and energy (fuels, power, heat)

Programme 2014-2016

Goal To contribute to the development and implementation of sustainable biorefineries – as part of highly efficient zero-waste value chains – synergistically producing Bio-based Food and Non-food Products as base for a global BioEconomy



Activities 2013-2015

1. Assessment market deployment potential integrated BRs
2. Support industrial/SME stakeholders finding their position in the BE
3. Optimal sustainable biomass valorisation using market pull approach
4. Policy advice
5. Knowledge dissemination (best practices, ...)
6. Training

1. Assessing market deployment aspects integrated biorefineries – Description Activities

1.1 Tackling technical and non-technical market deployment barriers

- Policies/regulations
- Level-playing-field
- Full chain stakeholder involvement *assessment & learning from each other*
- Technical barriers *(best practices)*

1.2 Identifying disruptive / game changing technologies

- Type of technology
- State-of-the-art *web, literature & patent assessment*
- IP position
- Stakeholders involved

1.3 Central vs. decentral processing

- Central processing vs. regional processing *TEE-assessment 5 country*
- Economy-of-Scale vs. Economy-of-Duplication *specific value chains,*
- International workshop (ws1) *best-practices, policy recomm.*

1.4 Biorefinery-Complexity-Index (BCI)

- Indication complexity BR facility
- Time-to-market
- Stakeholders involvement *Classification system ->*
- Initial investment costs *BCI – see lecture*
- Operational costs *Gerfried Jungmeier*

2. Stakeholder support finding their position in a future BioEconomy – Description Activities

2.1 Role involved market sectors

- Energy sector
- Biofuel sector
- Chemical sector
- Agro(food/feed) sector
- Co-operation best practices

Assessment current roles, potential future roles, and roles during transition (co-operation !)
International Workshop

2.2 Upgrading of existing industrial infrastructures to Biorefineries

- Power plants
- Biofuel facilities
- Oil refineries
- Pulp/paper industry
- Food industry

TEE-assessments
(pyrolysis-based in coop. T34)
Report & glossy leaflets
International Workshop
in cooperation with T39

2.3 Factsheets major biorefineries / national case-studies

- Success stories
- Classification
- Mass/energy balances
- Capacity
- Costs
- Sustainability issues

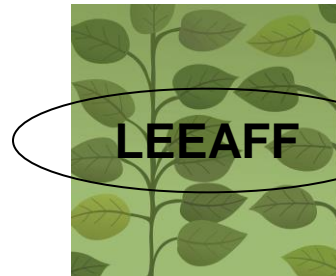
Three per country
See lecture
Gerfried Jungmeier

2.4 Added-value products from energy-driven biorefineries

- Update 2012 Bio-based Chemicals Report
- New report on Proteins for Food and Non-food Applications

3.1 Sustainability assessment toolbox testing (T42/T39)

- Development LEEAFF procedure for BR SA
- One case-study per country



- Land use
- Environment
- Employment
- Acceptability (social aspects)
- Financial aspects
- Feedstock issues

3.2 Sustainable bioenergy supply chains (T43/T42/T40/T39/T38/T29)

- Partnering in Strategic Fund Project (50% budget Task42, 50% budget SF)

3.3 Future market demand biomass for the BioEconomy (T40/T42)

- Supply, trade, demand biomass for BioEconomy
- Improved & new value chains
- Task42: types biorefineries = f(time, location, feedstock use)
- Desk study and international workshop (ws3)

3.4 Optimal sustainable biomass valorisation (T42/others)

- Identification BioEconomy Strategies in IEA Bioenergy Member Countries: current status, approaches and opportunities for IEA Bioenergy

4. Preparing policy advise on further needs – Activities Description

4.1 “Roadmap” Biorefinery (T42/IEA Headquarters)

- Contributing to potential project to be defined by IEA Headquarters on “Sustainable Biomass Valorisation by the Biorefining Approach”

No activity – skipped from work programme

4.2 Biorefinery (related) policies in participating countries

- Assessment BR (related) policies in participating countries
- Assessment BR (related) at EC, US, ... Level
- Distribution info to GOs
- International workshop (ws4) on biorefinery (related) policy development and implementation at national and international level

Scheduled for 2015

4.3 Country reporting

- Current status and developments within partnering countries
- Reports prepared in PPT-format once – and updated regularly
- Reports on Task42 website

The planning is that a country report for all countries is available on the website by the end of 2014

5.1 Bi-annual Task meetings + Tele-conferences in between

- Bi-annual closed internal Task42 progress meetings
- Bi-annual coupled open (industrial) stakeholder meetings
- Bi-annual coupled excursions

2013(1): Wageningen, NL; 2013(2): Graz, AT; 2014 (1): Berlin, D; 2014(2): Hamburg, D;
2014(3): Guelph/Toronto, CAN; 2015(1): IT; 2015(2): coupled to IEA Bioenergy
Conference Berlin

5.2 Annual Task42 meetings at national level

- Organised minimally once-a-year by the national Task representative

5.3 Task42 website

- www.iea-bioenergy.task42-biorefineries.com

5.4 Task42 newsletters

- After every T42 meeting sent to national contacts, and put on the website,

5.5 Task42 reports

- Activity reports (10)
- Country reports (1 ppt per country + updates)
- Task meeting reports (2 a year)
- Brochure, poster, leaflets -> New T42 Brochure will be available in Summer 2014 !

5.6 International workshops/seminars (6); ind. stakeholder meetings (6)



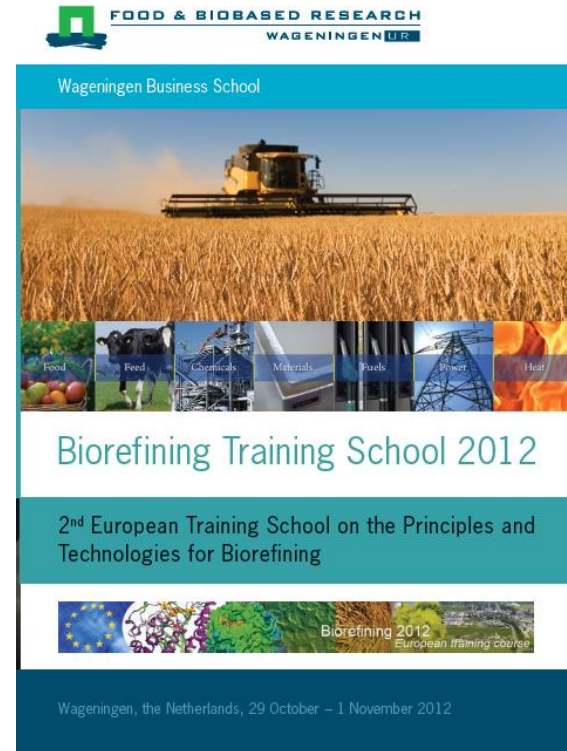
6. Developing and organising training activities – Task Description & Achievements so far

History

- One day training course
 - Ghent, Belgium, 12 June 2009
 - Amsterdam, NL 13 September 2010
- Four day training course
 - Paris, France, 28 August 2011 – 01 September 2011 (120 att.)
 - Wageningen, NL, 29 October 2012 – 01 November 2012 (75 att.)

2013 – 2015

- Further development and updating
- Given minimally once-a-year in one of the partnering countries
- Lectures made available by web for teaching outside the EU
- Task42 financial involvement: paying travelling costs Task42 lecturers
- 3rd European Biorefining Training School, Budapest, Hungary, 7 – 10 July 2014



IEA Bioenergy Task42 Biorefining

Sustainable and synergetic processing of biomass into marketable food & feed ingredients, products (chemicals, materials) and energy (fuels, power, heat)



Content

Activities and results T42 so far

Descriptions, schemes, pictures of about 35 running Biorefineries worldwide

Available @ T42 website from 15 September 2014 !!!

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Part of the sub-activities are co-ordinated by country representatives

Thank you for your attention



www.IEA-Bioenergy.Task42-Biorefineries.com