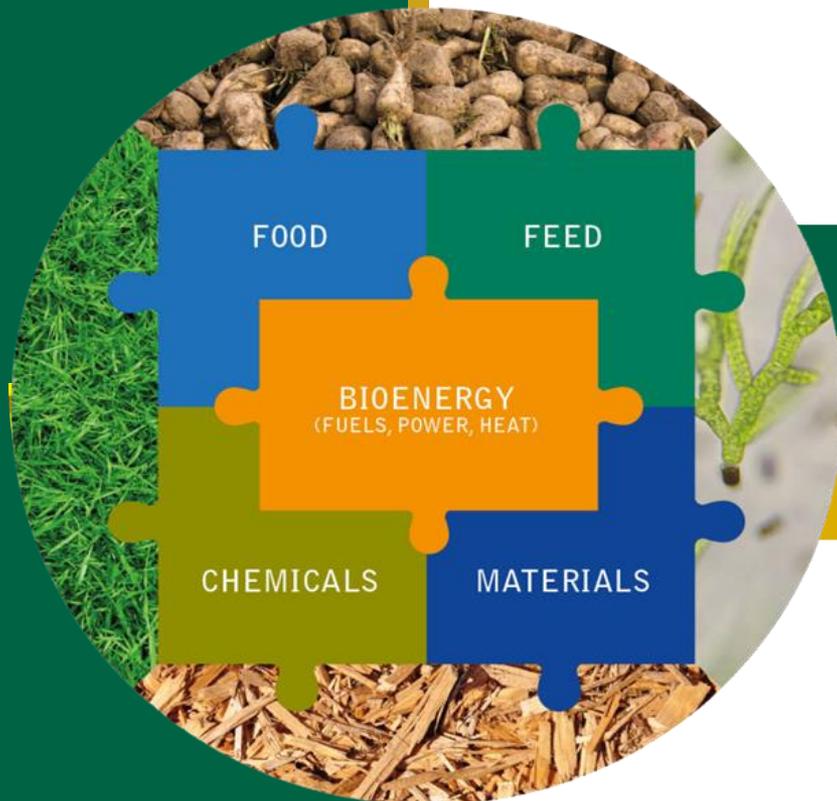


Task42



René van Ree

Coordinator IEA Bioenergy Task42

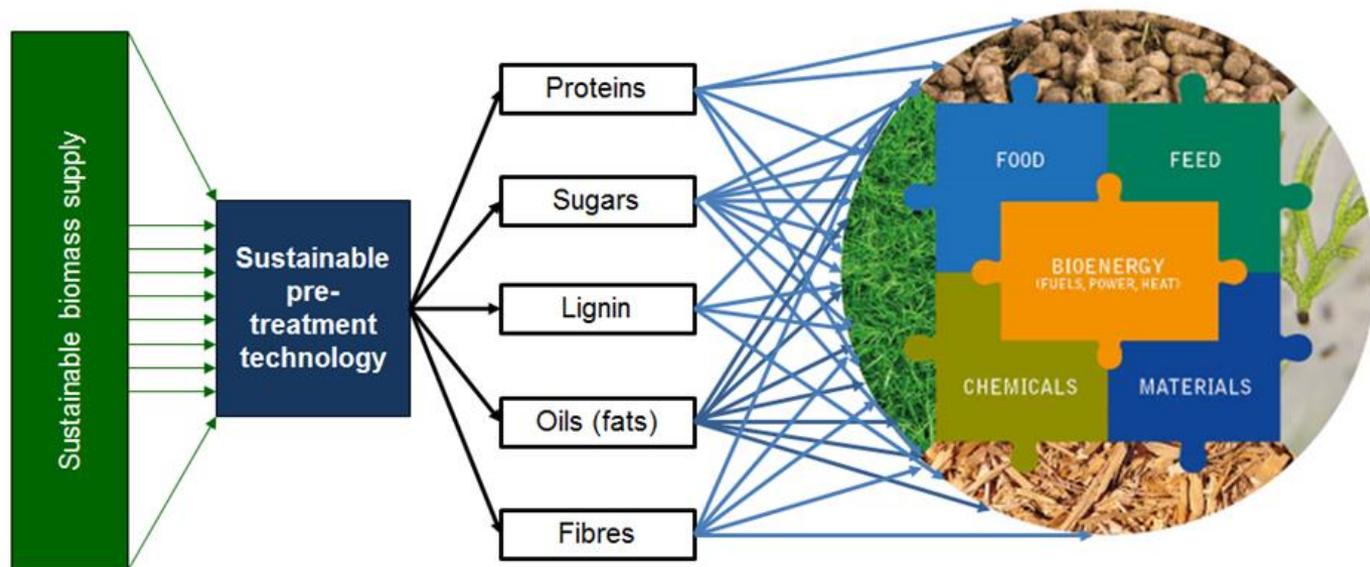
Wageningen Food and Biobased Research

Austrian Biorefining Stakeholder Workshop,
Technical University of Vienna, 23 October 2017

Biorefining

Definition IEA Bioenergy Task42

Sustainable processing of biomass into a portfolio of marketable biobased products (food and feed ingredients, chemicals, materials, fuels, energy, minerals, CO₂) and bioenergy (fuels, power, heat)



Task 42



Vision Biorefining is the optimal strategy for large-scale sustainable use of biomass in the BioEconomy resulting in cost-competitive co-production of food/feed ingredients, biobased products and bioenergy with optimal socio-economic and environmental impacts, viz.

- > efficient use of resources
- > reduced GHG emissions

Mission To facilitate the commercialisation and market deployment of environmentally sound, socially acceptable, and cost-competitive biorefinery systems and technologies, and to advise policy and industrial decision makers.

IEA Bioenergy Task42

WP 2016 - 2018

Countries involved: AT, AUS, CAN, DEN, GER, IRE, IT, NL, US

Scope involve 4 different Activity Areas (AAs)

- **AA1 - Biorefinery Systems** (AT et al)
Analysis and assessment of biorefining in the whole value chain
- **AA2 - Product Quality** (GER et al)
Reporting on related biobased products/bioenergy standardisation, certification and policy activities
- **AA3- Evolving BioEconomy** (IT et al)
Analysing and advising on perspectives biorefining in a Circular BioEconomy
- **AA4 - Communication, dissemination & training** (NL et al)
Knowledge exchange, stakeholder involvement, reports & lecturing

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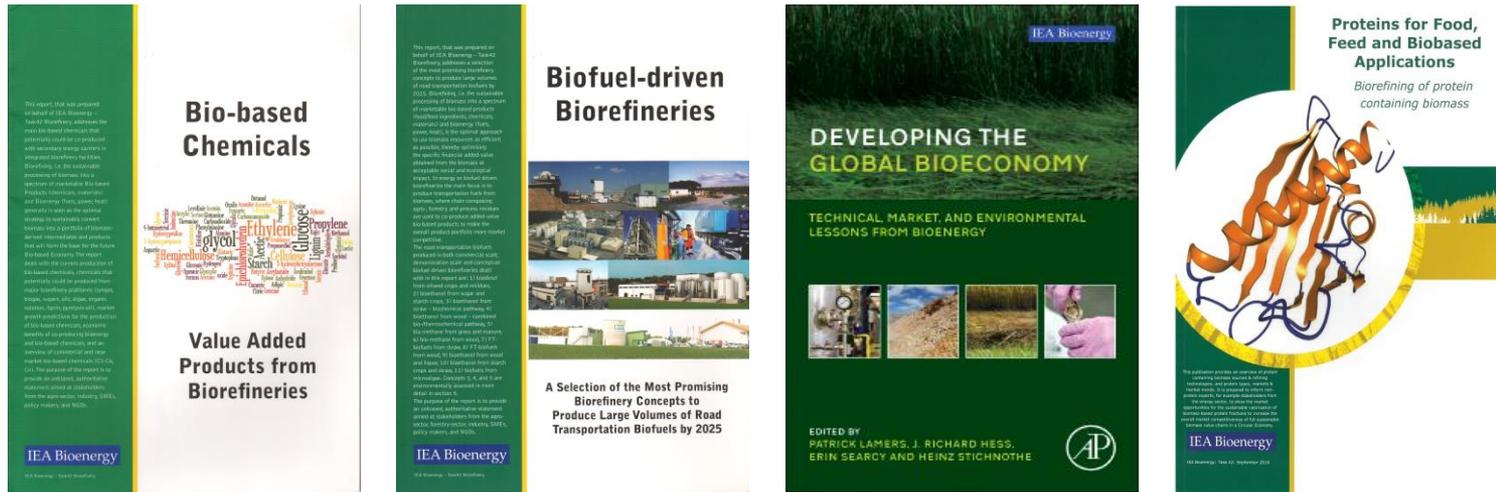
Deliverables 2016 - 2018

- Biorefinery Expert System (SA) / Factsheets
- Monitoring of international standardisation/certification activities BM-use
- Monitoring INT BioEconomy developments
- Joint Tasks Projects (bioenergy supply chains)
- Strategic Reports on
 - Proteins for Food and Non-food (2016)
 - Biobased Fibrous Materials (2017)
 - Biobased Chemicals (2018)
- Updates of National BR Country Reports
- (Thematic) Stakeholder Workshops
- Conference & training contributions, ...
- Biannual newsletters

IEA Bioenergy Task42

Results so far

Thematic Reports



- Biobased Fibrous Materials (AT) by end 2017
- Update Biobased Chemicals Report by end of 2018

Country Reports

AT, AUS, CAN, DEN, FRA, GER, IRE, IT, JAP, NL, NZ, TUR, UK, US



Task42 – Biorefining in a Future BioEconomy

IEA Bioenergy Task42

Results so far

Biorefinery definition, classification system and factsheet methodology

Part A: Biorefinery Plant

Part B: Value Chain Assessment

Biorefinery FACT SHEET

1-platform (oil) biorefinery using oilseed crops for biodiesel, glycerin and feed*

Part A: Biorefinery plant

The commercial scale energy driven biorefinery "1-platform (oil) biorefinery using oilseed crops for biodiesel, glycerin and feed" is shown in Figure 1. The oilseed crops in the "1-platform (oil) biorefinery using oilseed crops for biodiesel, glycerin and feed" are transported to the biorefinery, where the vegetable oil and the animal feed are produced in the pressing step. The oil is considered as a platform, and it is esterified, producing FAME, biodiesel and raw glycerin. To derive pure glycerin for pharmaceutical purposes the glycerin is subsequently distilled. The heat and electricity are typically supplied by fossil fuel energy carriers. The plant scheme of the "1-platform (oil) biorefinery using oilseed crops for biodiesel, glycerin and feed" is similar to the biorefinery using only oilseed crops, with the inclusion of an additional step for the filtration of the used cooking oil or animal fat.

This biorefinery is state of the art and commercial production facilities have an annual biodiesel production capacity between 50,000 up to 150,000 t per year. Many of the successful operating biorefineries operating today are multi feedstock plants that are able to use different oilseed crops, fat and/or lipid residues. The oil platform and the glycerin platform offer the possibilities for a wide range of biochemicals and biomaterials that are currently under development and partly at the beginning of commercialization. For example, the oil from certain oilseeds can be further processed via hydrolysis to long-chain fatty acids for lubricants, and the glycerin can be converted to softening agents such as propandiol by fermentation or to triacetin by chemical conversion.

Also, as new configurations are developed, the external energy sources can be partially or fully replaced by bioenergy produced within the process to reduce the GHG footprint.

Case study, example

Figure 1: 1-platform (oil) biorefinery using oilseed crops for biodiesel, glycerin and feed

Table 1: Key characteristics of biorefinery plant – generic example

Biorefinery plant			
Biorefinery Complexity Index (Products/Platform/Feedstock/Process) = 8 (2/1/1/2)			
State of technology: commercial			
Products	Auxiliaries (external)		
biodiesel: 100 (Mta)	electricity: 0.99 (PJ/t)		
glycerin: 11 (Mta)	heat: 0.94 (PJ/t)		
animal feed: 132 (Mta)	materials: 21 (Mta)		
Feedstock	Costs		
oilseed crops: 268 (Mta)	investment: 50 (Mio €)		
water content: 12% (wt)	feedstock: 414 (M€)		
Efficiencies	Energy		
input to products: 84%	80%		
input to transportation fuel: 20%	52%		

Figure 2: Mass balance of biorefinery plant

Figure 3: Energy balance of biorefinery plant

Figure 4: Share of costs

Figure 5: Share of revenues

Part B: Value Chain Sustainability Assessment

The method of the sustainability assessment - economic and environmental – is given in Annex 1. The main assumptions and modelling choices are documented in Annex 2.

In future the following improvements of the assessment might be possible:

- Reduction of investment costs
- Use of renewable energy for auxiliary energy
- Further products made from glycerine with higher revenues
- Lower area demand due to a yield increase
- Using of straw for various products

A 1-platform (oil) Biorefinery Using Oilseed Crops for Biodiesel, Glycerin and Feed

Figure 6: Comparison of biorefinery with conventional reference system on whole value chain (incl. "end of life treatment")

Table 2: Key characteristics of biorefinery value chain – generic example

Whole value chain			
Greenhouse gas emissions (total)	biorefinery: 238 (210 to 260)	ref. (t CO ₂ eq/t)	
reference system: 381 (360 to 402)		ref. (t CO ₂ eq/t)	
change: -143 (-17.8 to -53.3)		[%]	
Cumulated energy demand (total)	biorefinery: 2.3 (2.1 to 2.6)	ref. (PJ/t)	
reference system: 3.9 (3.5 to 4.3)		ref. (PJ/t)	
change: -1.6 (-1.2 to -1.9)		[%]	
Land	biorefinery: 8.8 (8.3 to 10.2)	ref. (PJ/t)	
reference system: 8.9 (8.3 to 10.2)		ref. (PJ/t)	
change: 0 (-1.5 to 2.2)		[%]	
Ammonia area demand (total)	biorefinery: 30 (20 to 10000)	ref. (t)	
reference system: 120 (120 to 120)		ref. (t)	
change: -90 (-480 to 610)		ref. (t)	
CO₂e	annual revenues: 127 (120 to 192)	ref. (Mio €)	
specific costs: 520 (480 to 800)		ref. (€)	
Revenue	annual revenues: 127 (120 to 192)	ref. (Mio €)	
specific revenues: 520 (480 to 800)		ref. (€)	

Figure 7: Estimated cumulated fossil energy demand of biorefinery and reference products

Figure 8: Estimated cumulated energy demand of biorefinery and reference products

Figure 9: Estimated greenhouse gas emissions of biorefinery and reference products

Figure 10: Estimated cost and revenues of biorefinery plant

Annex:

Methodology of sustainability assessment and data with references

IEA Bioenergy Task42

Results so far

Stakeholder Meetings, Excursions & Workshops

Between 30-40 over last 9 years



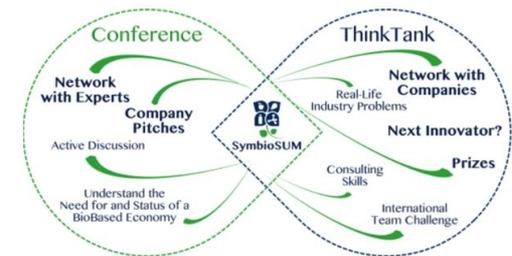
Knowledge & experience transfer

Lectures at international conferences

Publications in journals

Specific thematic workshops

Specific biorefinery education
and training courses



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Task42 - Biorefining in a Future BioEconomy

To 3 recent deliverables

IEA Bioenergy Task42

Joint Workshop with IEA-IETS



The role of industrial biorefineries in a low-carbon economy Gothenburg, Sweden, 16 May 2017

- Strategic biorefinery developments
- How to overcome deployment barriers



2 plenary lecture sessions
each followed by an interactive workshop with all
participants

IEA Bioenergy Task42

Joint Workshop with IEA-IETS



Interactive workshop focus

- Pulp and paper mills
- Chemical industries
- Food and feed industries
- Petroleum refineries
- Energy utilities



Examples of notes from the different brainstorm groups

Main deployment barriers

Social

Public perception on both BM sustainability and BBPs

Food habits, throw-away society

Resistance to change

Technological

TRL, complexity BRs, lack of qualified staff, etc.

Economic

Large investments, high risks, profitability?

BR business models, etc.

Markets

Conservative industry, need for cooperation

Opposition and competition, volatile markets

Policy

Lack of consistency and LT vision

Legislation (waste, food safety, etc.)

IEA Bioenergy Task42

Joint Workshop with IEA-IETS

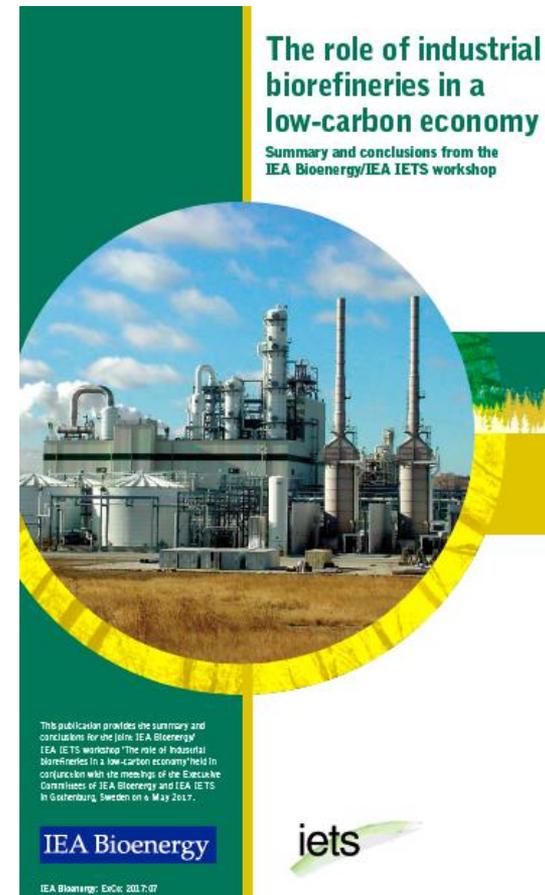


Recommendations

- Policy
- Business
- Research and education



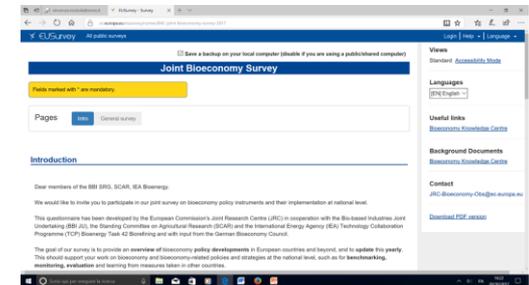
Examples of notes from the different brainstorm groups



IEA Bioenergy Task42 BioEconomy Questionnaire

On-line Joint BioEconomy Survey 2017 JRC-SCAR-BBI-IEA Bioenergy

- Personal info (organisation or coordinated answer)
- National institutions
- National BioEconomy definition/scope
- National BioEconomy policy and strategy
- BioEconomy Infrastructure (funding, register, certification schemes, educational programmes)
- BBI SRG or IEA Bioenergy member
 - Questions for BBI SRG members
 - **Questions for IEA Bioenergy members:**
 - **commercial, flagship and demo/pilot biorefinery plants**
 - **R&D-projects**
 - **stakeholders involved**



<https://ec.europa.eu/eusurvey/runner/BKC-joint-bioeconomy-survey-2017>

Deadline EC countries: 29-10-2017

IEA Bioenergy

Task42 – Biorefining in a Future BioEconomy

Joint Thematic Workshop on Bioenergy and Biorefining in a Circular (BIO)Economy, Brussels, 27 September 2017



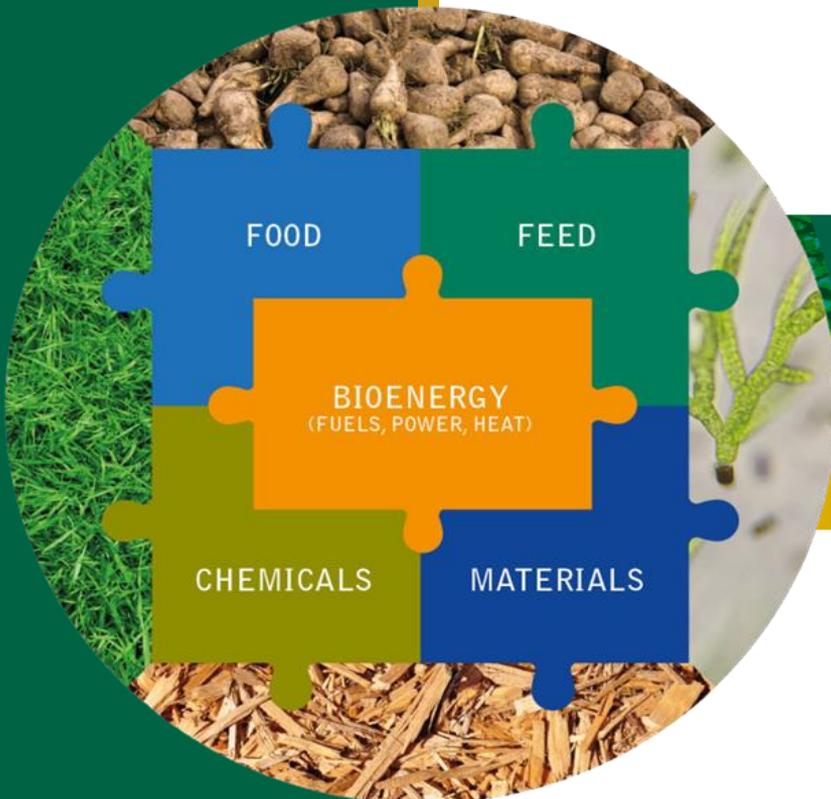
ETIP Bioenergy
European Technology and Innovation Platform



IEA Bioenergy



Food and Agriculture Organization
of the United Nations



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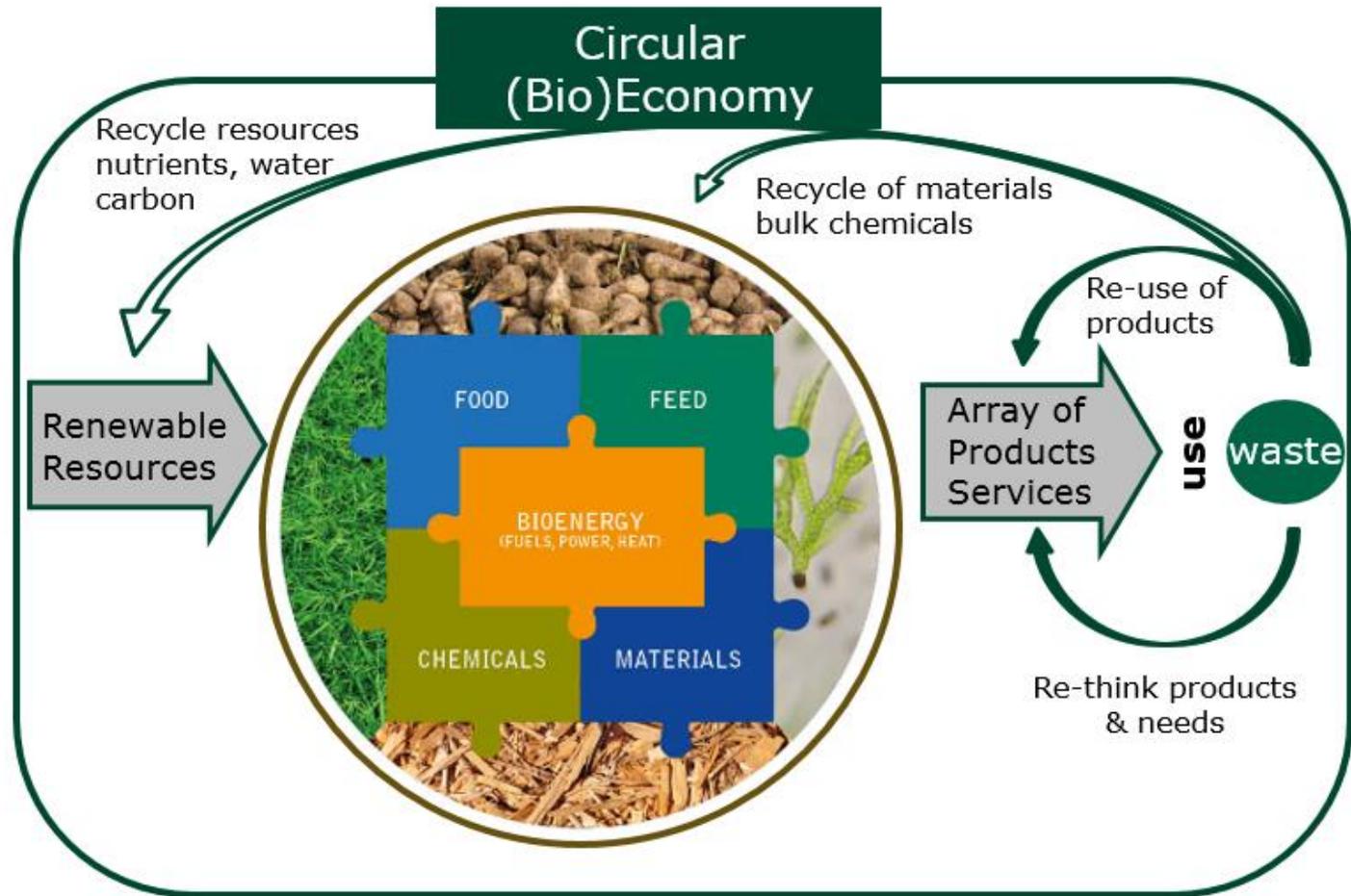
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Aim of this meeting

1. To inform each other on running and planned activities in the field of Bioenergy and Biorefining in a Circular (Bio)Economy;
2. To analyse cooperation opportunities to be able to use available (financial) resources as efficient as possible and to come-up with results that will have a broad support;
3. To define one/more joint activities to be performed in the coming year(s);
4. To organise (a) joint dissemination event(s) to communicate our views/results to a wider public (side event international conference, etc.).

Setting the Scene

Bioenergy in Future Circular (Bio)Economy



Further cooperation

1. Continuation parallel activities and keeping each other actively informed on major achievements (reports, etc.)
2. Organising an annual joint dissemination event on Bioenergy and Biorefining in a Circular BioEconomy: success stories, lessons learned, innovation needs etc.
3. Joint database bioenergy/biorefinery facilities or coupling existing ones.
4. Contact other international organisations (OECD, BIC/BBI, etc.) and assess cooperation opportunities.
5. Identifying (2018) and final (2019 onward) execution of some joint projects



Attendees

T42 Coordination in Austria

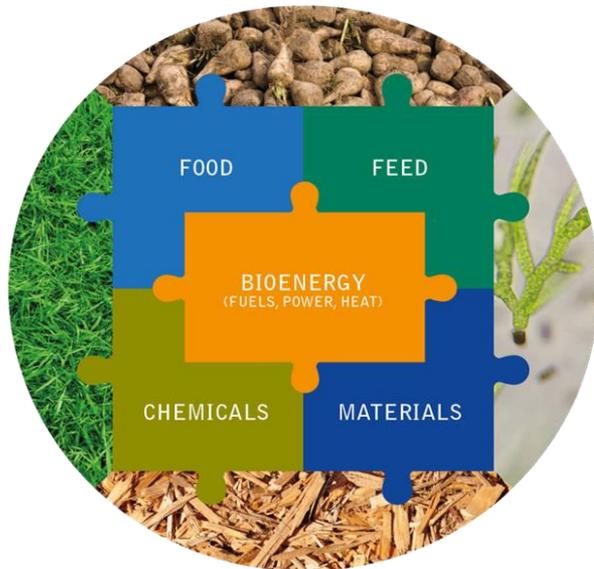


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Thank you for your
kind attention

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Task42 – Biorefining in a Future BioEconomy



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