IEA Bioenergy

WAGENINGEN UNIVERSITY & RESEARCH

Biorefinery Approach in the EU and Beyond

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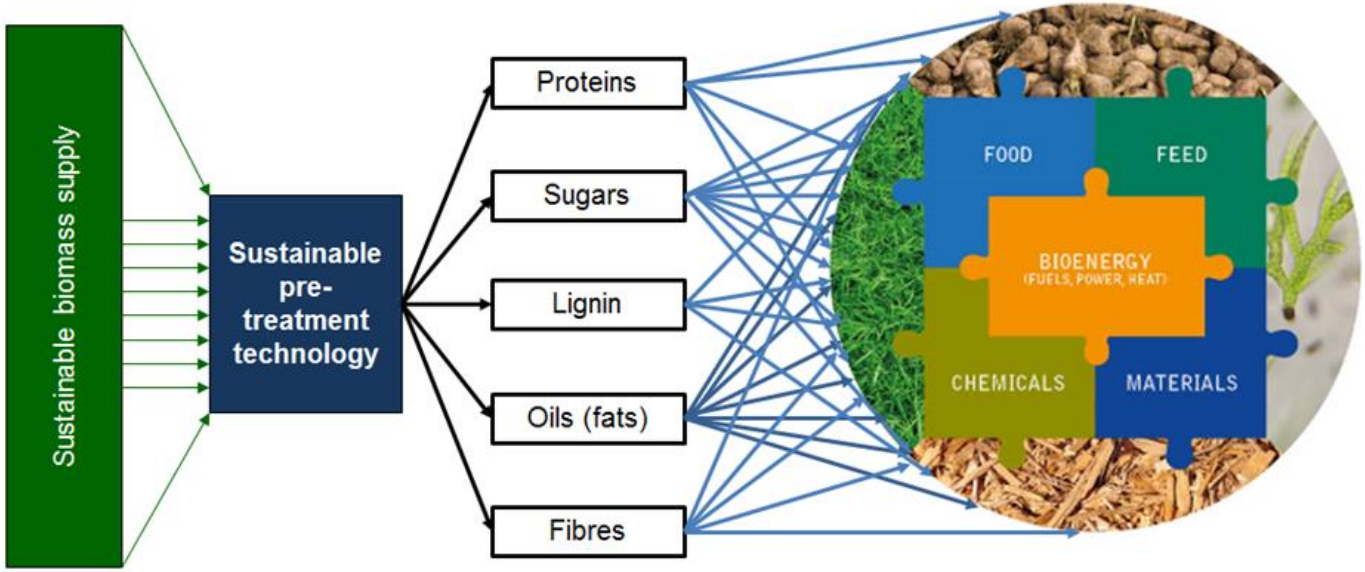
Biorefining

Definition IEA Bioenergy Task42

Sustainable processing of biomass into a portfolio of marketable biobased products (food and feed ingredients, chemicals, materials, fuels, energy, minerals, CO_2) and bioenergy (fuels, power, heat)



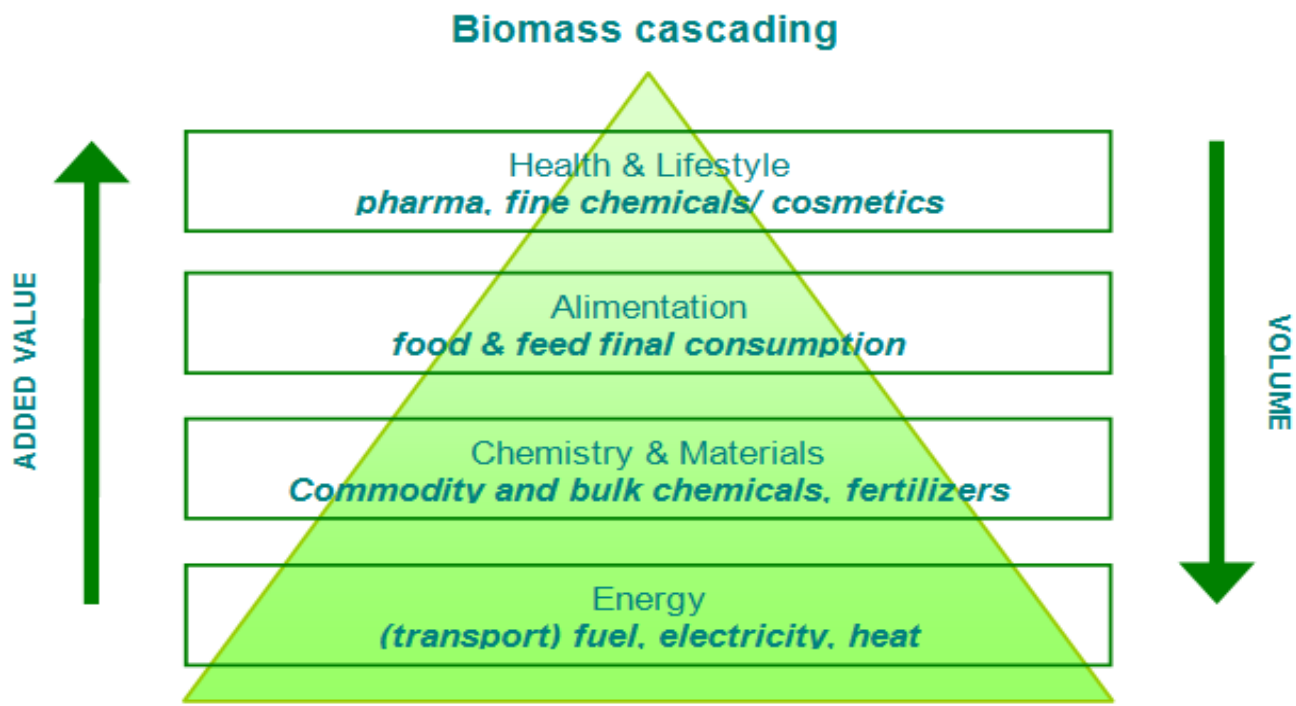
Motivation

Why Biorefining?

- Because the products and services we are using are based mainly on non-renewable resources
- Because the biomass resources are not inexhaustible, so they have to be used efficient and sustainable
- Non-renewable and current biomass processes are inefficient and not sustainable, consequently business as usual will not work out any more in the future!

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** (efficient use of resources, reduced GHG emissions, ...)

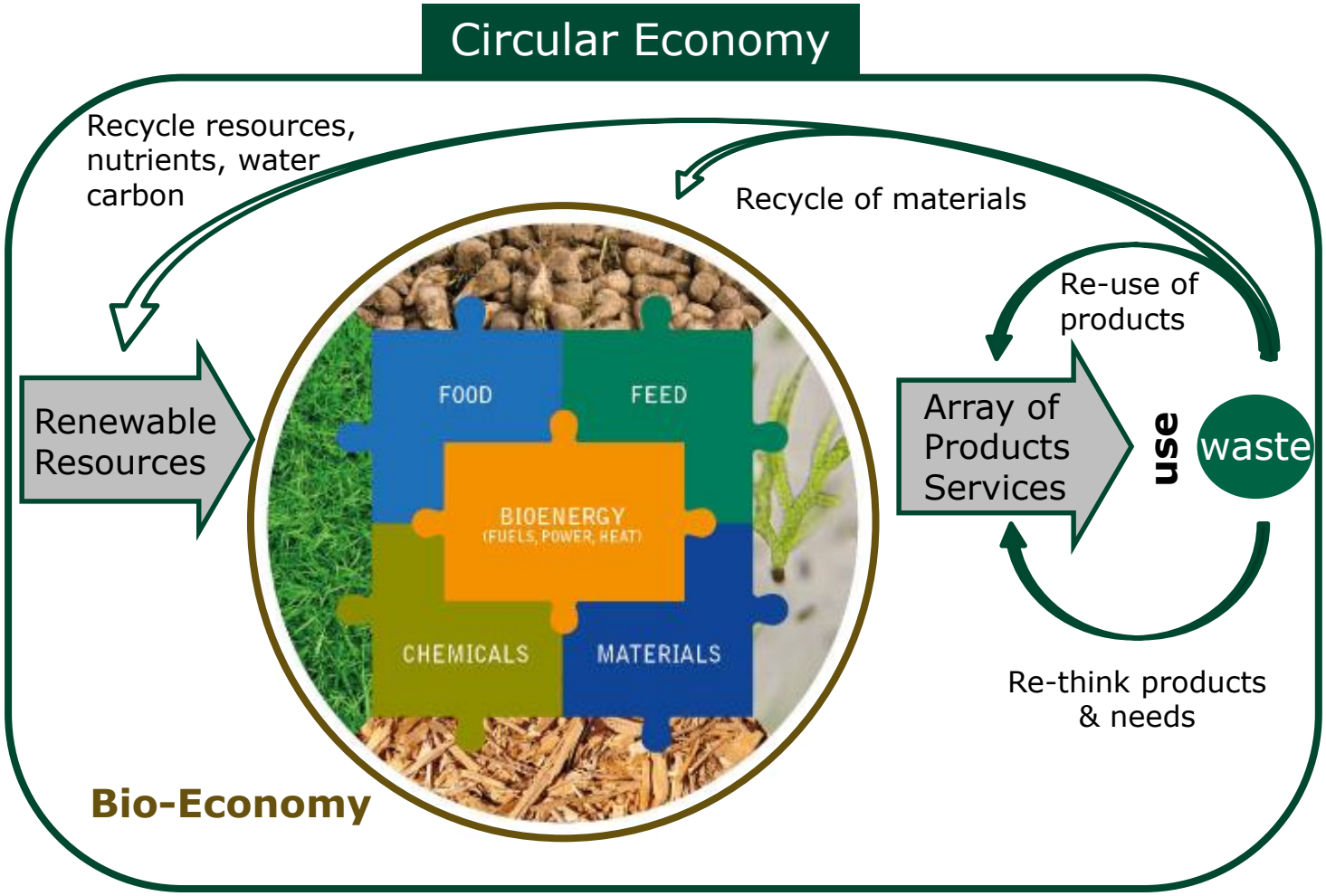
Biorefining vs Biocascading



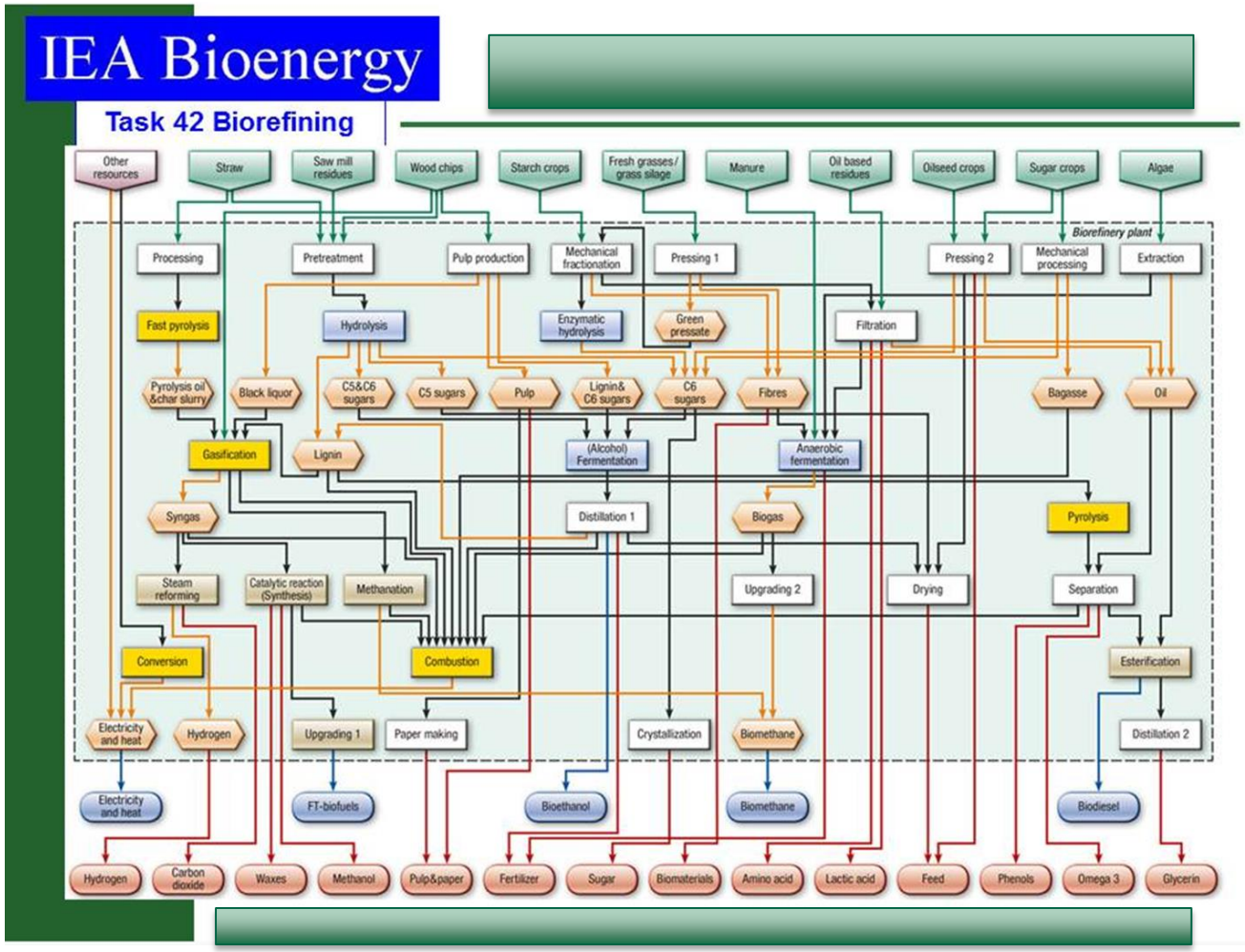
Cascading = biomass use over time: high-value 1st – energy – disposal

Biorefining = optimal sustainable biomass use (function/ value) to portfolio of BBPs

Concept of future Economy



Biorefining –Potential



Theoretical potential is enormeous, however, the practical potential is restricted due to both technical and economic constraints

Biorefining – General SOTA

Biorefining approach already applied for ages in the human food, animal feed, wood and the pulp/paper industry

(Bio) Energy sector: main focus on production of secondary energy carriers (power, heat, gas); residues (ash/slag, digestate, CO_2, water, ...) mainly treated as waste; however, more and more focus on retrofitting existing facilities to energy/biogas-based biorefineries, where residues are treated as (resources for) added-value co-products optimising full process/chain sustainability

Chemical sector: main focus on platform chemicals; however, more and more refocus to functionalised chemicals being more sustainable and market-competitive even at relatively low US$/bbl raw oil

Biorefining – General SOTA

Biofuel sector:

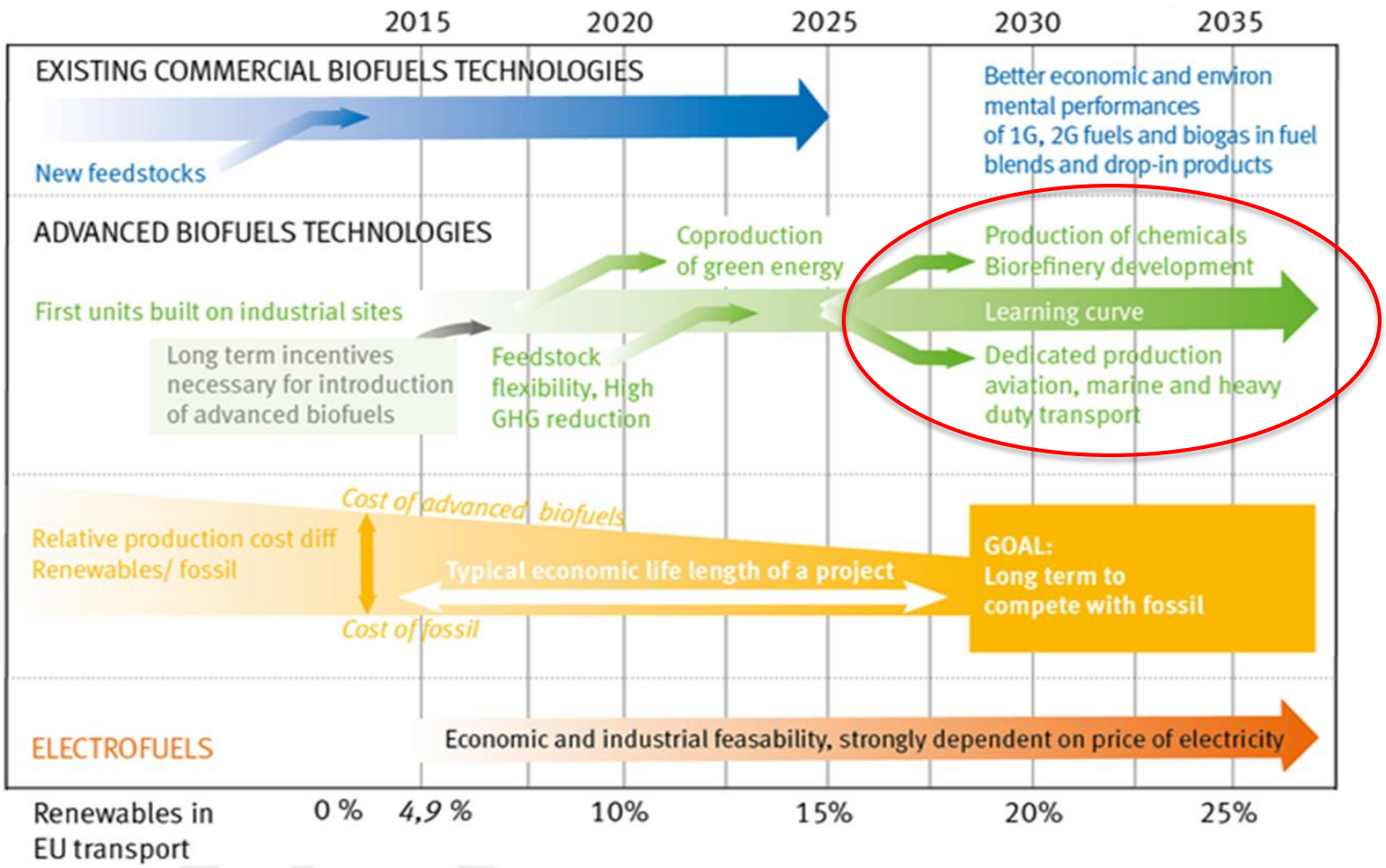


Figure 5: Biofuels deployment

Ref. ETIP Bioenergy (EBTP) 2016

Energy and Biofuel based Biorefineries

Energy based biorefineries

Main Product	Biorefining opportunities	Main issues
Power Heat CHP	• Use of 1/2/3 residues • Upsteam ref. raw mat. • Integration existing & new infrastructures	Profitability (low coal €) Sustainability
Biogas (SNG, CHP)	• Upstream ref. raw mat. • Digestate valorisation • Biogas/CO_2 valorisation • Digestion 2 fractionation	Profitability Raw. mat. rel. policies

Advanced biofuel based biorefineries

Main Product	Biorefining opportunities	Main issues
Truck fuels Aviation fuels	• Sugar & syngas platforms • Lignin valorisation (c2bbp2>€)	Sustainability Techn SOTA
Shipping fuels	Ligin val. in robust engines	New desulp.reg.

Product based Biorefineries

Markets	Current sit	Biorefining opportunities
Pharma	Chem & Nat	Extraction from land/aq. crops
Food	Veg & Meat	Ingredients (proteins, CHs, oils, vitams, ...) from biomass (reduced meat cons./neg.em.)
Feed	Crops & Res	
Chemicals	Mainly fossil	Functional chemicals (instead of platform chemicals; more efficient biomass use)
Materials	Mainly fossl	Better performance materials (stronger, lighter)
Fuels	Fossil / 1G bio	Non-food BM to advanced fuels
Energy	Fossil / RE	Use of BR residues
Minerals	Mining	Separation and bring back to the field/process to incr. overall sustainability
Water/CO_2	Use/Em. = -/-	

Biorefining – Major non-technical deployment barriers

- Biomass sustainability & Food/Non-food disc.
- Biomass mobilisation & contractability
- Regulation/policy (waste, ...)
- Standardisation & certification BBPs (t>)
- Still no level-playing-field (artificial market pull to energy/fuel sectors)
- Stakeholder co-operation and communication: separate worlds a) Food/Non-food and b) upstream/downstream (cult./BR)

Technical deployment barriers will be solved; this is only a matter of time and sufficient budget

Biorefining – Technical Research and Innovation Gaps

- Production of **biocommodities** for development international trading markets
- Development of **robust** and **Food/Non-food flexible biorefineries** (to ensure stable farmer income)
- Development of **mobile harvesting/processing units** (grass, casave, mais, wheat, sunflowers, ...) co-producing food/fuel/minerals for use at local level and biobased intermediates for final processing at regional level or export (linking smallholders to markets) (preservation products)
- Downscaling of plant-based protein biorefining technology to produce food ingrendients at regional level
- Development of **Integrated Bio-industrial Complexes** at city locations (safe food, ...)

www.iea-bioenergy.task42-biorefineries.com
www.wur.eu/wfbr

Thank you for your attention

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