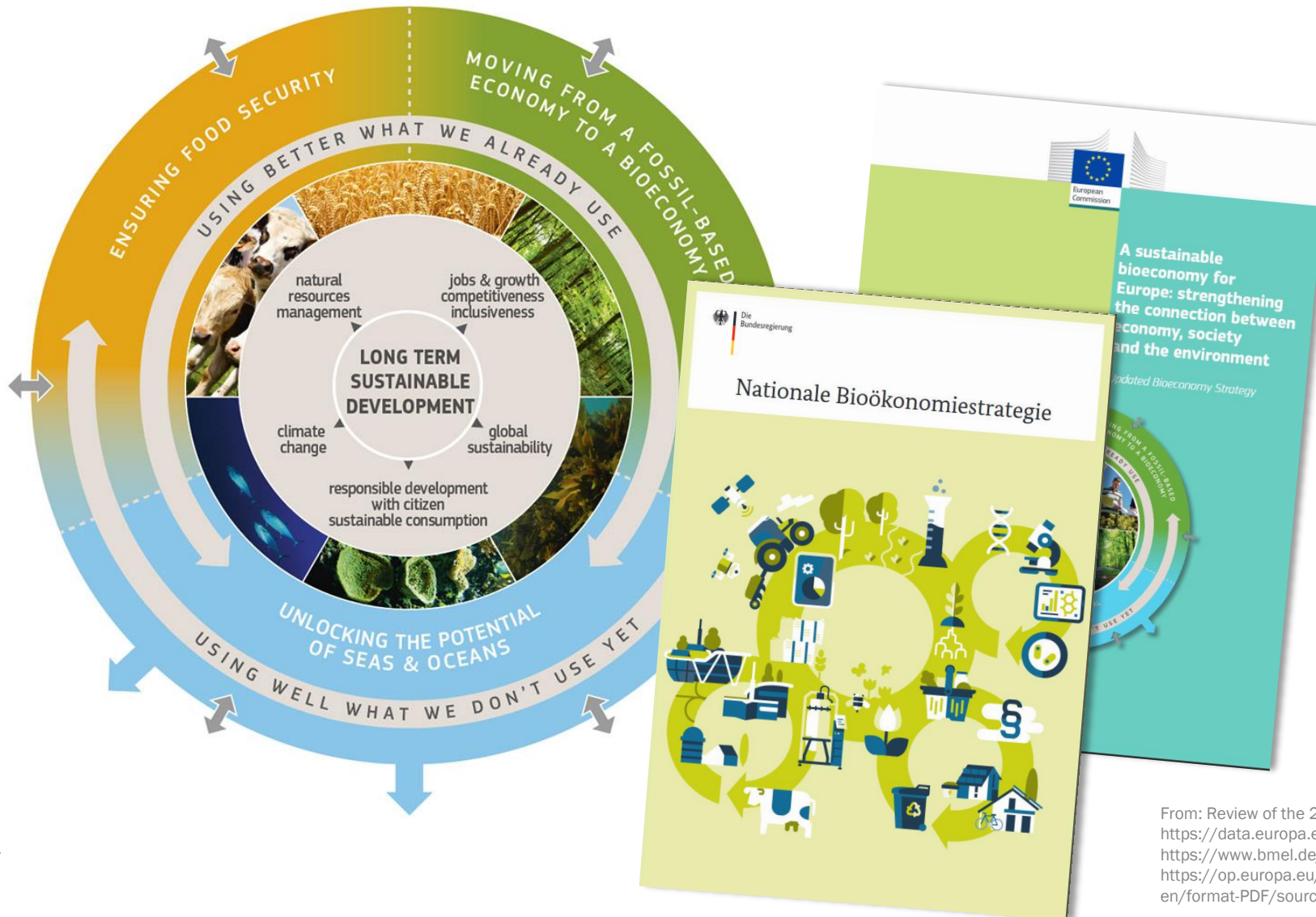


## Role of biorefineries in a circular economy

# Background

## Pressure to act increases



- » Closing material cycles via recycled products (Circular Economy) and biomass-based products (Bioeconomy).
- » Bioeconomy comprises the production, development and use of biological resources, processes and systems [...] in all economic sectors
- » Biorefineries as integrated processing plants of the bioeconomy
- » Efficient biomass use as an overarching goal in EU and DE bioeconomy strategies

From: Review of the 2012 European Bioeconomy Strategy, 2018. Available:  
<https://data.europa.eu/doi/10.2777/086770>  
<https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/nationale-bioekonomiestrategie-langfassung.pdf>  
<https://op.europa.eu/en/publication-detail/-/publication/edace3e3-e189-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-149755478>



# Implementing complex topics synergistically



### Potentials

Evaluation and development of available resource potentials, the contextualization of biomass as a renewable carbon source in energetic and material target products as well as the evaluation of the cascade use of material flows and the sales opportunities of products from biorefineries



### Technologies

Highly efficient biomass processing in increasingly integrated biorefineries, variety of technical options, further development of integrated conversion, processing and recycling technologies including plant design and scaling, including expansion of the resource and product range



### Use

Not all biorefinery products substitute already established fossil products (e.g. fuels, chemicals); properties conceivable for development of new products for various applications



### Scientific support

Monitoring of material flows as well as processing technologies, impact assessments, sustainability analyses of technologies incl. technical-economic-ecological system analyses with harmonized methods, evaluation of competing uses and conflicting goals, certification systems, socio-economic aspects, acceptance issues

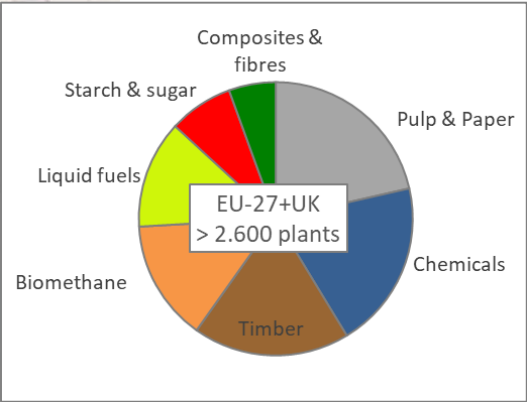
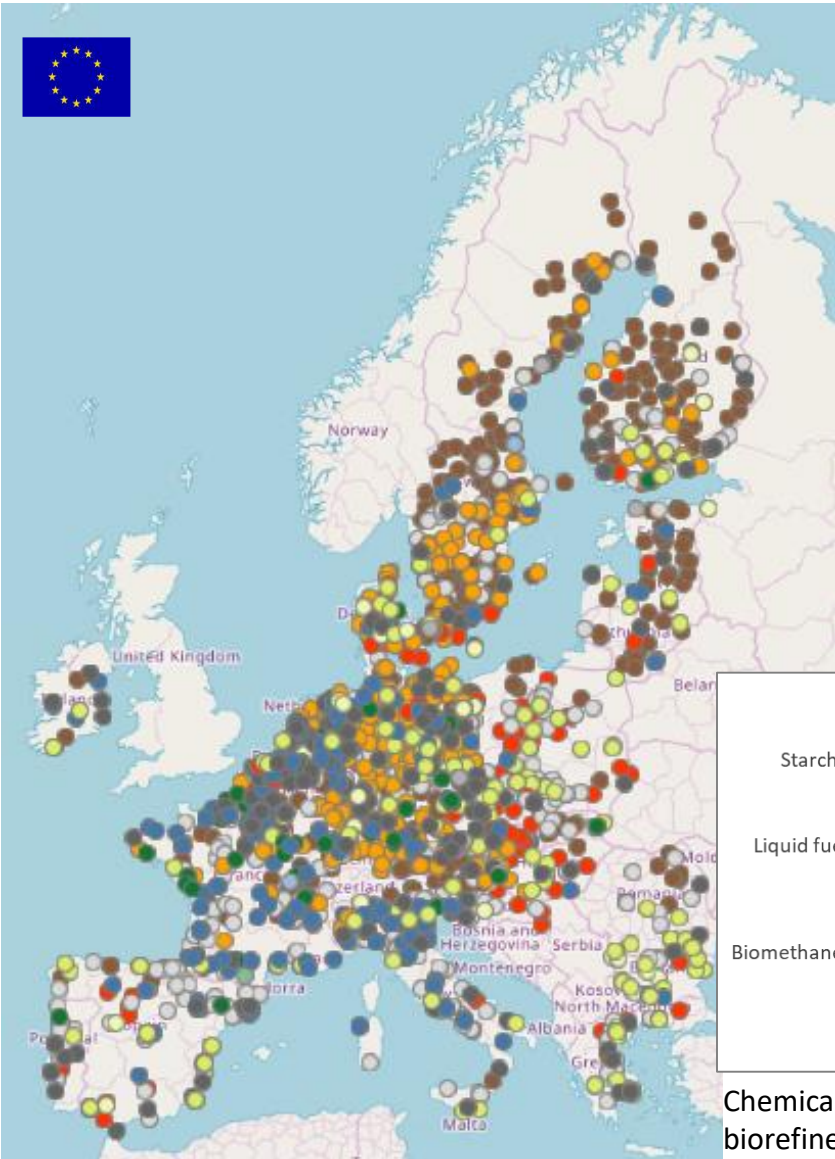


### Networking & R&D platform

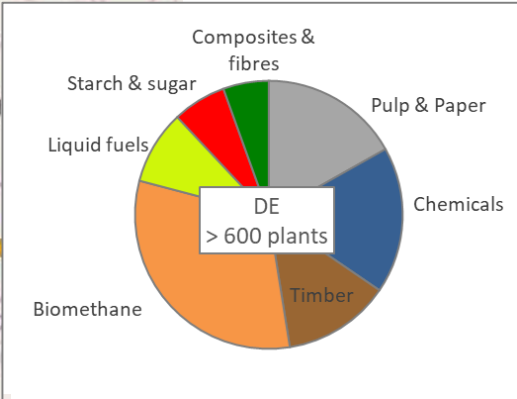
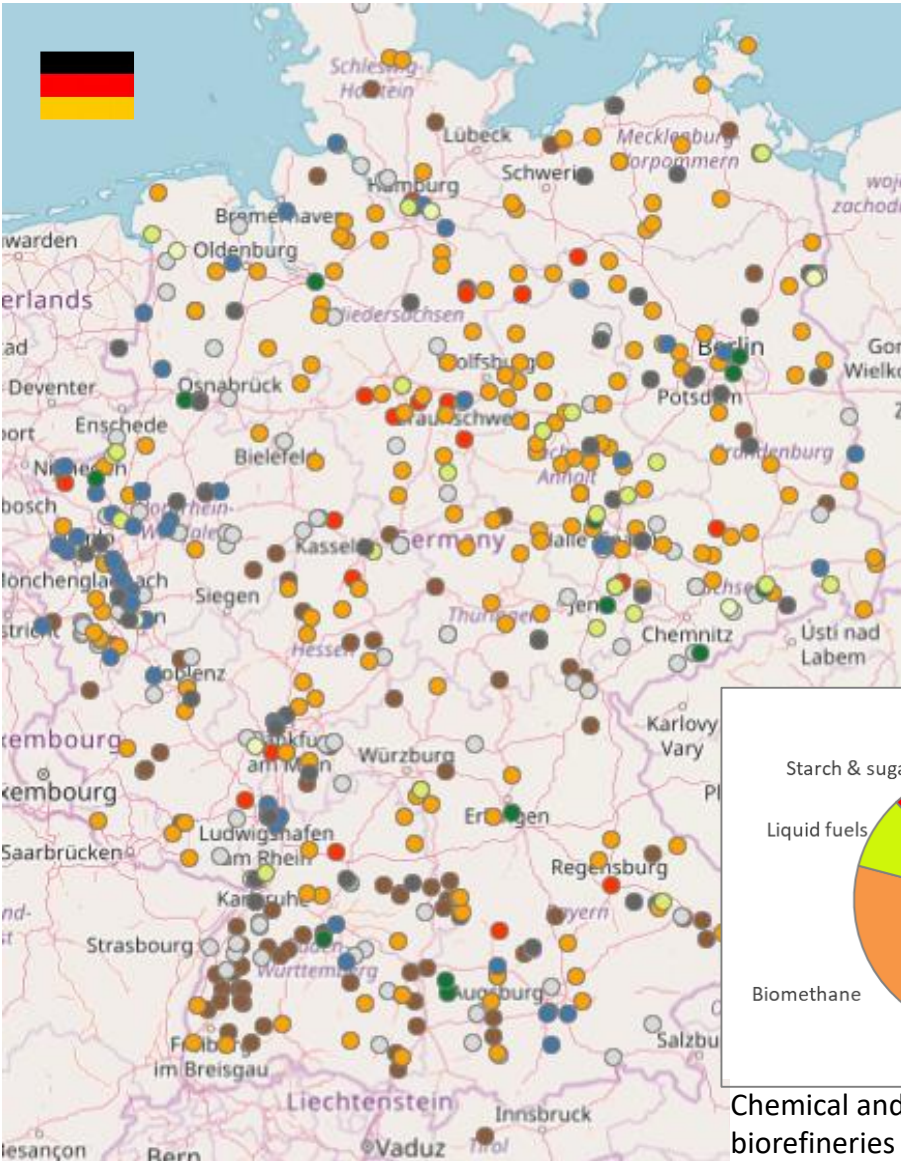
Exchange of experience, bundling of R&D results, securing a pioneering role in the bioeconomy and technology export, creation of an R&D platform with special consideration of the required technologies

# Biorefineries

## Status quo



Chemical and material based biorefineries about 298

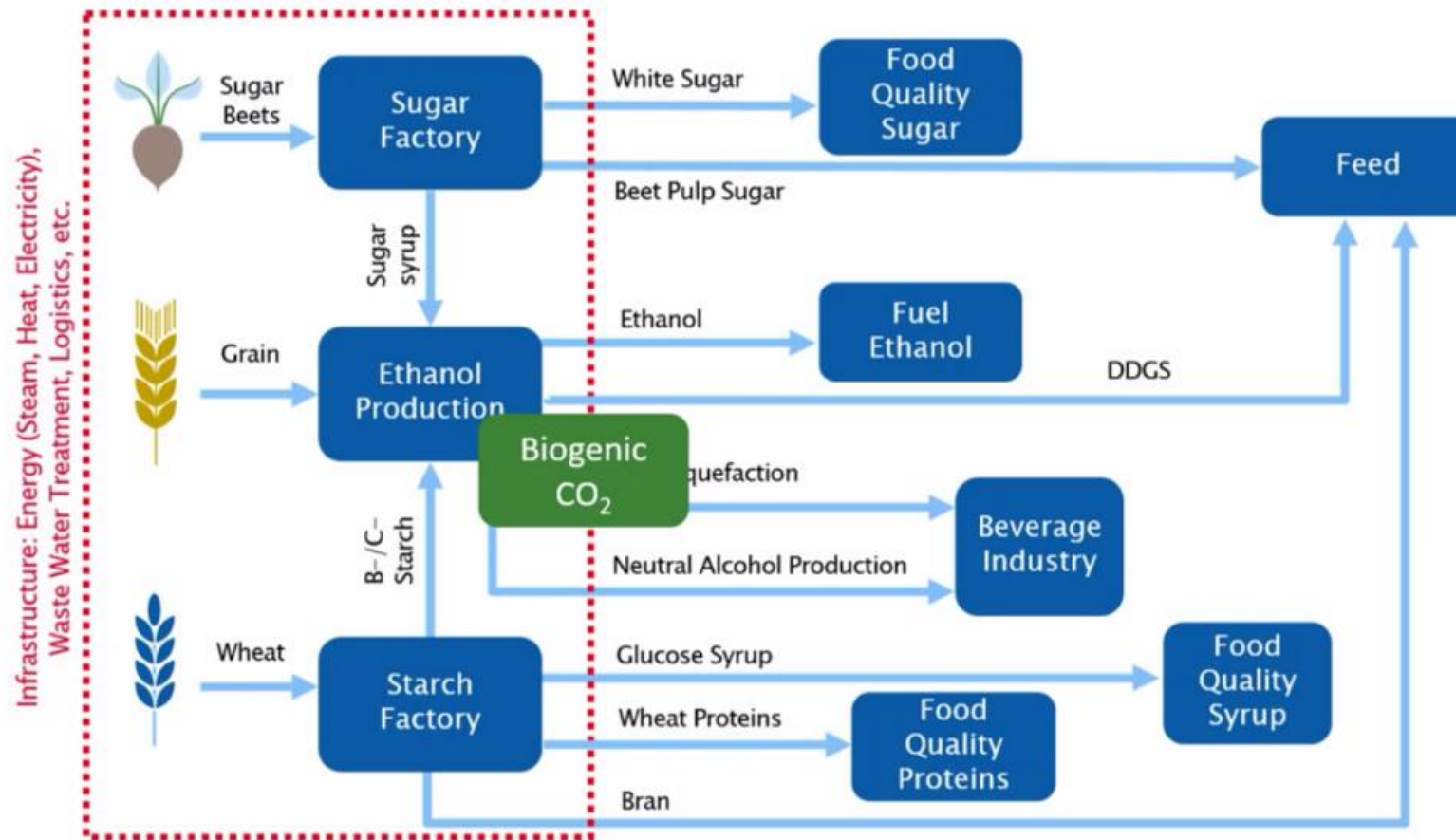


Chemical and material based biorefineries about 59

Taken and processed from Dashborad [https://datam.jrc.ec.europa.eu/datam/mashup/BIOBASED\\_INDUSTRY/index.html](https://datam.jrc.ec.europa.eu/datam/mashup/BIOBASED_INDUSTRY/index.html) (Zugriff 05/22)  
Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) [Dataset] PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>

## Example

# Sugar and starch biorefinery



Target industries: food, feed, fuel

### History

1857-2005: Sugar factory

2005: + bioethanol / DDGS

2010: + liquid CO<sub>2</sub>

2016: + wheat starch plant

2020/21: + EtOH (adv.) from starch residues



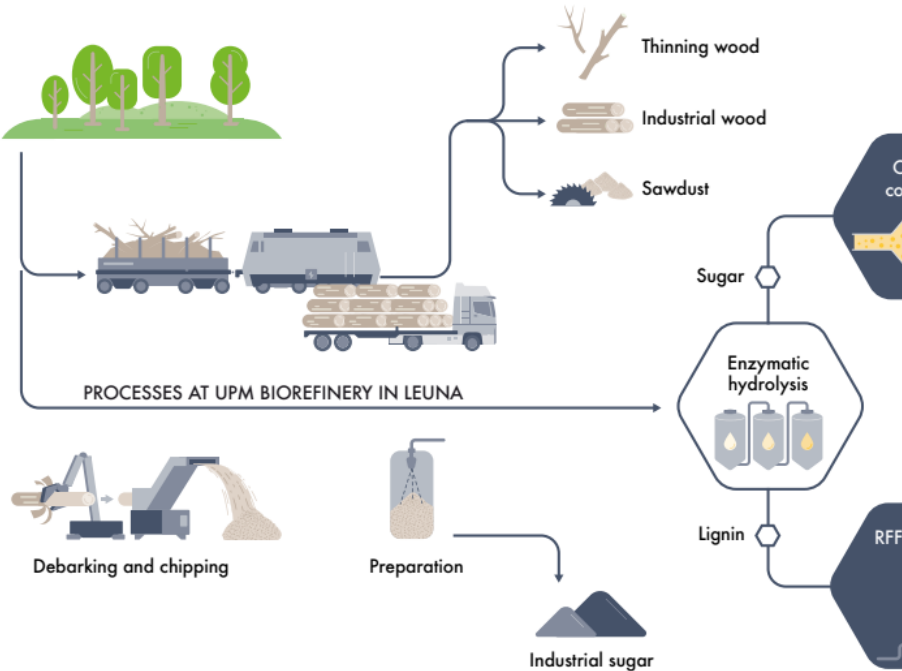
# Example

## Lignocellulose biorefinery

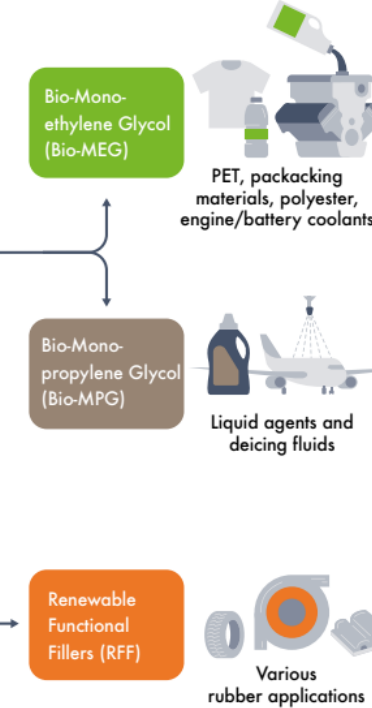


### UPM BIOREFINERY IN LEUNA VALUE CHAINS

#### SUSTAINABLE BIOMASS



#### END USES



Novel, globally unique biorefinery

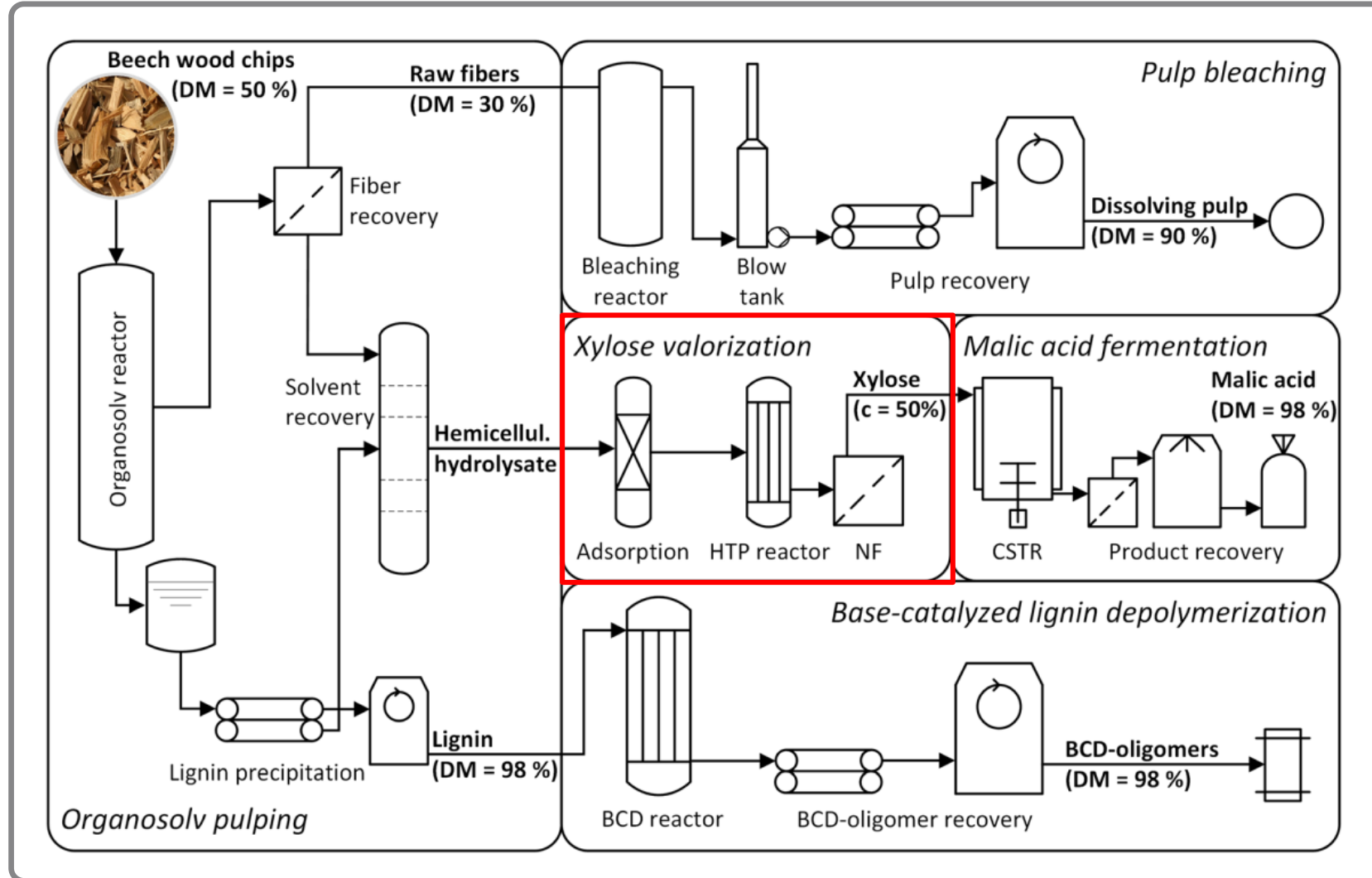
**Target industry**  
Chemical industry

**Production capacity**  
220,000 t/a

**Timeline** (as of 05/2022)  
Investment decision (750 MEUR): 2020  
Start of construction: 01/2021  
Commissioning: late 2023  
Production start: 2024

# Example

## Lignocellulosic biorefinery KomBiChem<sup>Pro</sup>



and partners

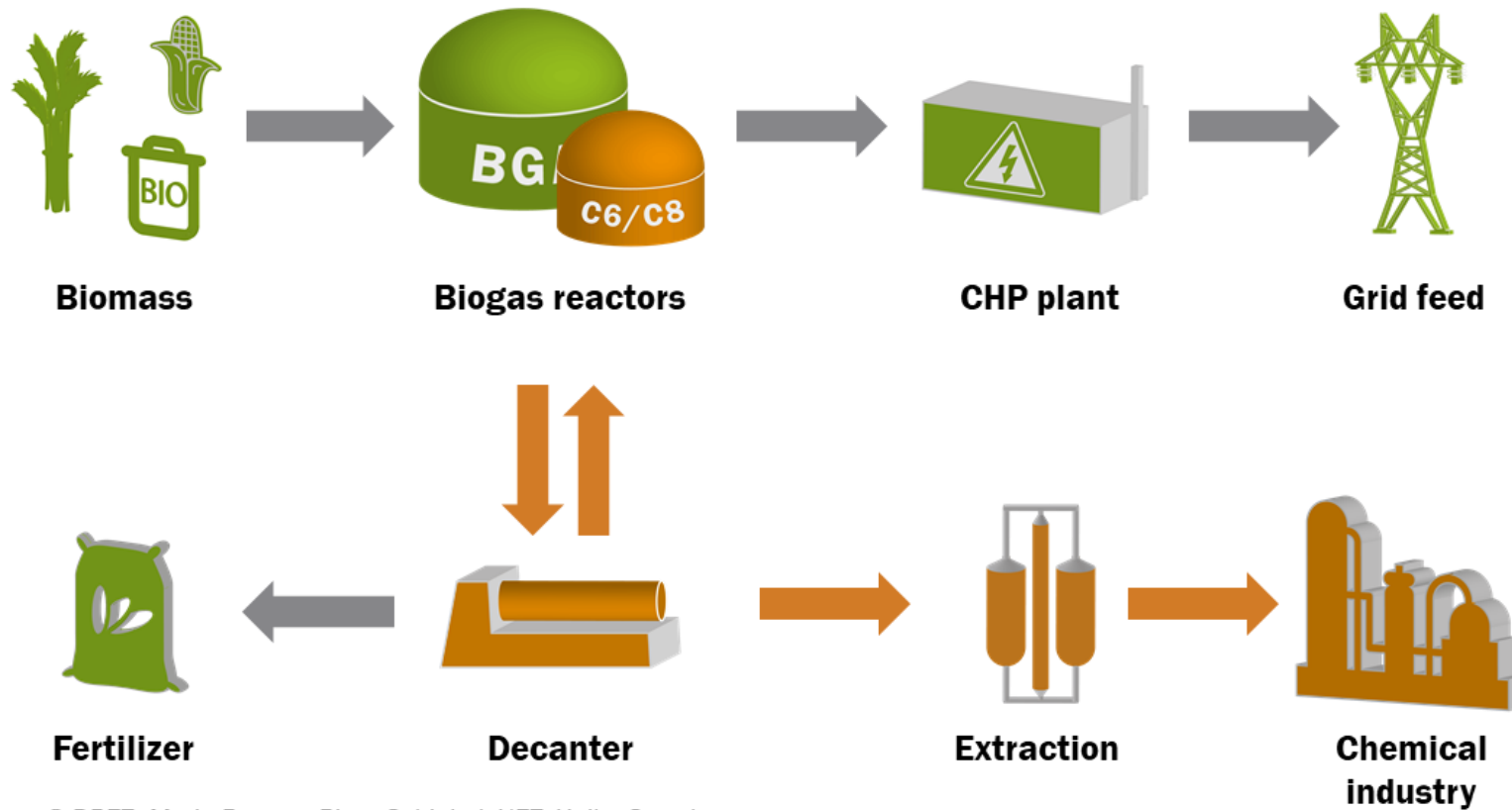
Wood biorefinery with complete utilization of the wood components

The complete process chain was demonstrated at pilot scale

Xylose utilization, M&E balance and LCA at DBFZ

Individual technologies are being further developed

## Example Biogas plants to biorefineries



© DBFZ: Maria Braune, Björn Schinkel; UFZ: Heike Sträuber



Upgrading of **existing biogas plants** to **biorefineries**

### Bio-based products

Biogas / Biomethane

**Caproic acid (C6)**

**Caprylic acid (C8)**

Fertilizer

### Involved sectors

Chemical industry

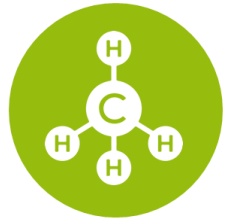
Biofuels / Renewable Energies

Agriculture



# Examples

## Biogas Hybrid Refinery



Climate-friendly,  
renewable methane as a  
fuel



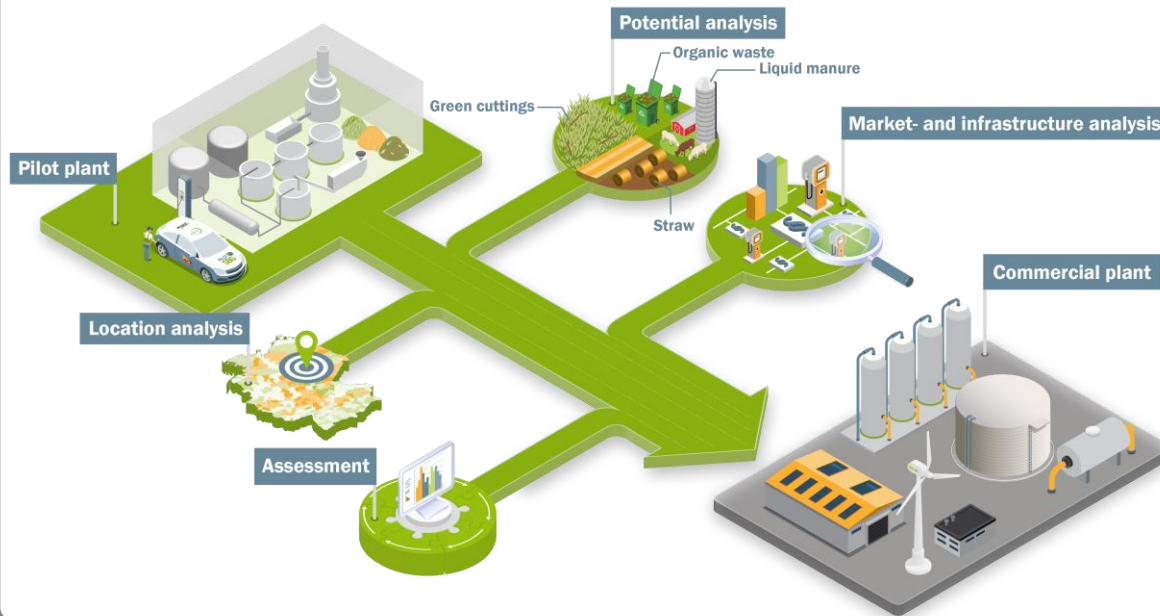
Innovative process  
concept following a  
zero waste approach



Utilization of **residues and  
waste materials** for advanced  
fuels production



Integration of electricity  
& green hydrogen



PILOT  
SBG



SynBioPTx approach

Conceptualization and  
realization of a pilot plant  
as R&D technology platform  
for advanced methane as  
fuel for the transport sector

Feasibility study for  
enhanced for further  
commercial implementation  
of the overall concept

- » GreenDeal poses major challenges for all sectors >> Educt and product diversification and the need to also implement more complex technology options
- » Highly efficient biomass processing increasingly takes place in highly integrated biorefineries
- » Numerous new, innovative biorefinery concepts are being developed, often also through iterative expansion of the product range at existing plants
- » Trend: large industrial companies take over the implementation of biorefinery concepts (usually requiring considerable planning and engineering capacities as well as investments)
- » Previously rather independent sectors are increasingly linked (agriculture and forestry, chemicals, food, P&P, fuels etc.)
- » Biomass- and electricity-based technologies with a number of previously untapped synergies (SynBioPTx) >> Higher renewable carbon (C) potential can be tapped while at the same time offering new flexibility options

## Smart Bioenergy – Innovations for a sustainable future

Department Biorefineries

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**Green Deal &  
beyond - Der Beitrag  
biomassebasierter  
Forschung und  
Innovationen**

**21.-23.06.2022**

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