



ICEBE
IMAGINEERING
NATURE



**BIO
REFINERY**
@ICEBE

Entwicklung von Bioraffinerien mit Fokus auf stofflicher Nutzung von Lignin

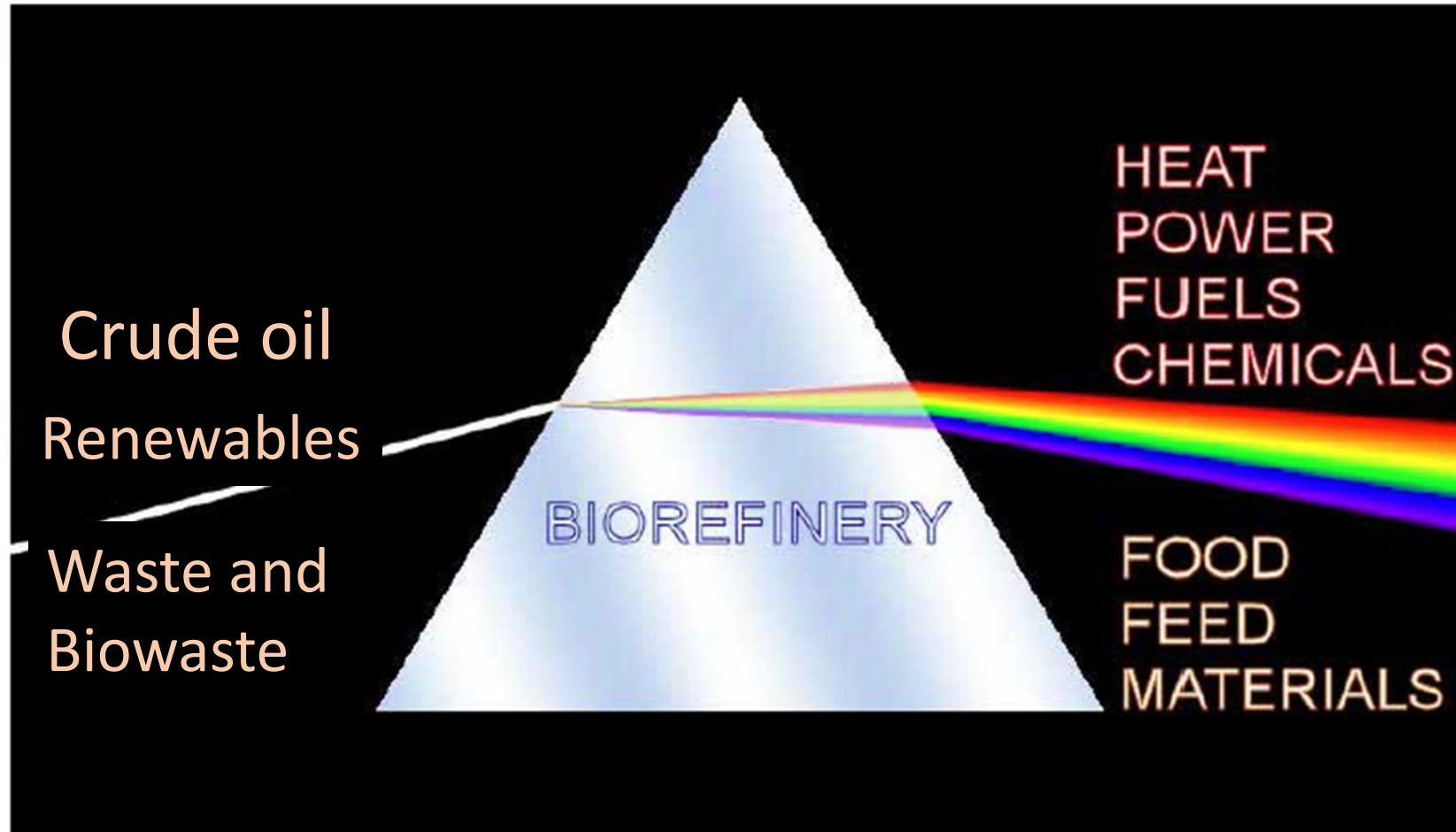
WKO – Wirtschaftskammer Österreich;
Wiedner Hauptstraße 63, 1045 Vienna

Anton Friedl & Martin Miltner

Inspired by nature – Imagineering nature Industry 5.0™

14.12.2020

From classical refinery to bio-refinery



Ref. adapted from: De Jong, E. & Jungmeier, G. 2015. Chapter 1 – Biorefinery Concepts in Comparison to Petrochemical Refineries

EC Roadmap for the Chemical Industry in Europe towards a Bioeconomy 2019

EC Research Agenda – Horizon Europe Programme
European Partnership for a circular bio-based Europe

Bioökonomie - Eine Strategie für Österreich 2019

Bundesministerium für Nachhaltigkeit und Tourismus (www.bmnt.gv.at)

Bundesministerium für Bildung, Wissenschaft und Forschung (bmbwf.gv.at)

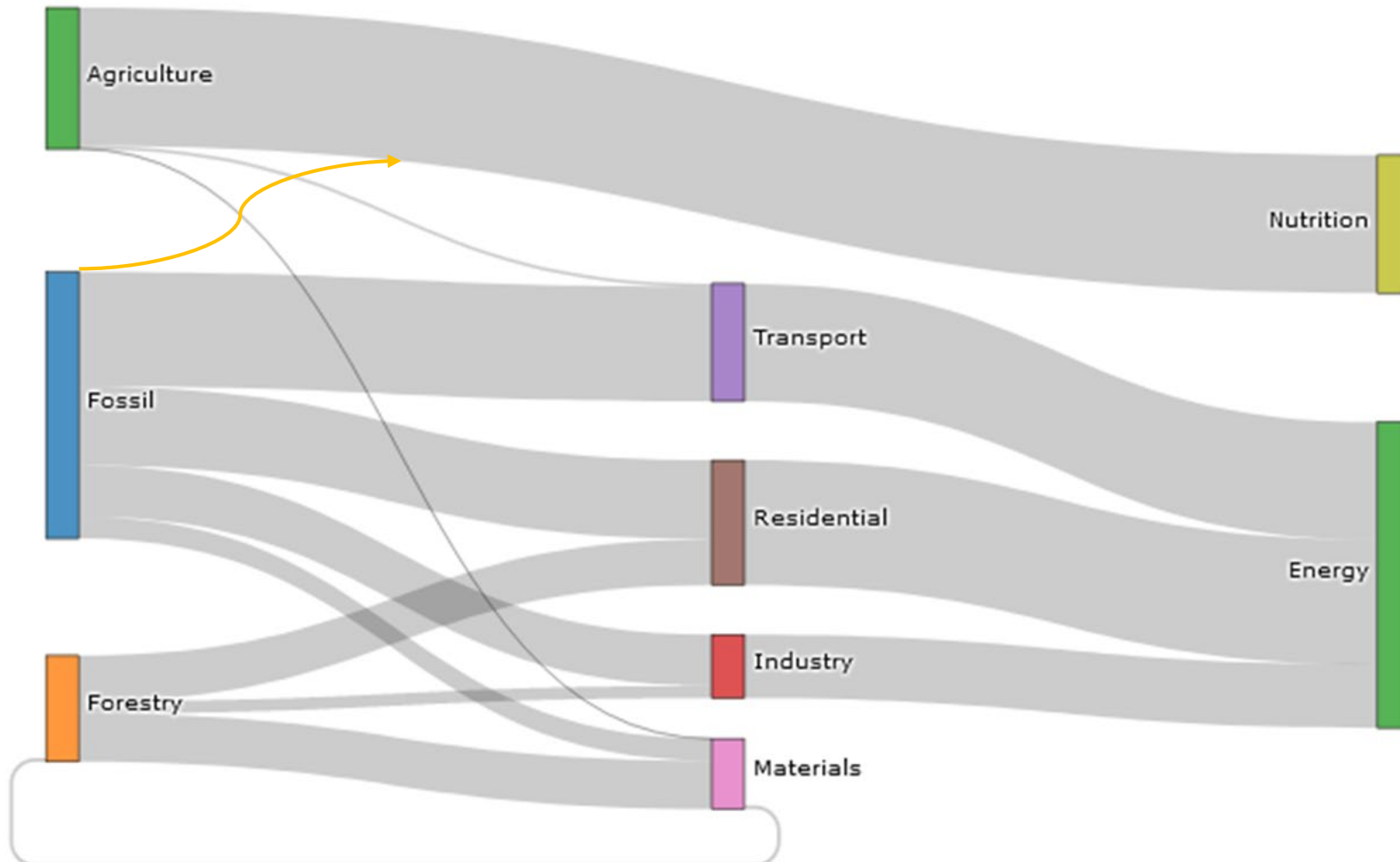
Bundesministerium für Verkehr, Innovation und Technologie (www.bmvit.gv.at)

Bioraffinerien und Kreislaufwirtschaft – today

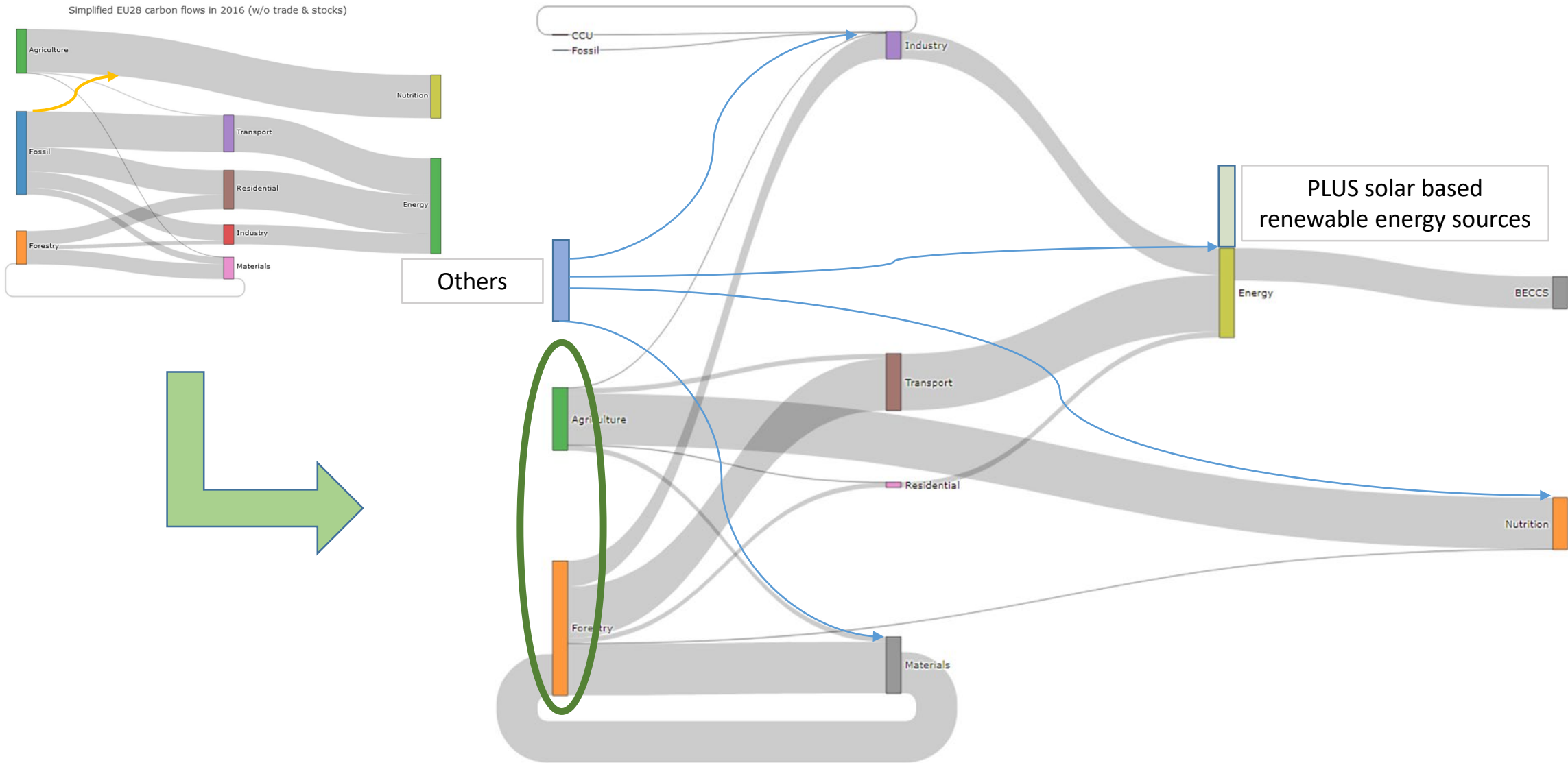
Ausschreibung „KEM Bioökonomie/Kreislaufwirtschaft“ - 15.2.2021

Carbon management

Simplified EU28 carbon flows in 2016 (w/o trade & stocks)



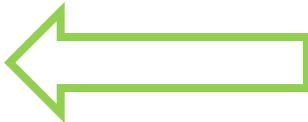


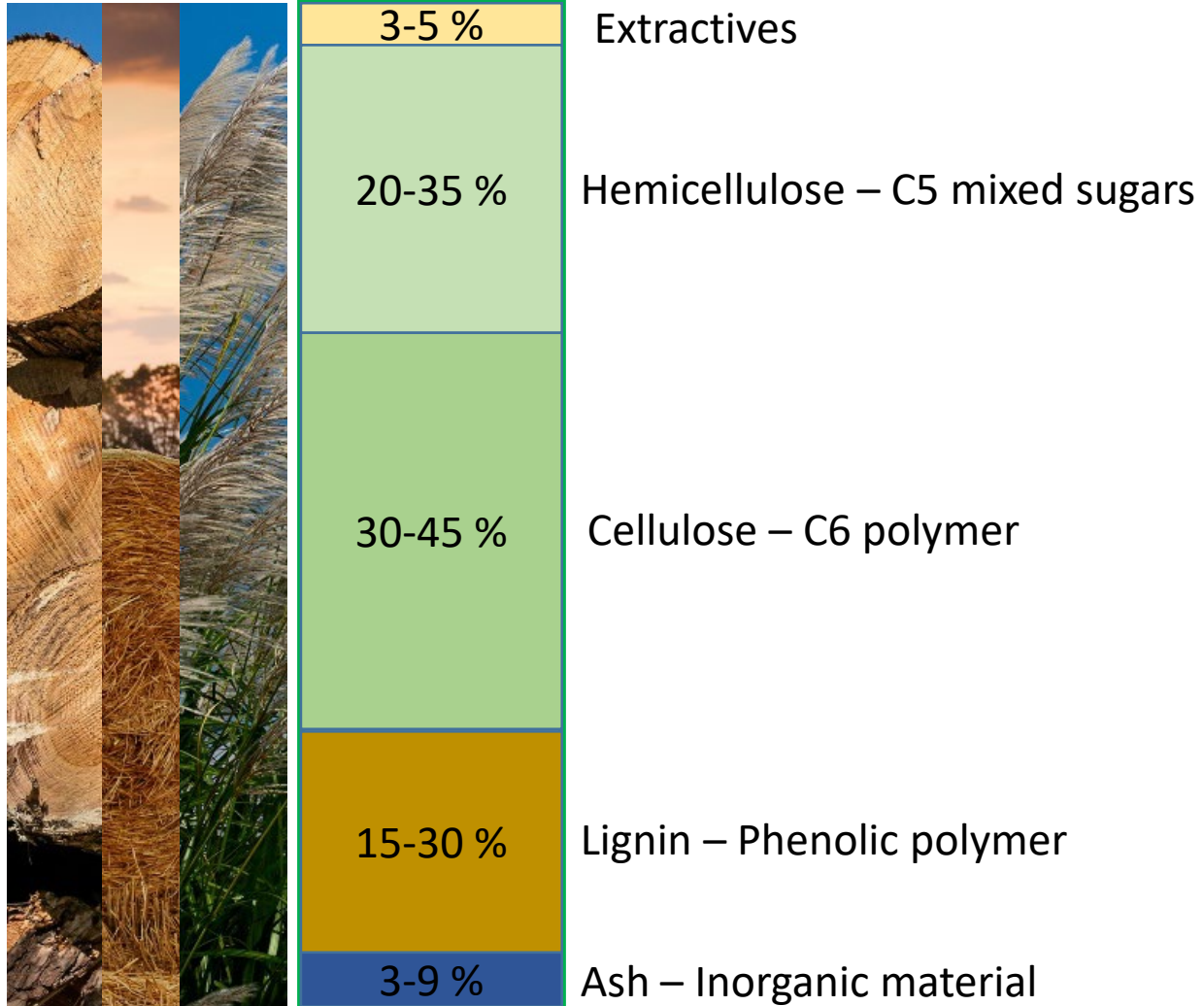
Biogenic carbon management



- Cellulose: Polymer von β -(1-4)-Glucose (C6)
- Hemicellulose: Polymer of various C5 and C6 sugars
- Lignin: Phenolic Polymer
- Acetic acid
- Extractives / Secondary plant compounds
- Ash (inorganic nutrients)



- Mechanical treatment (mechanical pulping)
- Chemical pretreatment (chemical pulping)
 - Sulfite (SPORL)- or Sulfate (Kraft)- cooking
 - Organosolv (Ethanol / Water mixtures)  **TU Wien approach**
- Biochemical conversion  **TU Wien approach**
- Thermochemical conversion  **TU Wien approach**



■ Goal of pretreatment

- Mobilisation of components

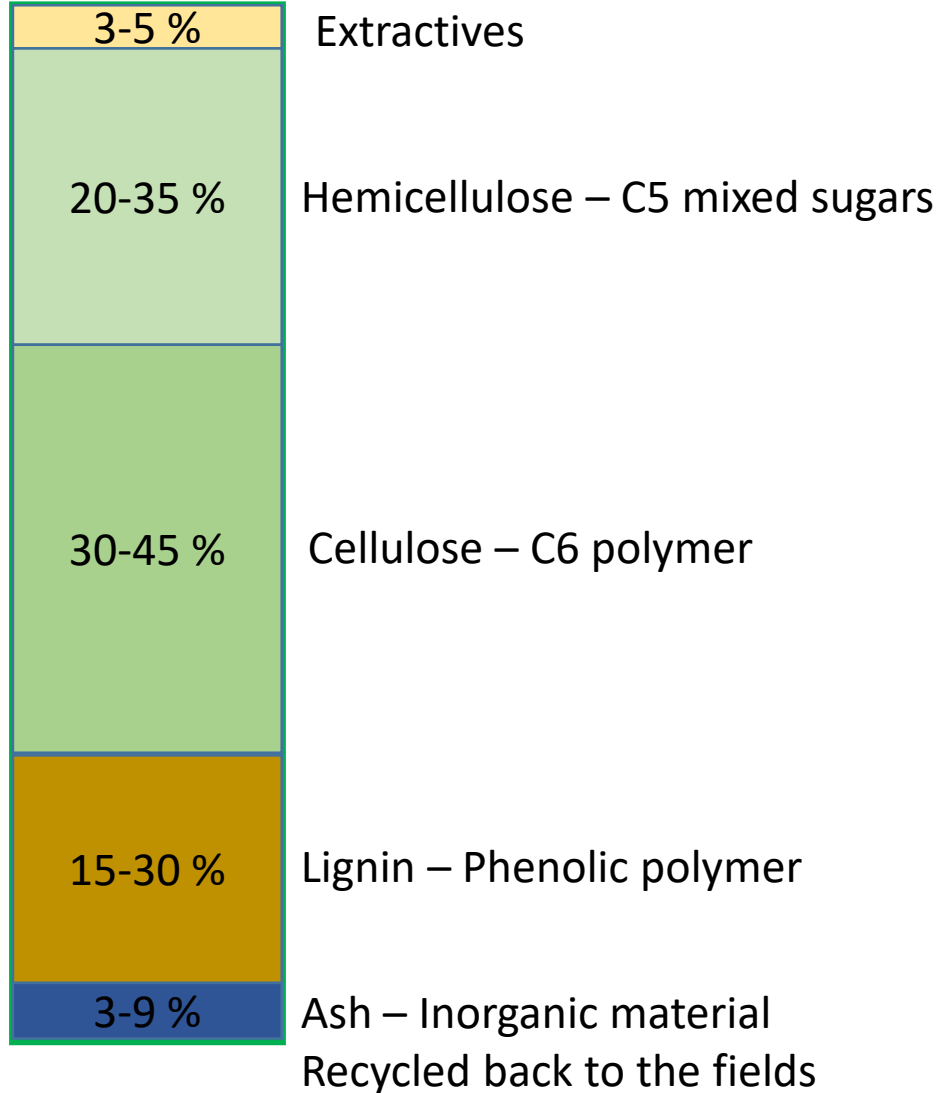
■ Steps

- Extractives
- Hydrolysis of hemicellulose
- Dissolution of lignin
- Cellulose kept in good quality

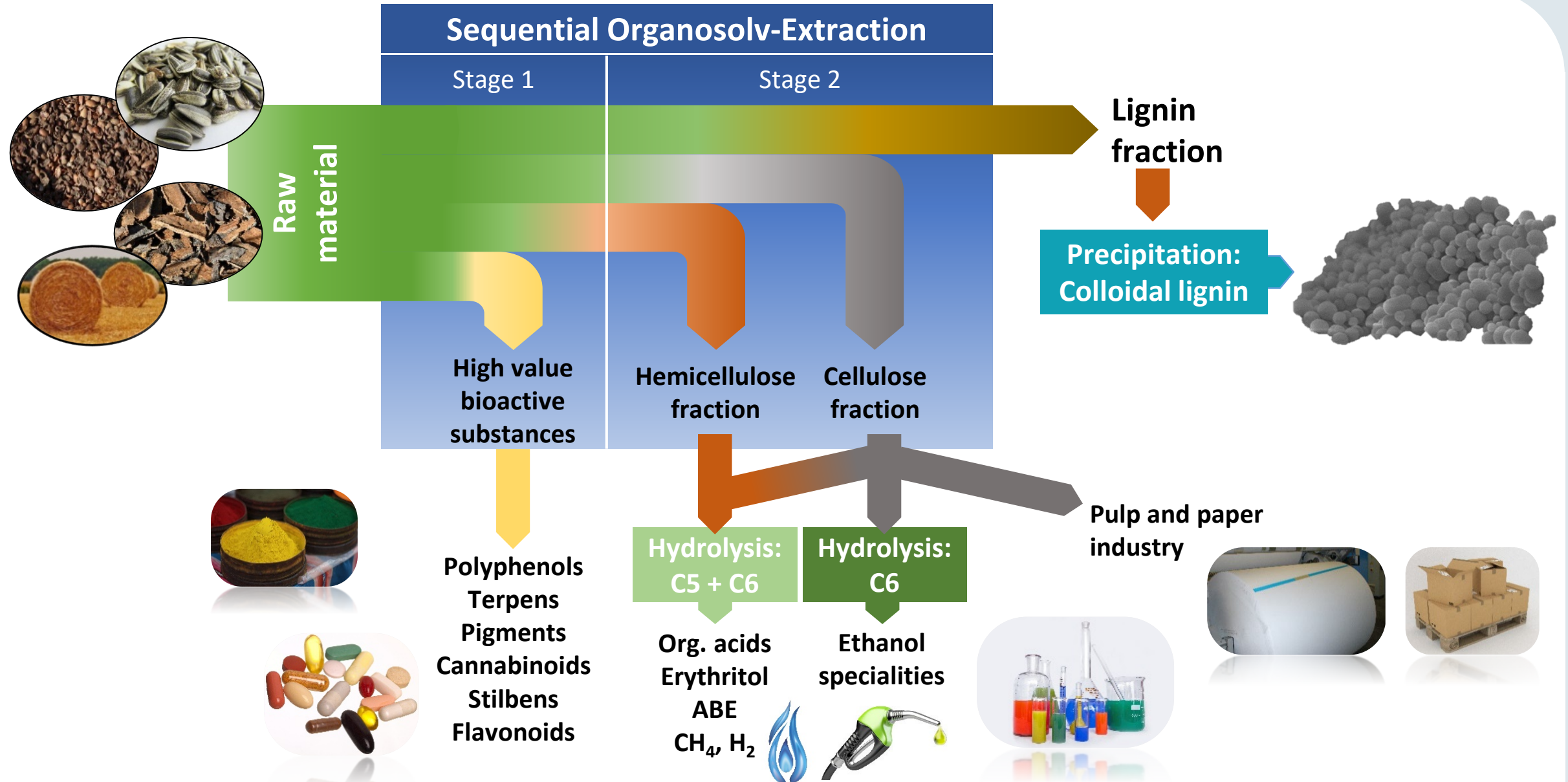
■ Targets

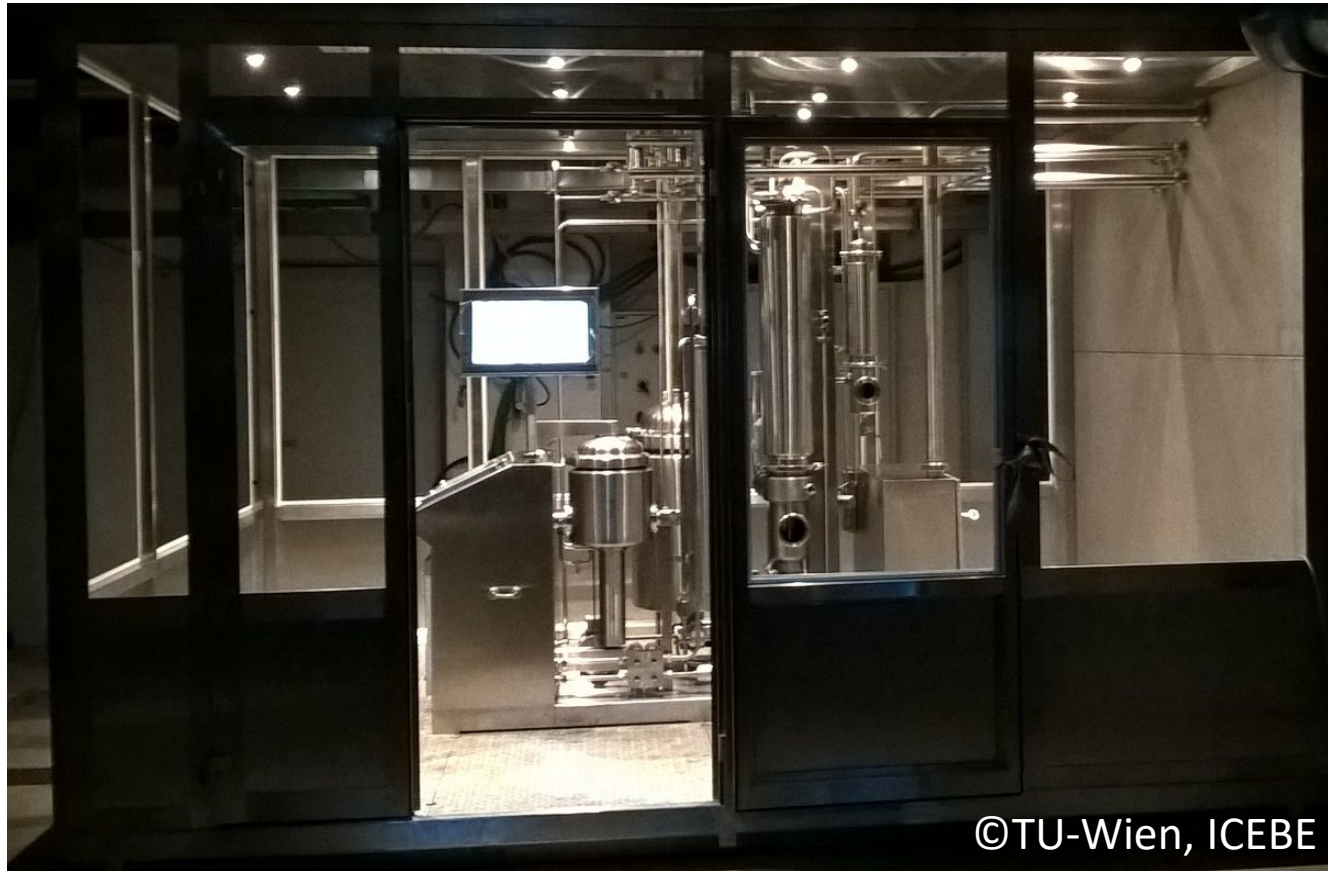
- High quality products
- 100% valorisation
- Low energy demand
- Low investment and running costs

Lignocellulose Biorefinery



- Existing Market – e.g. Tall oil
- Fermentation
e.g. Products or Energy
- Market development for special
Fibers
- **Lignin Products for Cosmetics and
others**
Feedstock (approx. 100 €/t)
Lignin product 15 -100 €/kg
**Revenue min. 1500 €/t of Feedstock
plus revenues from other fractions**

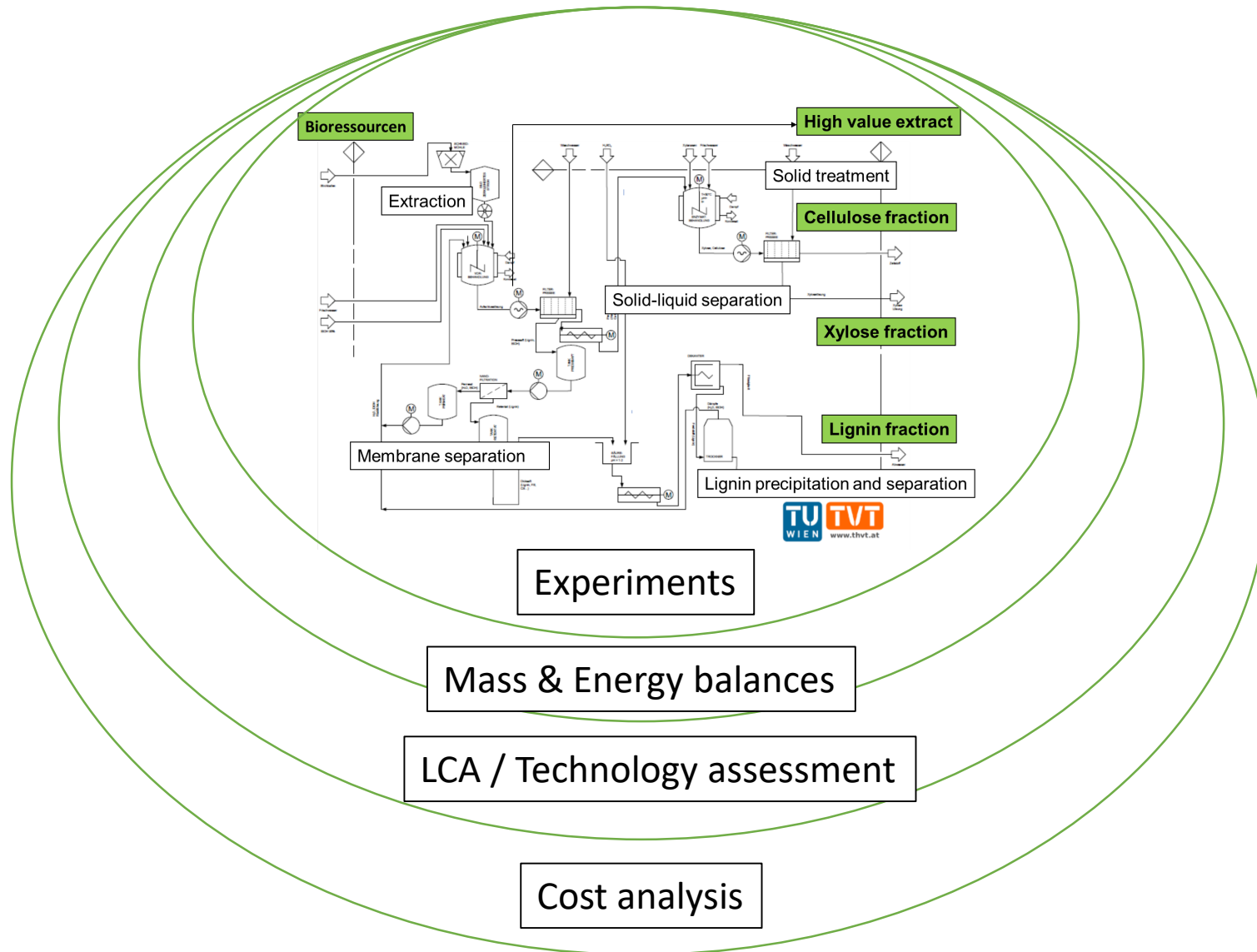




Ref.: custom-built by **Samtech Extraktionstechnik GmbH** - <https://samtech.at/de/>

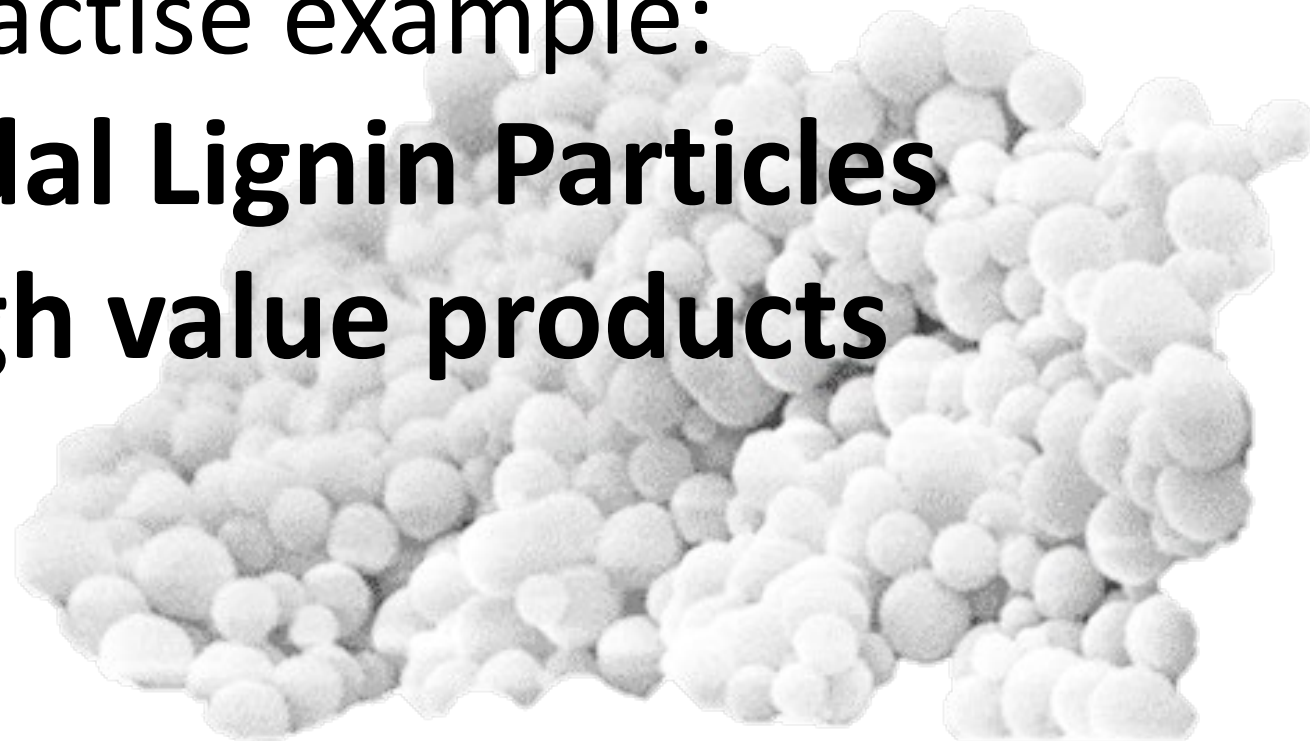
- Extractor Volume 10 Liter
- 250 °C / 30 bar

Biorefinery @ TU Wien approach

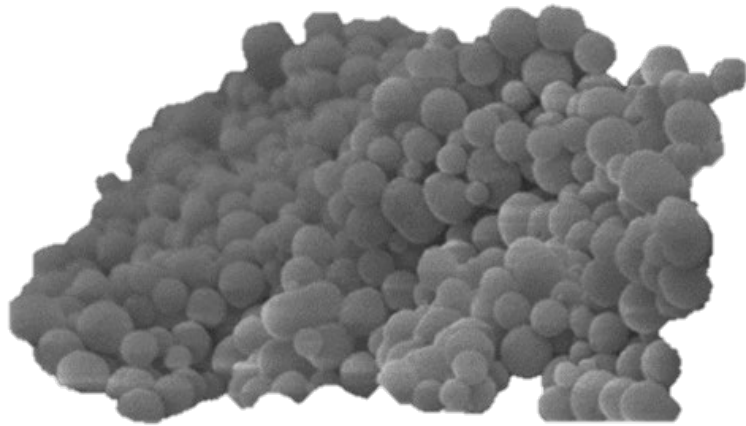


Practise example:

Colloidal Lignin Particles as high value products



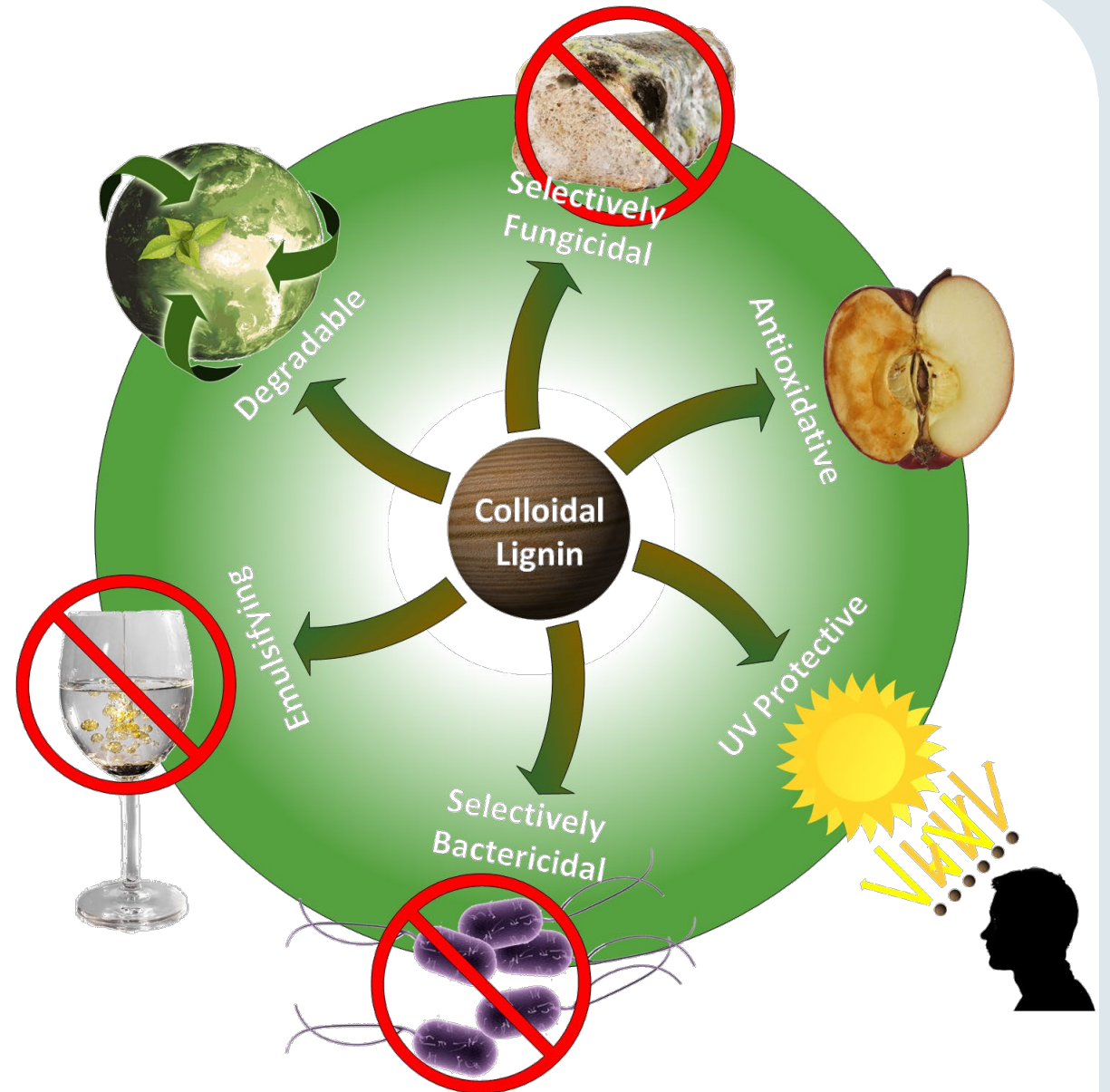
Characteristics of (colloidal) lignin



- Highly increased surface area
- Intensified natural properties of lignin
- Improved dispersibility



Improved Applicability

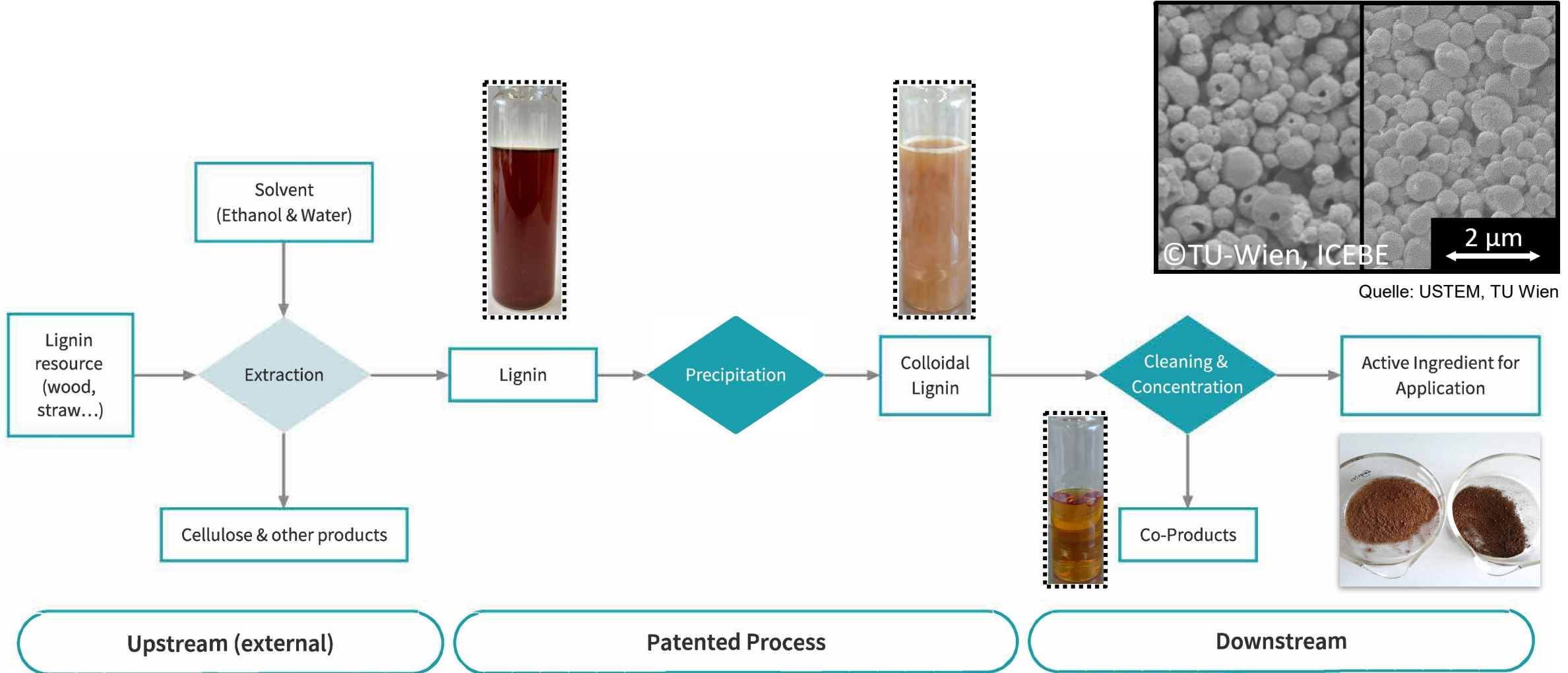




- **Emulsifier in diverse applications**
- **UV-Absorber in cosmetics, paints, wood coatings, functional textiles etc.**
- **Antioxidant in cosmetics, food packing, food supplements etc.**
- **Pharmacological effects, drug carrier systems**

Added value

Value creation process for Colloidal lignin



Market volume in billion USD:

1.1

UV-Blockers (all applications)

3.3

Antioxidants (all applications)

4.7

Preservatives (cosmetics, food, wood)

6.6

Emulsifiers (all applications)

Typical market prizes:

Emulsifiers (Oleates, Glycerides, Sorbates)

10 – 15 €/kg

Inorganic UV filters (ZnO, TiO₂)

25 – 100 €/kg

Organic UV absorbers (Benzophenone, Oxybenzene)

20 – 100€/kg

- 100% funding by BMBWF via FFG, + training, networking...
 - Host TU-Wien: Prof. Anton Friedl
- Project start November 2019, duration 18 months
- Topics:
 - Scale-up of colloidal lignin production to pilot scale
 - Development of end user products containing colloidal lignin:
 - Sunscreen
 - Paints, coatings and wood preservative
 - Assessment of certification and accreditation efforts & timeline
 - Business development and preparation of company foundation





LIGNOVATIONS

Company to be founded mid 2021

Commercial production ramp-up (100t/a) in 2023



Martin Miltner



Angela Miltner



Stefan Beist



Stephan Jung



Production of Colloidal Lignin

- Starting with bought raw lignin
- In future also starting with biomass and own extraction



Development of tailor made Colloidal Lignin for Customers

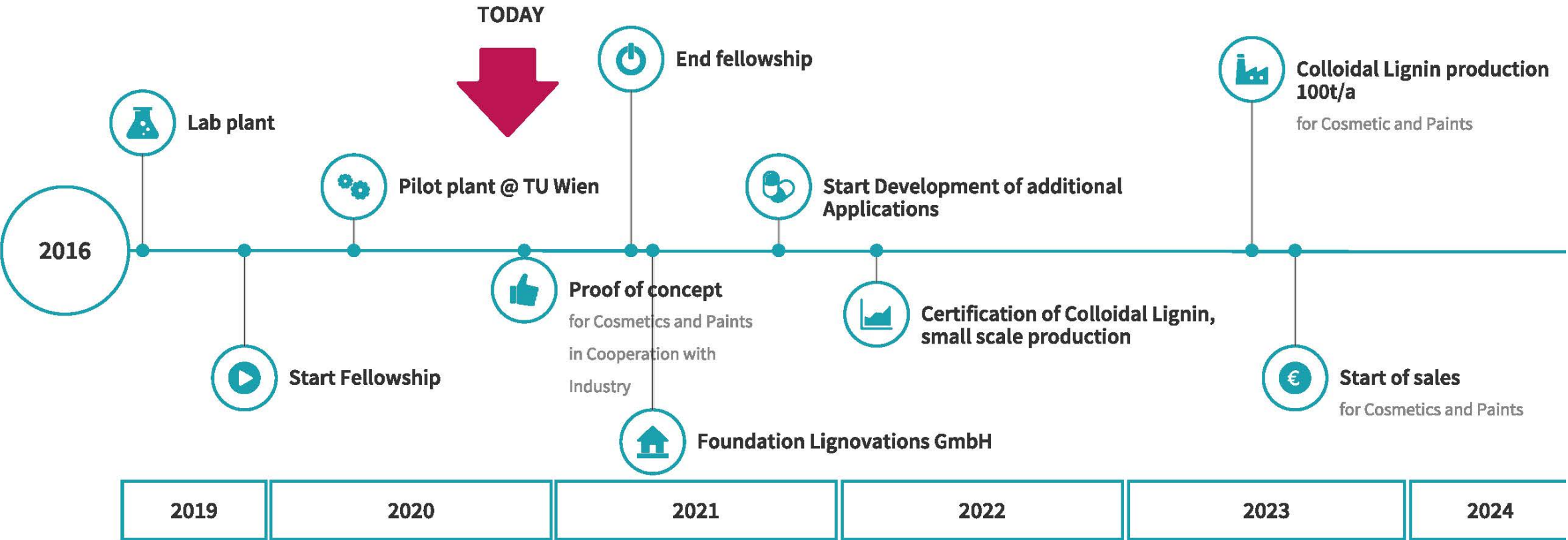


Licensing and Engineering Services



Analytical Services and Quality Control

LIGNOVATIONS - Timeline to market





Biorefineries need at least one high value product

- Lignin will be one of them!
- Extractives have also a market
- Cellulose – fibers
- Hemicellulose (mixed sugar fermentations – e.g. Erythritol and/or energy)
- Energy production from by-products to be at least energy self-sufficient



Biorefineries need to valorize the whole feedstock with closed cycles of process water and chemicals – environmental friendly production



Investigation of technological, environmental and social impact

Thank you very much for your attention!



Ref.: custom-built by **Samtech Extraktionstechnik GmbH** - <https://samtech.at/de/>