SMIBIO

Biorrefinerías verdes en Europa

Green biorefineries in Europe

3er Taller SMIBIO
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WIP Renewable Energies

The SMIBIO project is implemented in the framework of ERANet-LAC, a Network of the European Union (EU), Latin America and the Caribbean Countries (CELAC) co-funded by the European Commission within the 7th Framework Programme for Research and technology Development (FP7).

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Biorefineries - definition

Definition :

Biorefining is the sustainable processing of biomass into a spectrum of marketable Biobased Products and Bioenergy.

Biobased Products: chemicals & materials, but also human food & animal feed

Bioenergy: fuels, power and/or heat

In general both Energy-driven and Product-driven Biorefineries can be distinguished.

Product-driven Biorefineries

The main goal of PdBs is the production of one of more Biobased Products – chemicals, materials, food and/or feed – from biomass. Process residues are used for the production of Bioenergy for internal/external use to maximise the economic profitability of the full biomass-to-products chain.

IEA Bioenergy Task 42

Green biorefineries – a definition

“Green biorefineries (GBR) are seen as integrated technologies and technology systems for production of materials and energy processing of green plants and part of green plants.”

The potential of this feedstock is considered to being large, as green plants are an almost inexhaustible raw material source and available worldwide.

Kamm et al. (ed.), 2010: 253.

Green biorefineries - basic processes

Primary refinary

- (Silage production)
- Wet fractionation technology (isolate substances in native form)
- Separation by mechanical pressing into:
  - fibre-rich press cake
  - nutrient-rich press juice

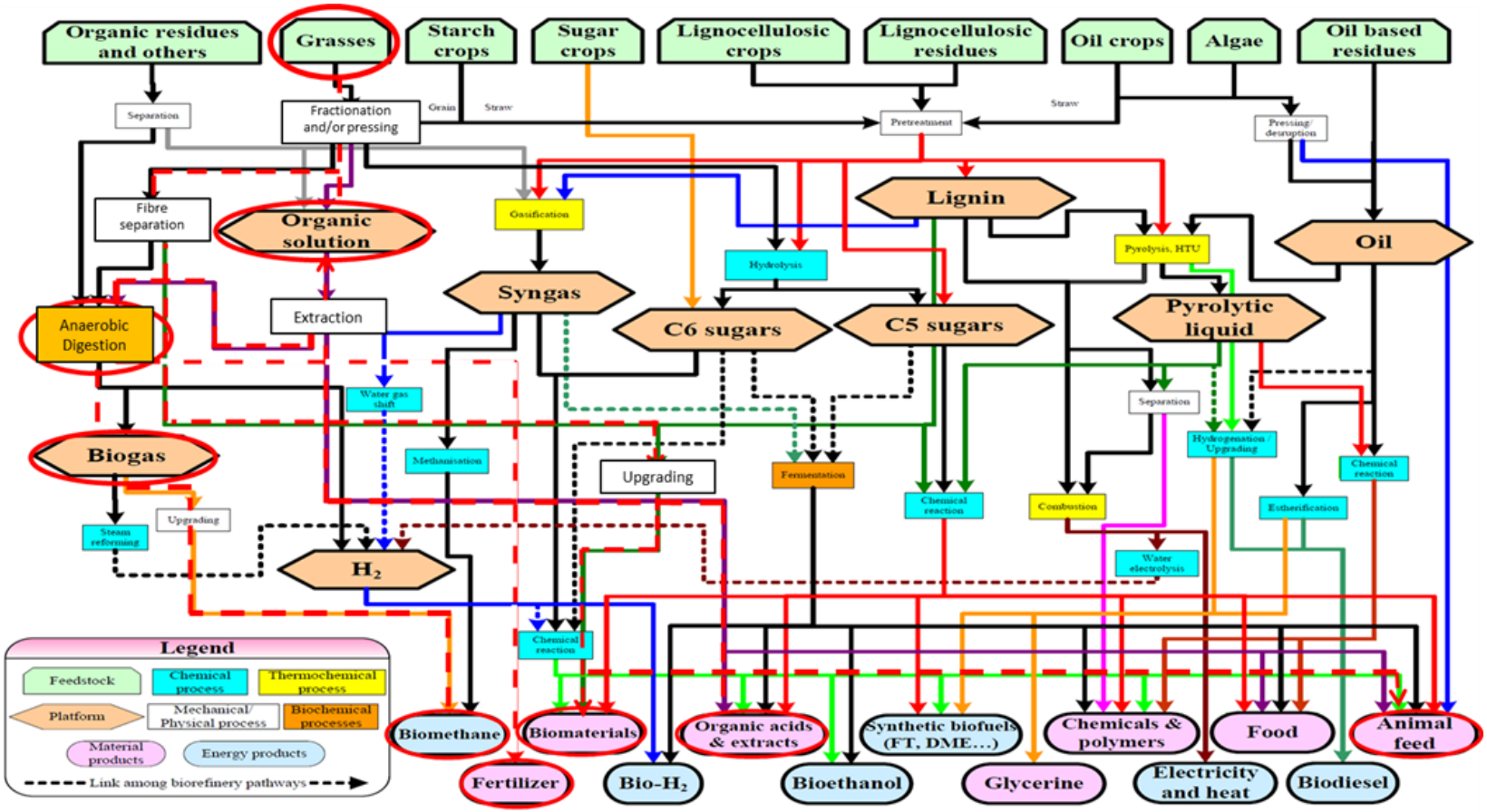
Secondary refinary

Press juice and press cake > further processing

- press juice:
  - direct use in a biogas plant
  - fractionation of component substances (e. g. lactic acid, amino acids, proteins) by separation technologies
- press cake:
  - directly processed into animal feed
  - raw material for fibre-based products (insulation materials, fibres for bio-composites)
  - co-substrate in biogas plant
- GBR is typically coupled with biogas plant > recovery of residual parts (from press cake, press juice or fibre processing)

Kamm et al. (ed.), 2010: 269-281.

Biorefinery classification



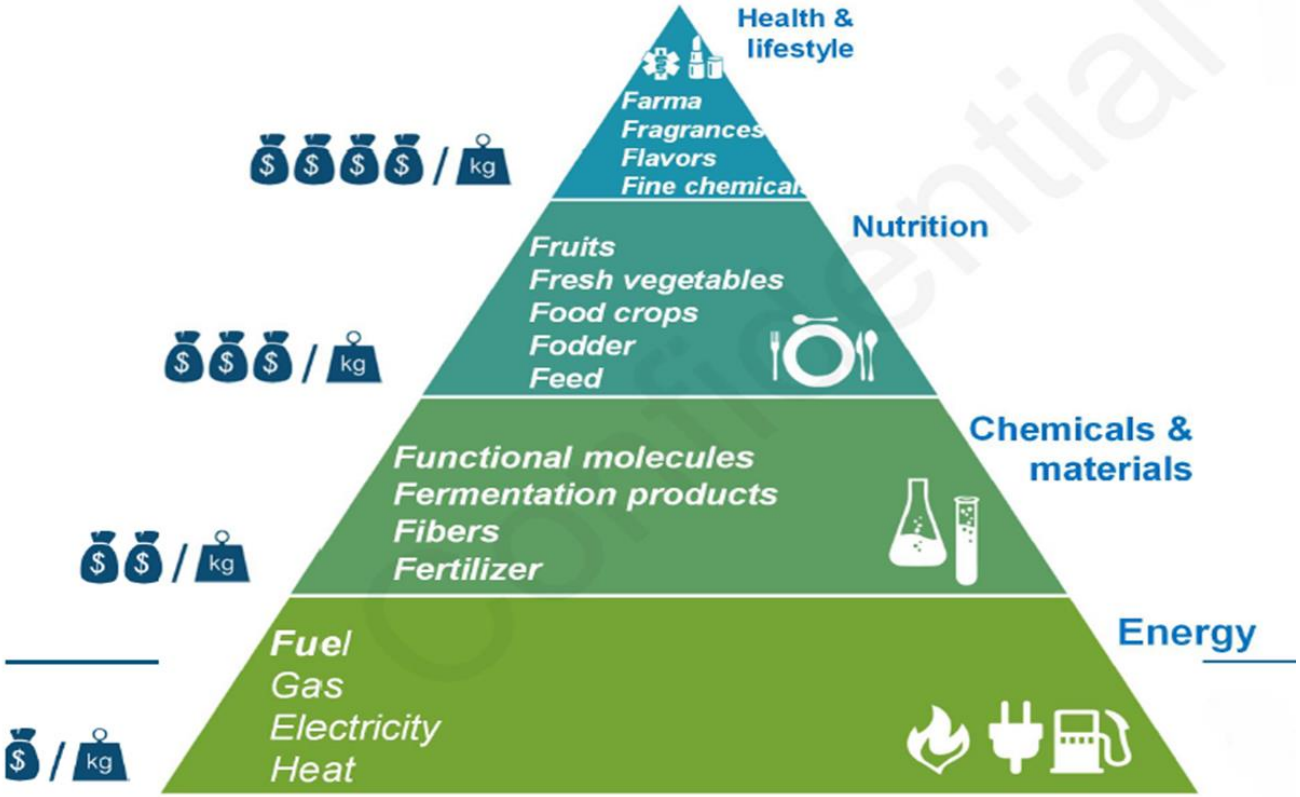
IEA Bioenergy Task 42 biorefinery classification system (IEA Bioenergy, 2014: 4)

Grass - what‘s in it?

- Grass consists mainly of water.
- ca. 10-20% of the grass is dry matter (DM), with a yearly average of 16.3% DM
- DM mainly consists of protein, amino acids, carbohydrates, minerals and fats [g/kg DM]
- the average crude protein content is 23% of the dry matter.
- most abundant protein is called ribulose-1,5-bisphosphate carboxylase oxygenase, or simply Rubisco
- presence of polyphenol oxidase (PPO) and proteases in grass (enzymes that break down other proteins)
- essential that after cutting, the grass is either processed rapidly or preserved well enough to prevent degradation
- largest component of DM of grass is the fibre fraction. It includes cellulose, hemicellulose and lignin molecules
- annual production of 10.4 t DM per hectare (Europe, the Netherlands)

Source: Paping et al. 2014

Value pyramid



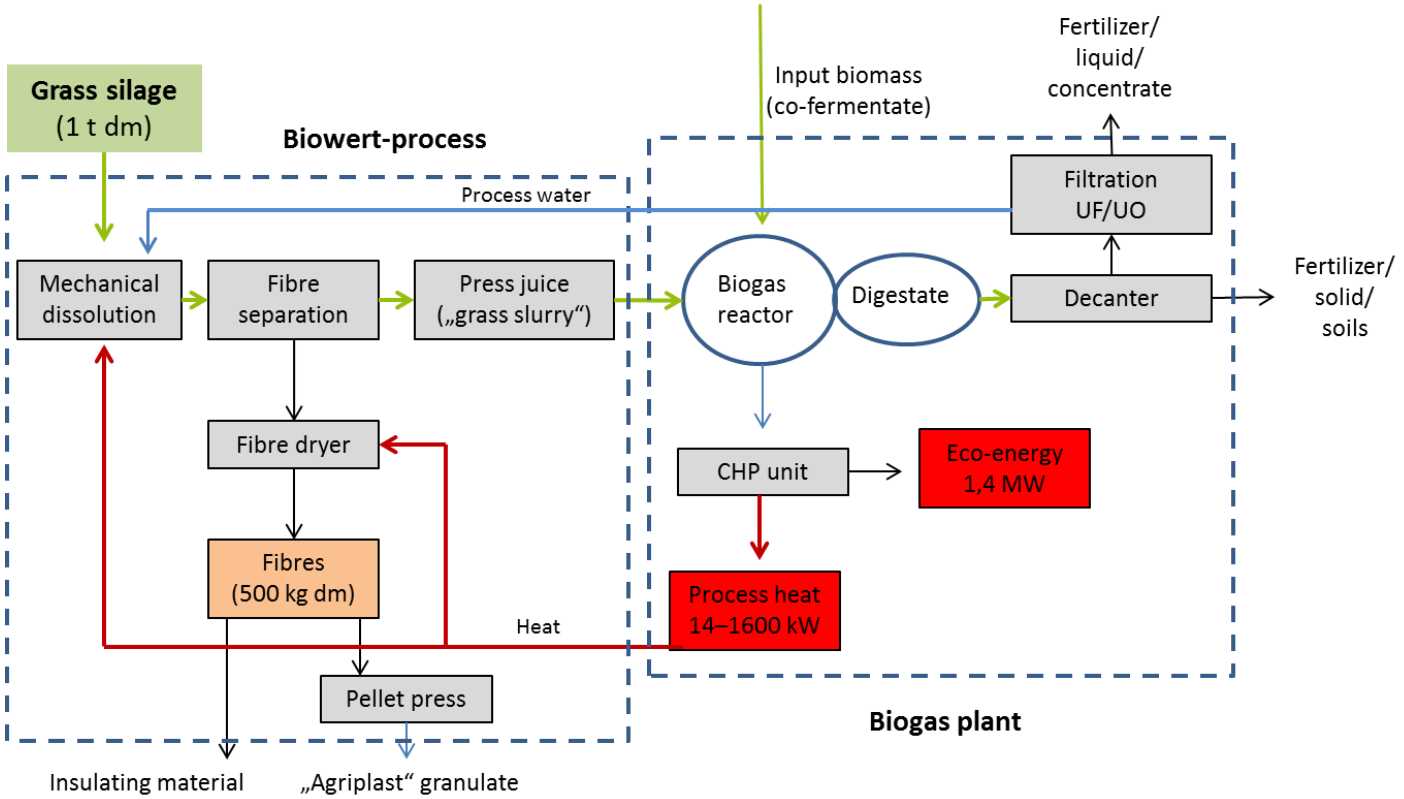
General information - GBR in Europe

- All GBR but the Biowert GBR are relatively new
- Viability of new concepts need to be proven first
- Keypoints:
  - Feedstock availability (amounts, logistics)
  - Instant use vs. Conservation
  - Control of decomposition processes

Biowert

GBR Biowert
Location: Brensbach, Germany (18,000 m² large)
Founded: 2007
Feedstock: silage grass (grass is provided by contracted farmers nearby)
Capacity: 5,000 t dm /a (20,000 t grass per year)
Investment costs: 13 million Euro

Biowert – the process



Biowert –the products

Products:

Biocomposites (Agriplast) – 75% grass fibres, 25% recycled plastics

Insulating materials

Fertilizers

AD input

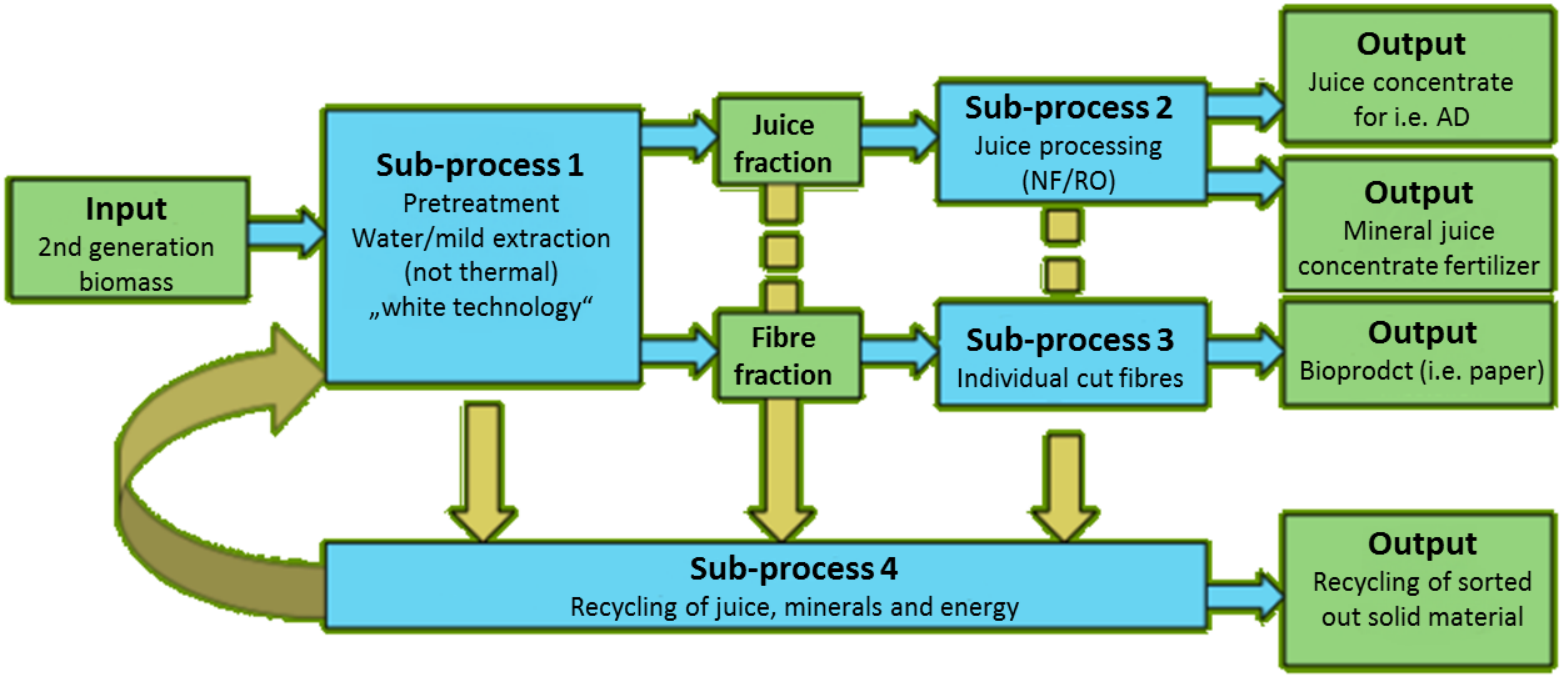




NewFoss

GBR NewFoss
Location: Uden, the Netherlands
Founded: 2016
Feedstock: silage grass (grass is provided by Staatsbosbeheer)
Capacity: 10,000 t dm /a (40,000 t grass per year)
Investment costs: n.a.

NewFoss – the process



NF = nanofiltration / RO = reverse osmose

Huthamaki egg boxes & Co.

Egg boxes

Grass paper

Lactic acid, amino acids, sugars etc.

NewFoss – the products

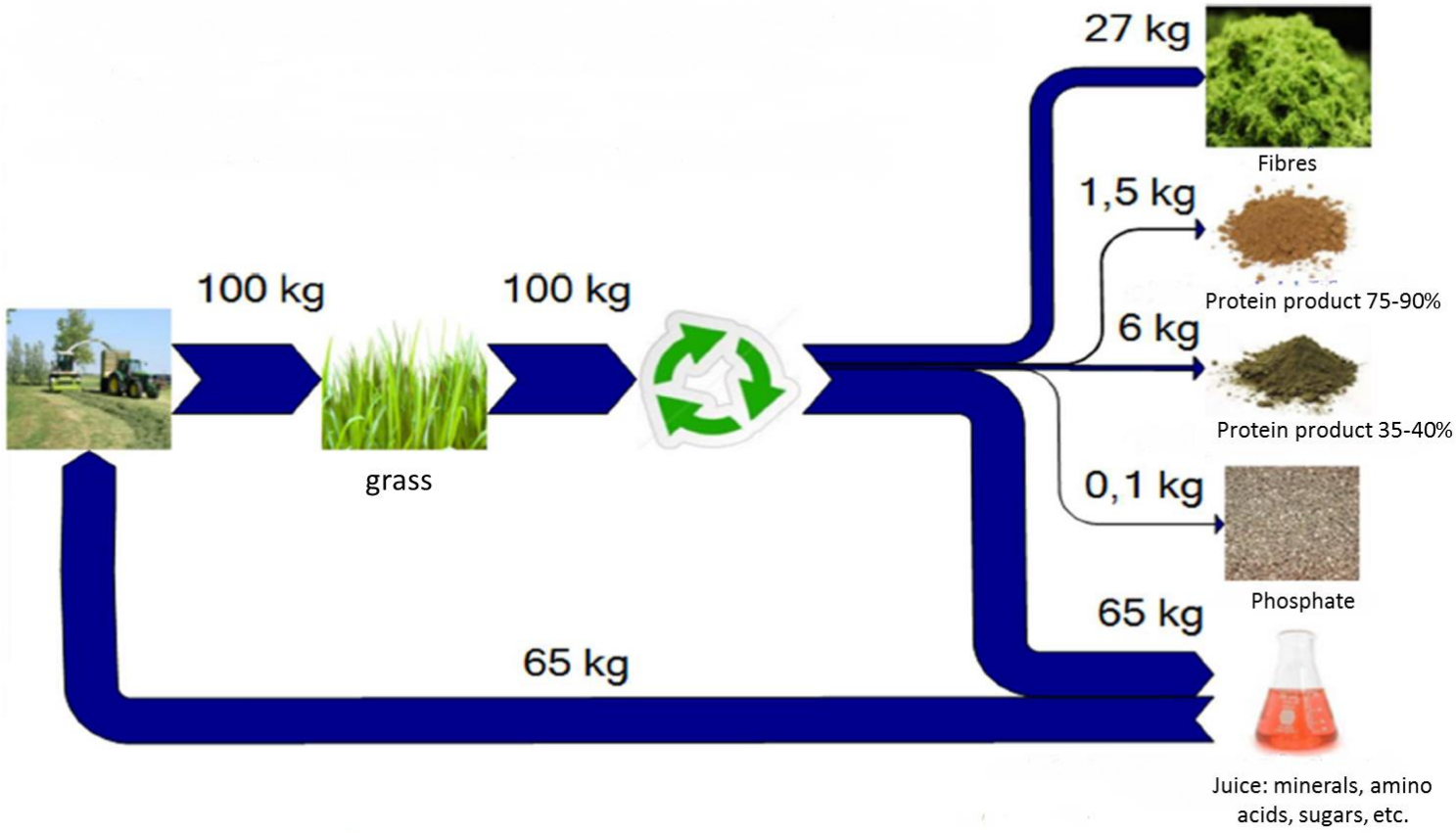
Benefits of NewFoss product (50% grass fibres, 50% recycled paper)

- **10% less CO_2 emissions (per ton paper produced)**
- **50% less water needed in paper production**
- **No feed competition (used grass is made up of 100 different plants > not suitable for feed production)**

Grassa

GBR Grassa
Location: mobile concept, the Netherlands
Founded: 2014
Feedstock: fresh grass or green feedstock (e.g. tomato stems, waterplants)
Capacity: 300 – 600 kg per hour
Investment costs: ca. 600,000 Euro
Runtime: 5 months of year (3,000 hours, diversification of feedstocks to lengthen season)

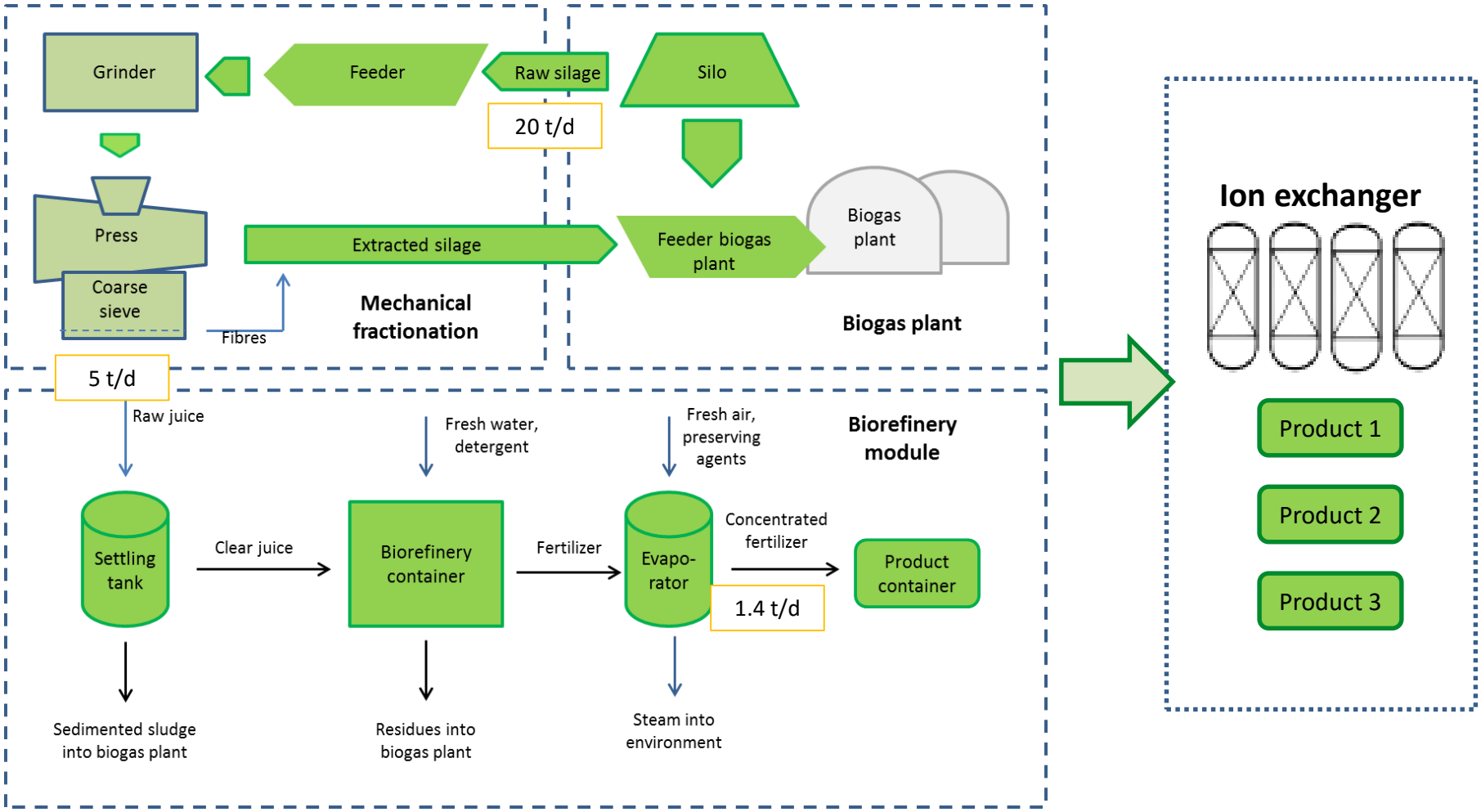
Grassa – mass balance



Biofabrik

GBR Biofabrik
Location: Blizevedly, Czech Republic, and Dresden, Germany
Founded: 2014
Feedstock: silage grass
Capacity: 20 t/day
Investment costs: ca. 700,000 Euro
Based on Austrian study (2003-2006)

Biofabrik – the process

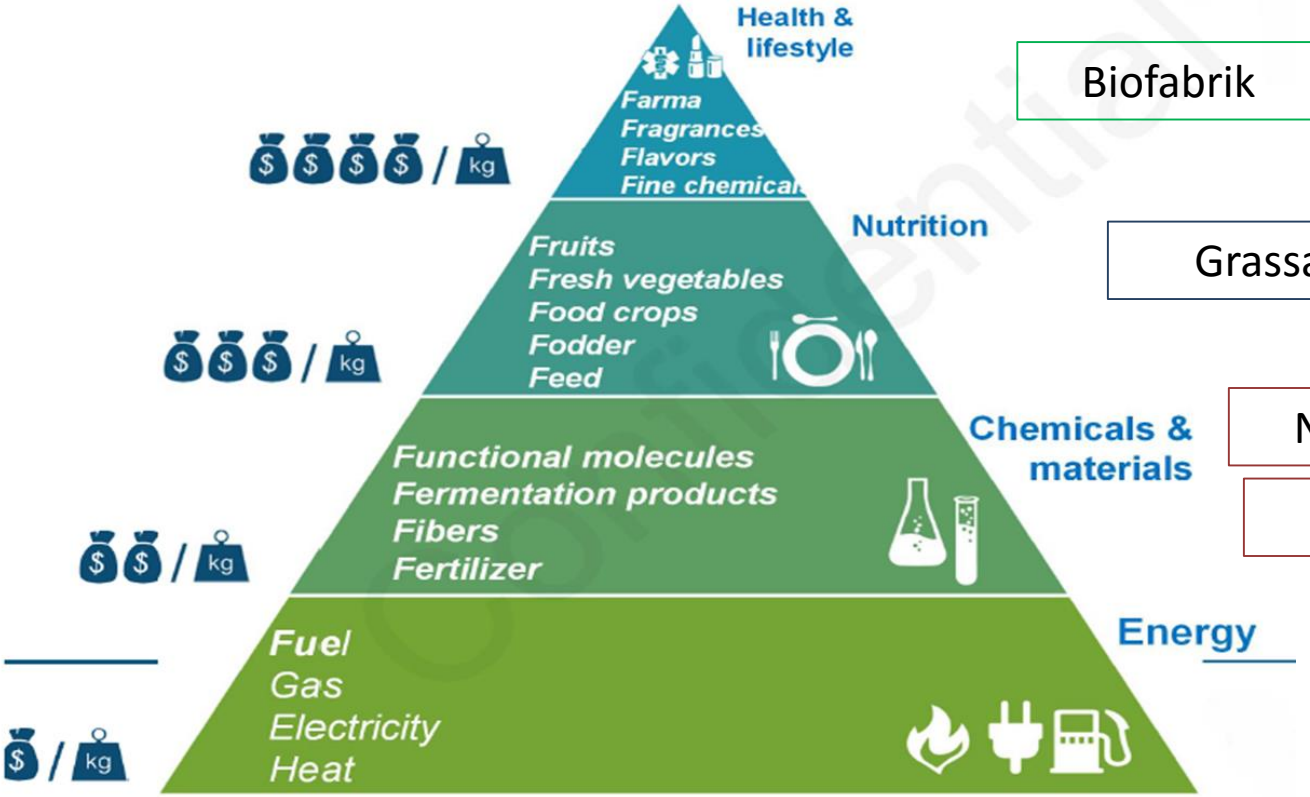


Biofabrik – the products

Fertilizer product
Blattwerk (GHX)

Amino acids for
food supplements

GBR in value pyramid



Biofabrik

Grassa

NewFoss

Biowert

Existing Mexican GBR

???

Potential for alfalfa?

Gracias por su atención

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WIP

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