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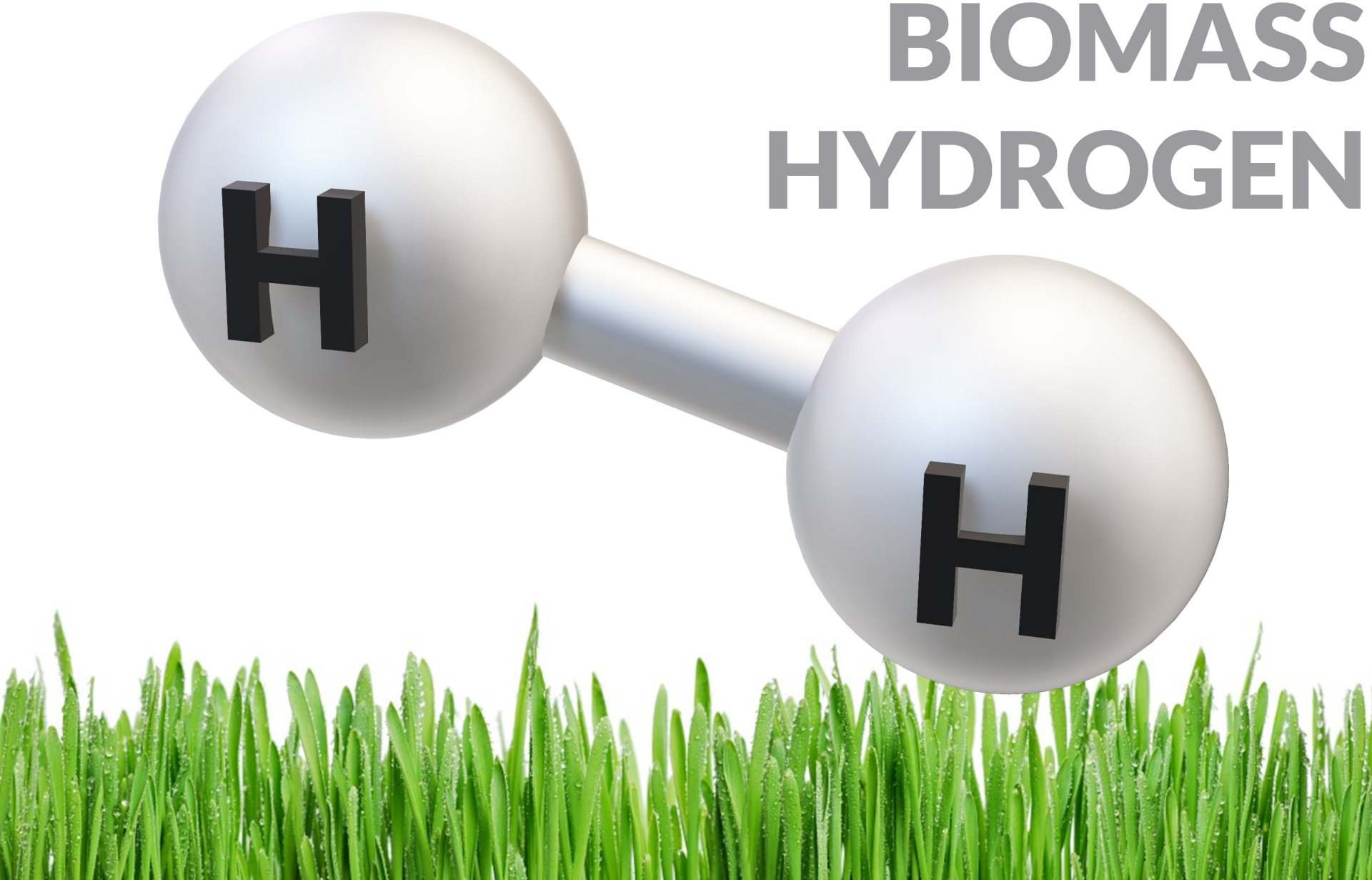
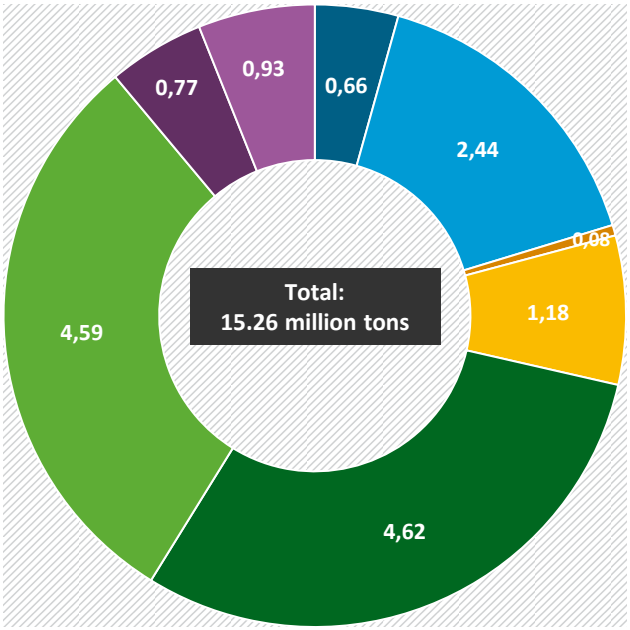
GREEN BIOMASS HYDROGEN



Bio2H_2 – Green Waste to Biomass

Composition of biowaste delivered to biowaste treatment plants (plus sewage sludge) 2019

million tons



- (liquid) manur
- Wastes and sludges from agriculture and food processing
- Waste from wood processing
- Municipal sewage sludge
- Green waste
- Biobin waste
- Food waste from canteens and restaurants
- Others

- Main part of biowaste is composted and used as fertilizer in agriculture and horticulture
- Moist biobin and food wastes are used in biogas plants as substrate for methane production

[1] reference: Statistisches Bundesamt, Abfallentsorgung 2019, Wiesbaden, Stand 06/2021

Bio2H_2 – Green Waste to Biomass

Biomass varieties and large-scale Production of H_2
Dr.-Ing. Matthias Betsch | *CEO Stadtwerke (municipal utilities) Bergheim*

Process design and evaluation
Prof. Dr.-Ing. Nils Tippkötter | *Head of Bioprocess engineering & Downstream processing, University of Applied Sciences Aachen*

Lead of Basic Research und Public relations
Dr. rer. nat. Simone Krafft | *Senior Scientist at Bioprocess engineering & Downstream processing University of Applied Sciences Aachen*

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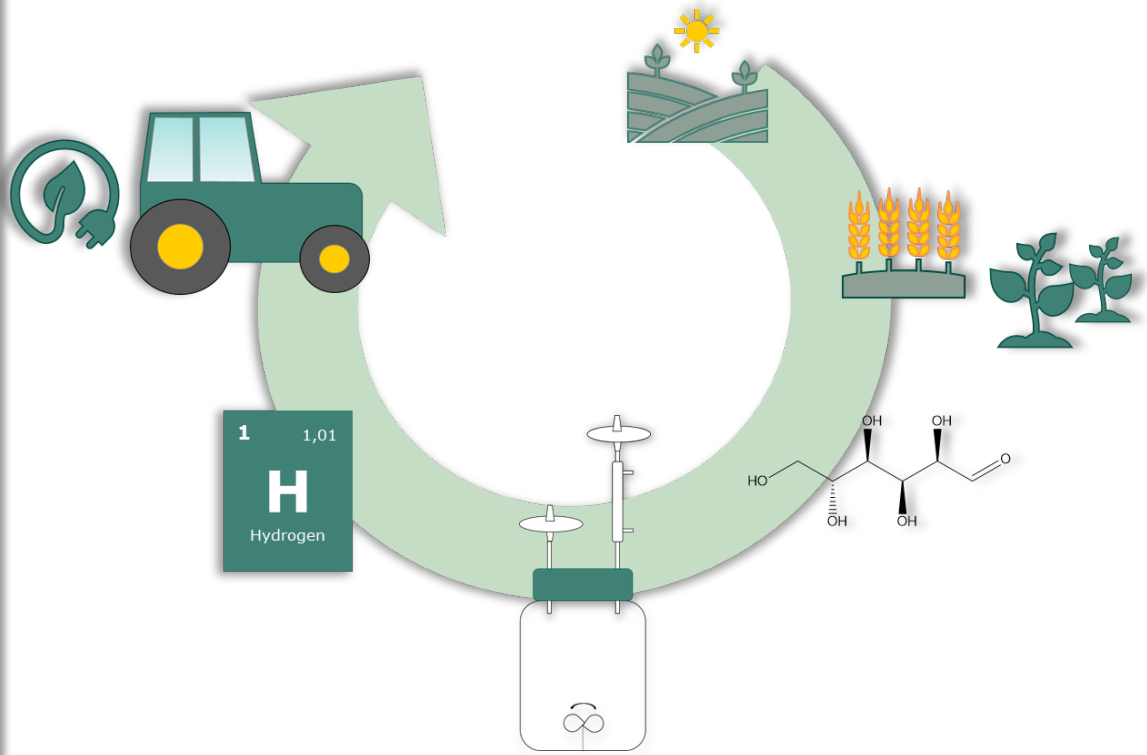
$Bio2H_2$ – Green Waste to Biomass

Concept of $Bio2H_2$

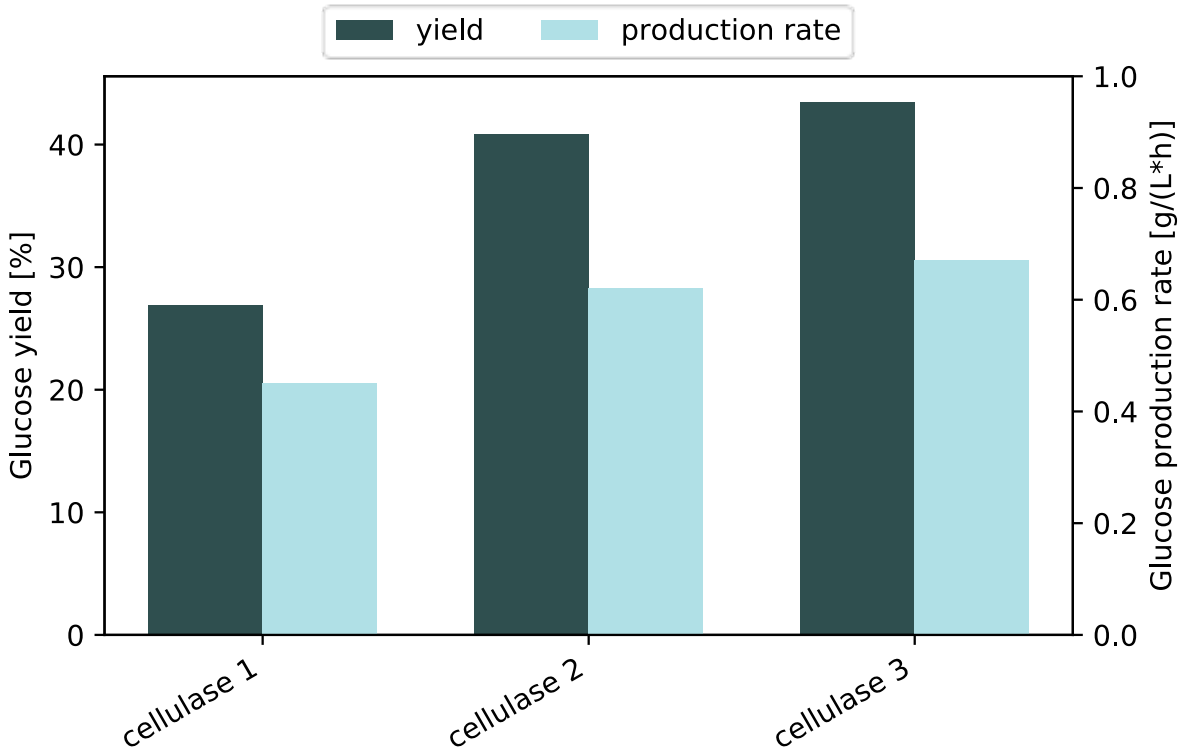
- Supplemental technology for decentralization of hydrogen supply
- Enzymatic-microbial hydrogen production from hydrolysed biogenic residues
- Adaptation of existing biogas plants
- Establishment of circular economy



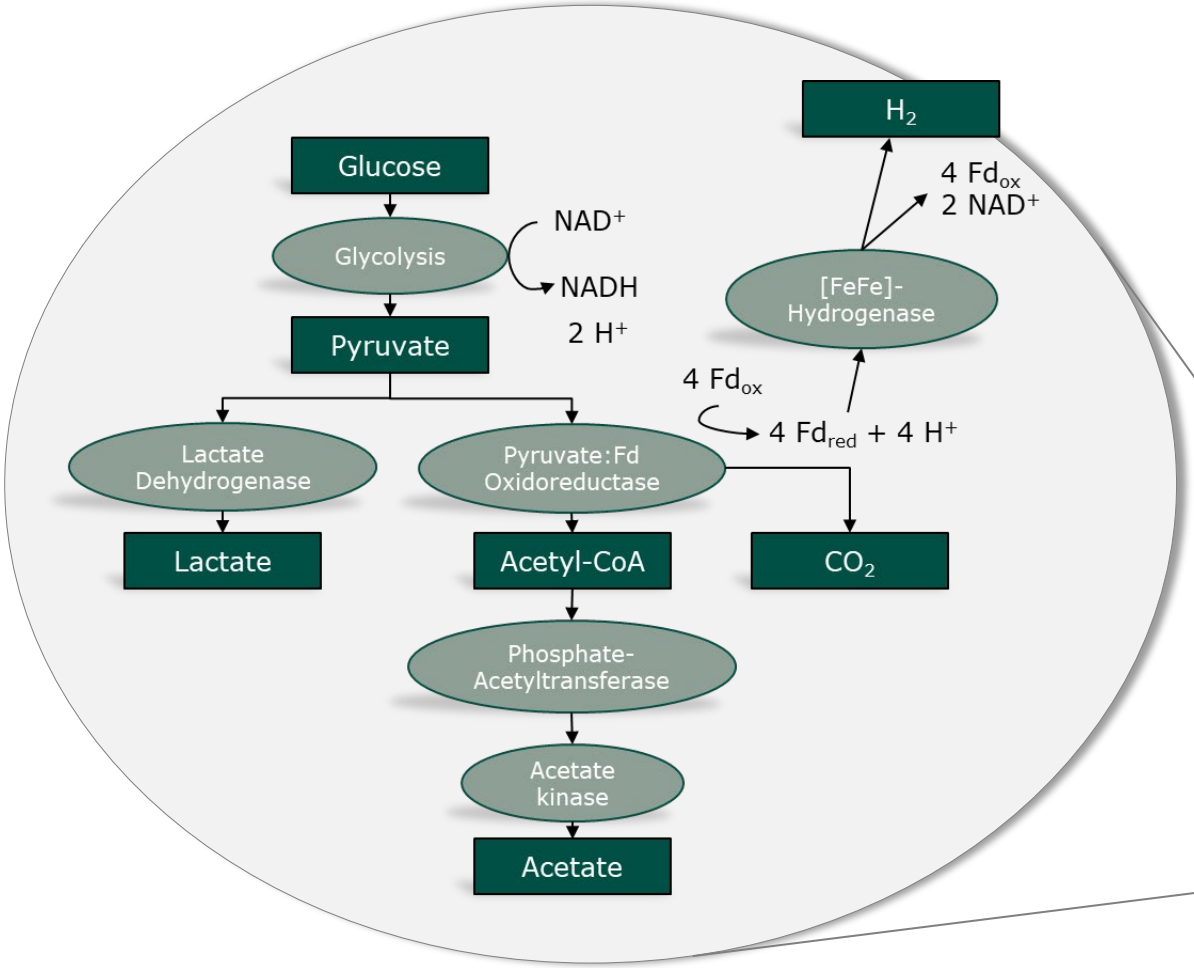
Bio2H_2 – Green Waste to Biomass

Enzymatic hydrolysis of renewable materials

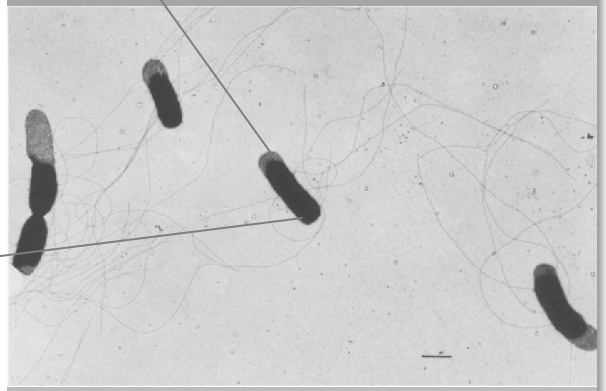
Comparison of commercial cellulase blends



Bio2H_2 – Green Waste to Biomass



Dark fermentation:
a microbial route for hydrogen production



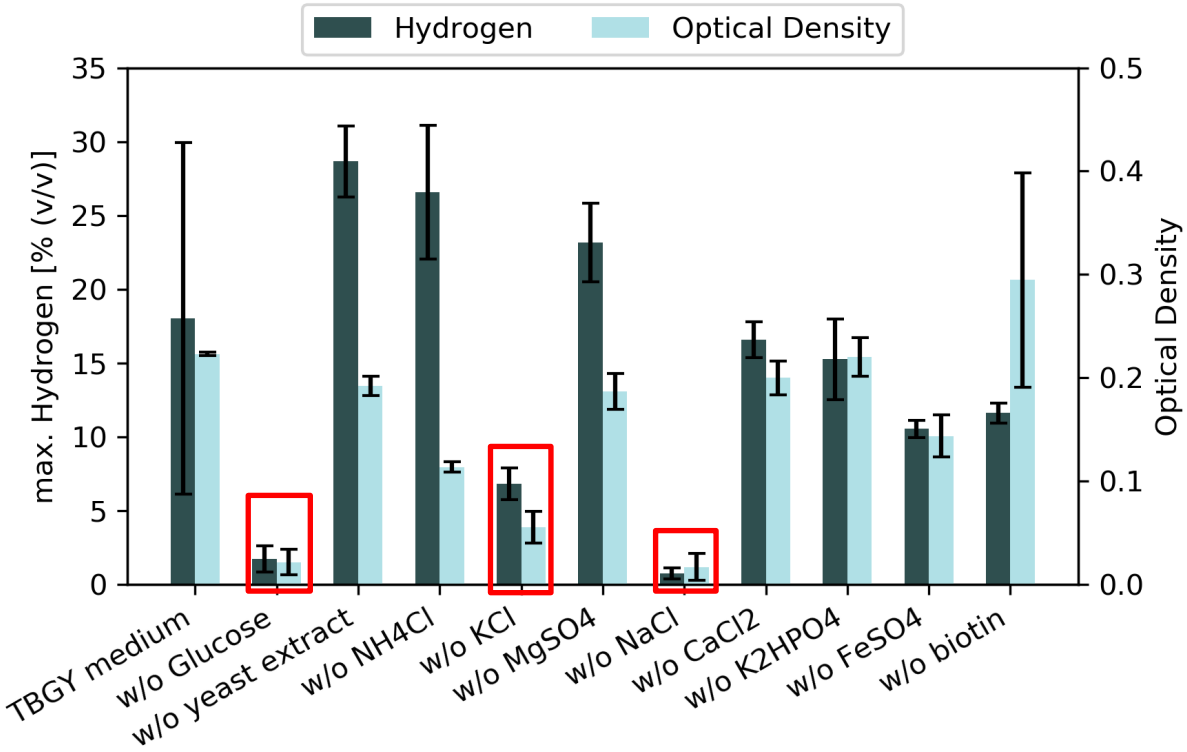
Thermotoga sp.

[2] E. Windberger, et al. (1989): *Thermotoga thermarum sp. nov*. and *Thermotoga neapolitana* occurring in African continental solfataric springs. In: *Arch. Microbiol.* 151 (6), S. 506-512

Bio2H_2 – Green Waste to Biomass

Media optimization

Which components are essential for hydrogen production?



Bio2H_2 – Green Waste to Biomass

Economic analysis of microbial hydrogen production

substrate: grass

Input: 20 t grass (wet weight)

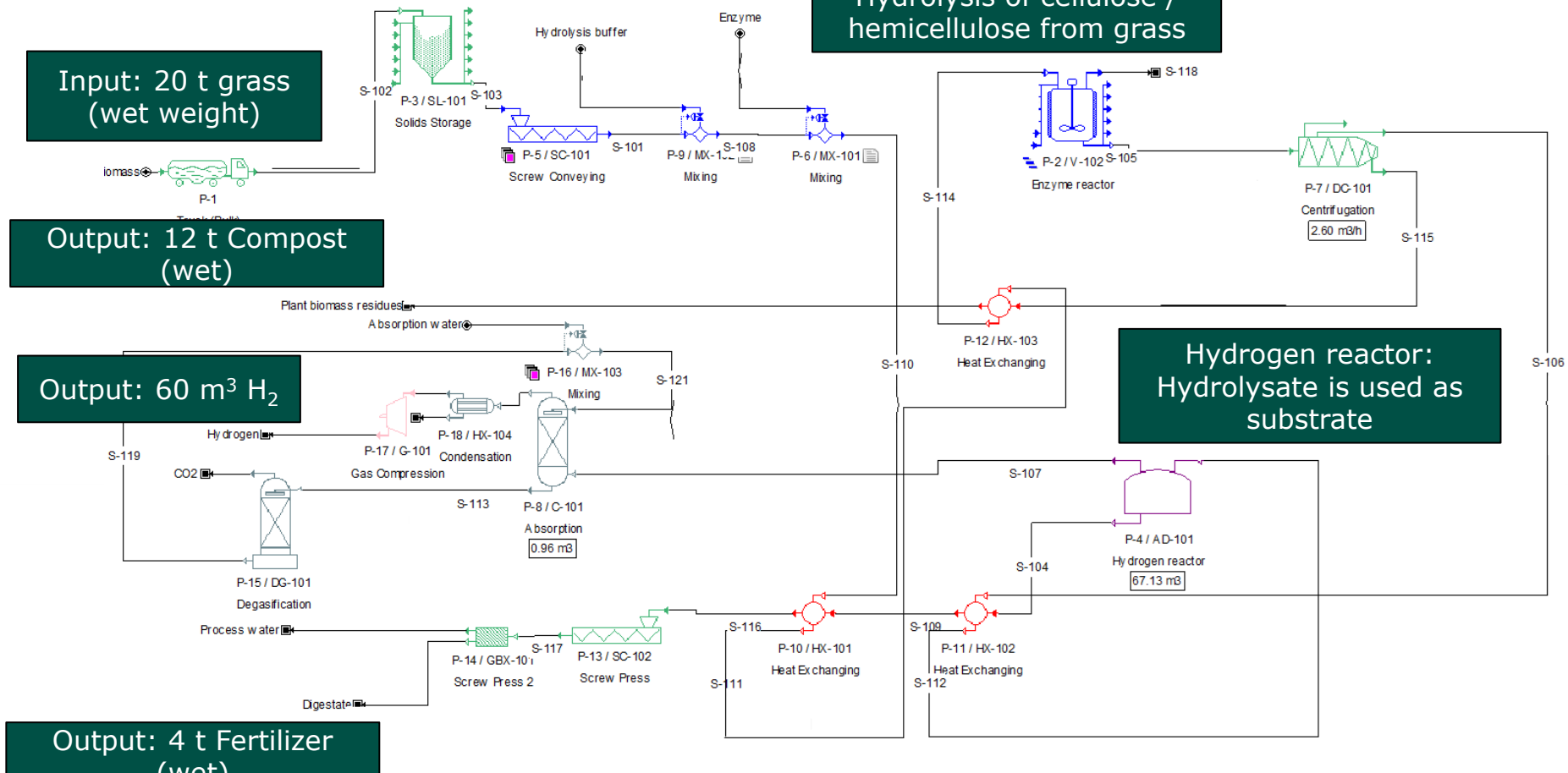
Output: 12 t Compost (wet)

Output: 60 m³ H_2

Output: 4 t Fertilizer (wet)

Enzyme reactor: Hydrolysis of cellulose / hemicellulose from grass

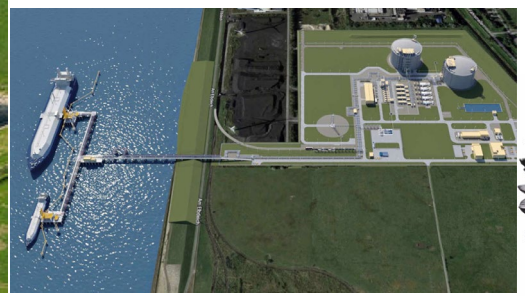
Hydrogen reactor: Hydrolysate is used as substrate



Bio2H_2 – Green Waste to Biomass

Invest Research

→ Test new Biomass Ressources an Microorganisms
→ Upgrade Biogas Plants in Brazil
→ Develop a Decentral Gas Cleaning Setup
→ Design, Invest, Build new H_2 Plants
→ On-Site Energy Utilization
→ Export Hydrogen



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