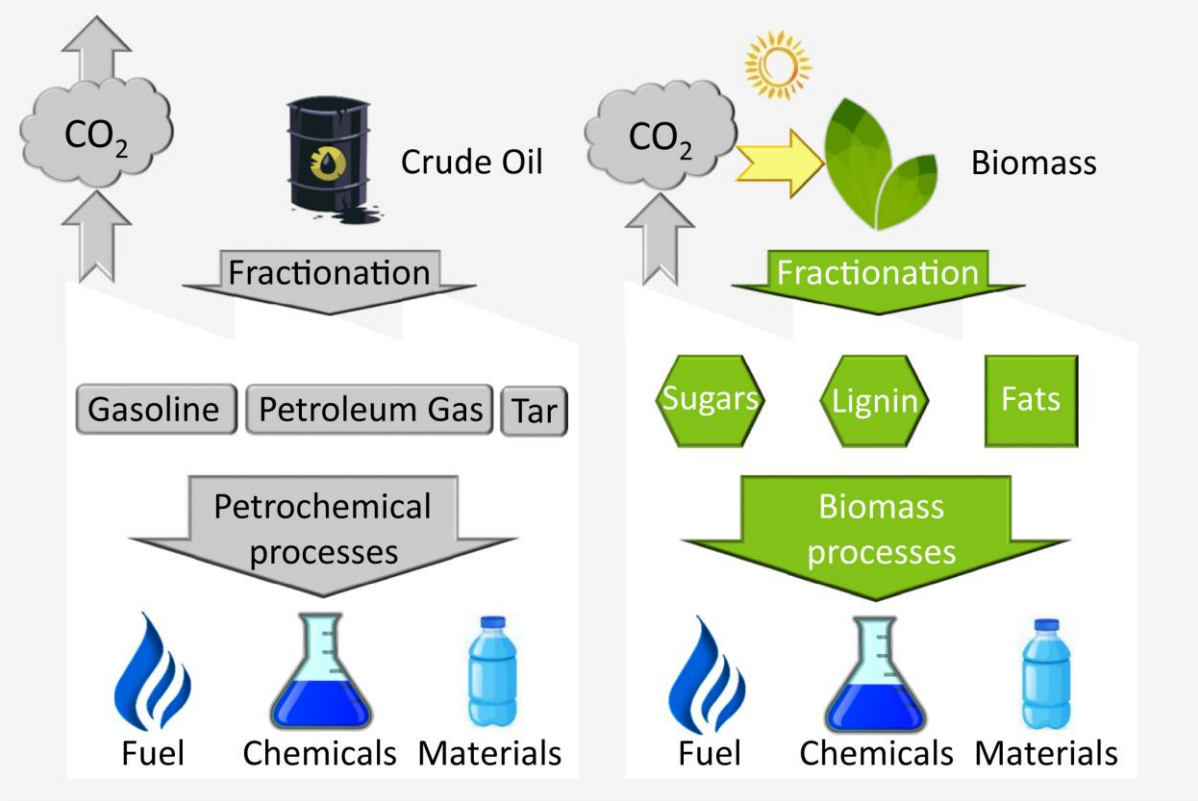
BIOREFINERY:
Present and Future Perspective



Short Review

Shell biorefinery: A comprehensive introduction

Green Energy & Environment: Volume 3, Issue 4, October 2018, Pages 318-327

Why Biorefinery?

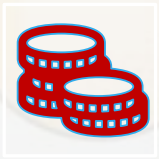
Carbon sequestration

Carbon emissions reduction

Bio-Circular economy

Energy and Food Security

Fossil fuel replacement

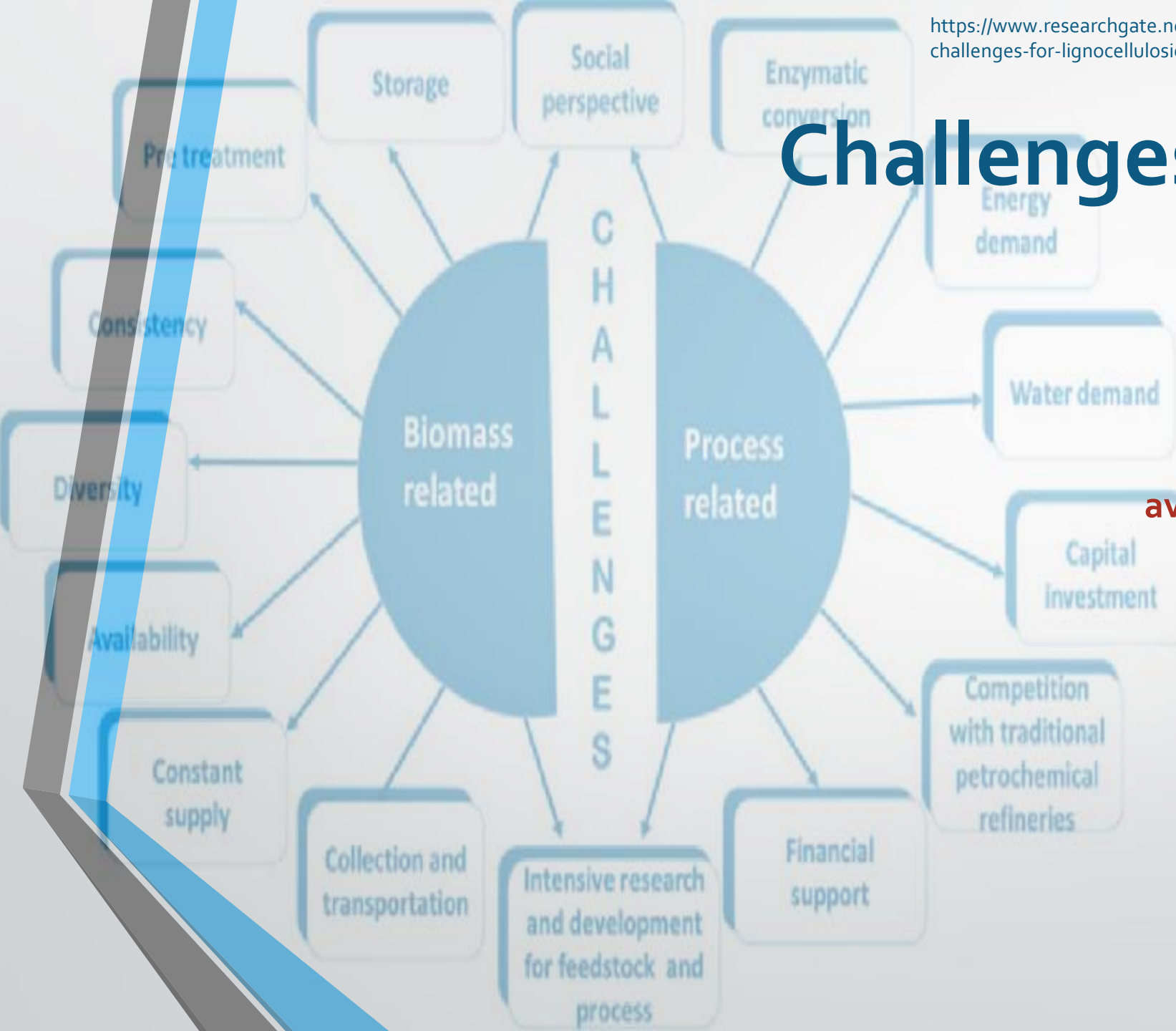


Economic opportunity

Research and Innovation

https://www.researchgate.net/figure/Major-current-and-emerging-challenges-for-lignocellulosic-biorefineries_fig2_326520102

Challenges in Biorefinery



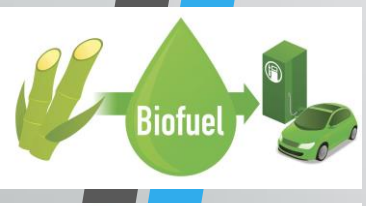
Feedstock availability/quality

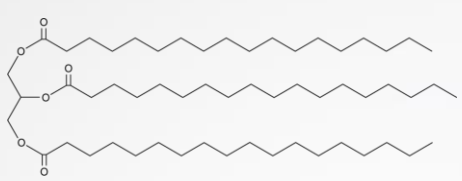
Technological complexity and Energy efficiency

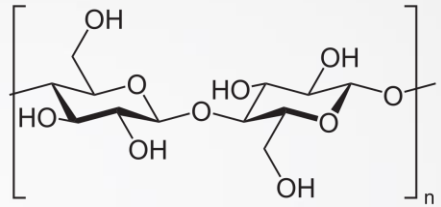
Economic viability

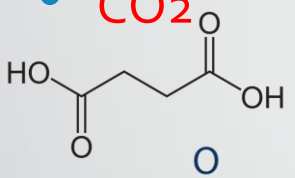
Environmental sustainability

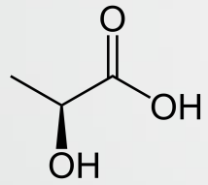
- **Feedstocks**
  - Sugar & Starch
  - Lignocellulosic materials
  - Plant based Oils
  - Algae and Marine biomass
  - Wastes (municipals, sludges, manure, others)
  - CO_2

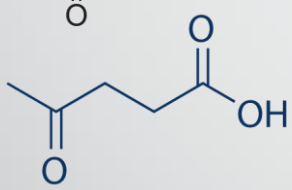


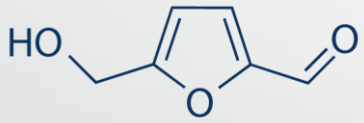












- **Processes**
  - Physical
  - Chemical/Thermochemical
  - Biological
  - Algae and Marine biomass
  - Wastes (municipals, sludges, manure, others)

- **Products**
  - Fine chemicals/Food – Food ingredients
  - Intermediate chemicals
  - Fertilizers/Soil conditioners
  - Biofuels