

The development of the Biorefinery and the SUSTOIL project

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Research

Industry

Networking

Education



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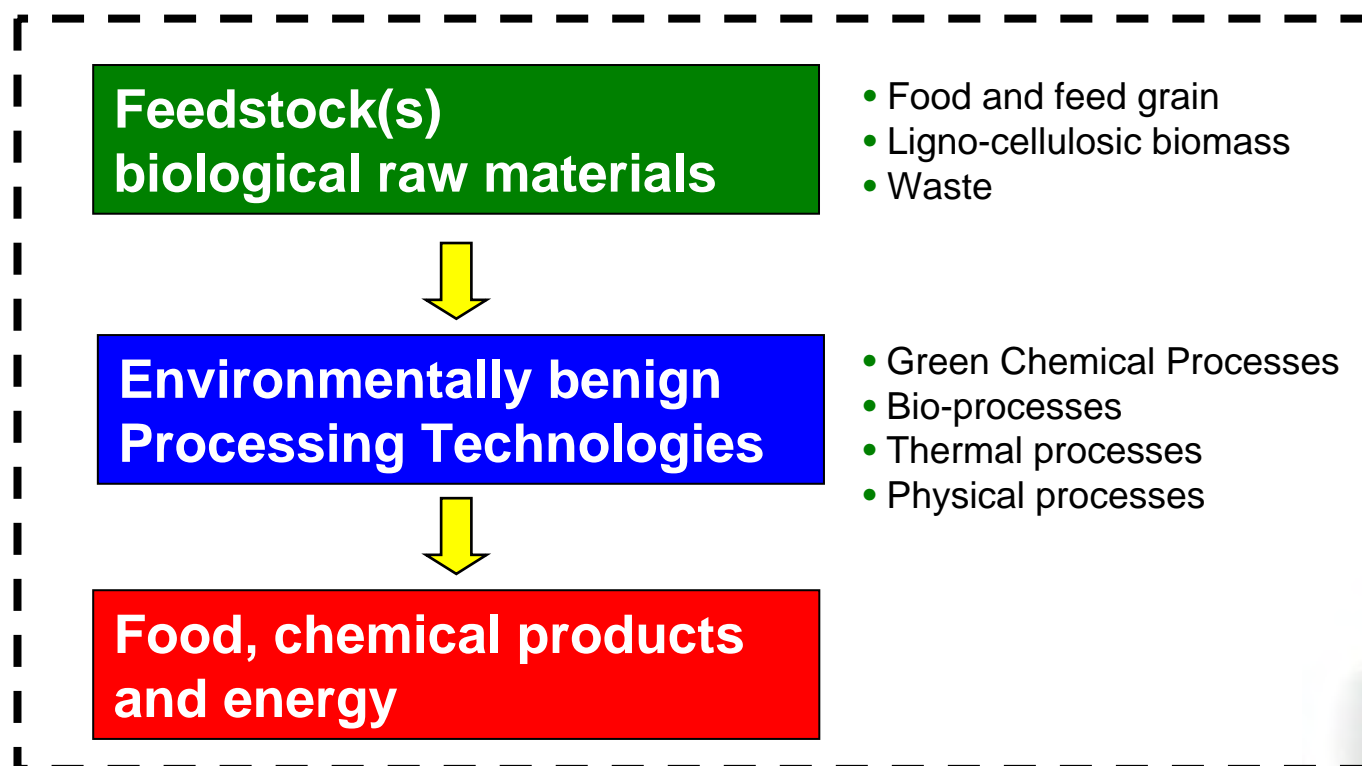
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Biorefineries

Integrated facilities that can convert a variety of renewable feedstocks into energy, chemicals and other valuable materials **cleanly** and **efficiently** maximising the value of the biomass and minimizing waste



Biorefinery evolution

- Raw material should be readily available from the local area
- Most biorefineries are predicated on a single main product stream
- By-products are crucial to the viability of the refinery even if they are low-value commodities
- Increasing economic viability can be achieved by adding value to the by-products

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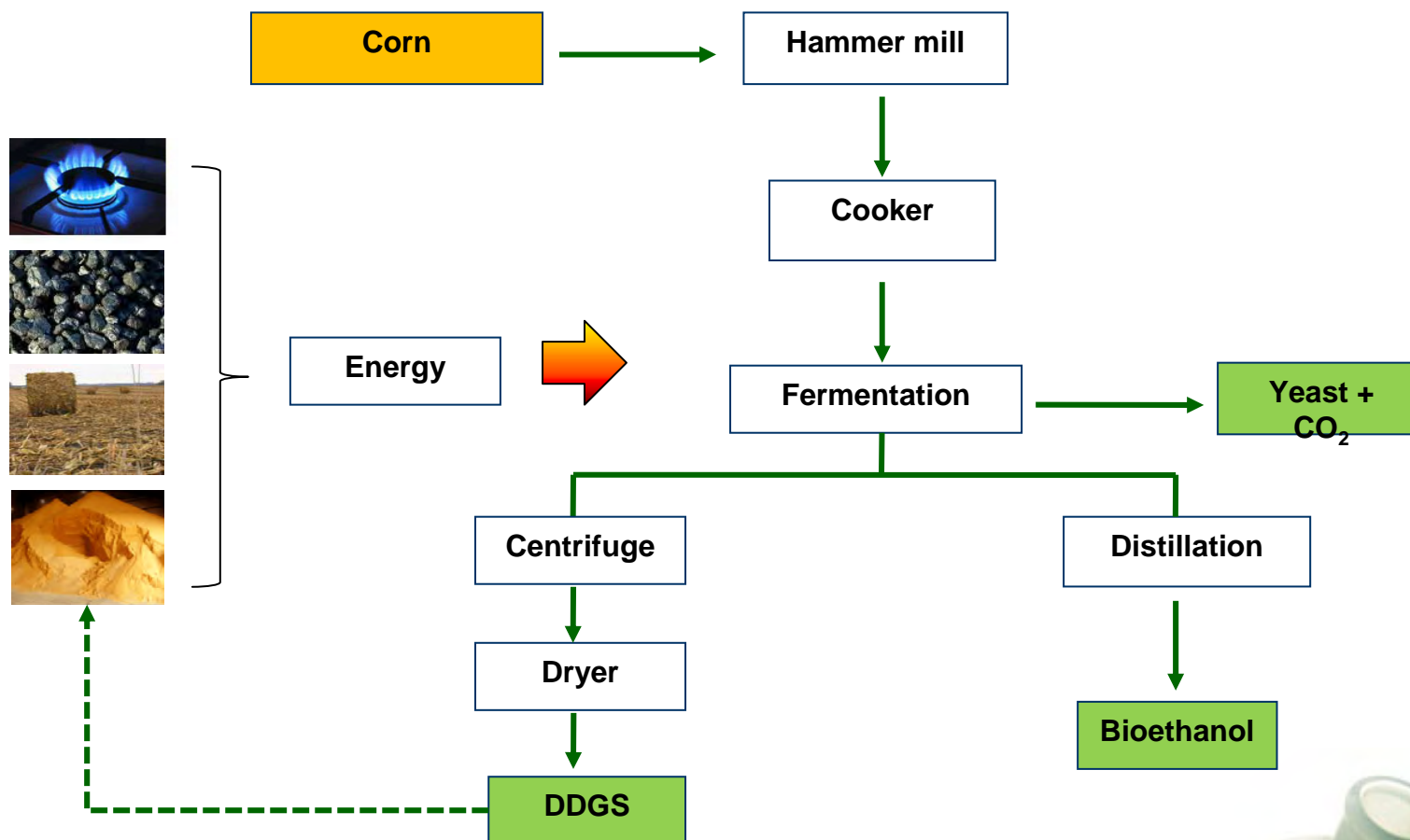
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Phase 1 Biorefinery (ethanol)

(Fixed processing capabilities)



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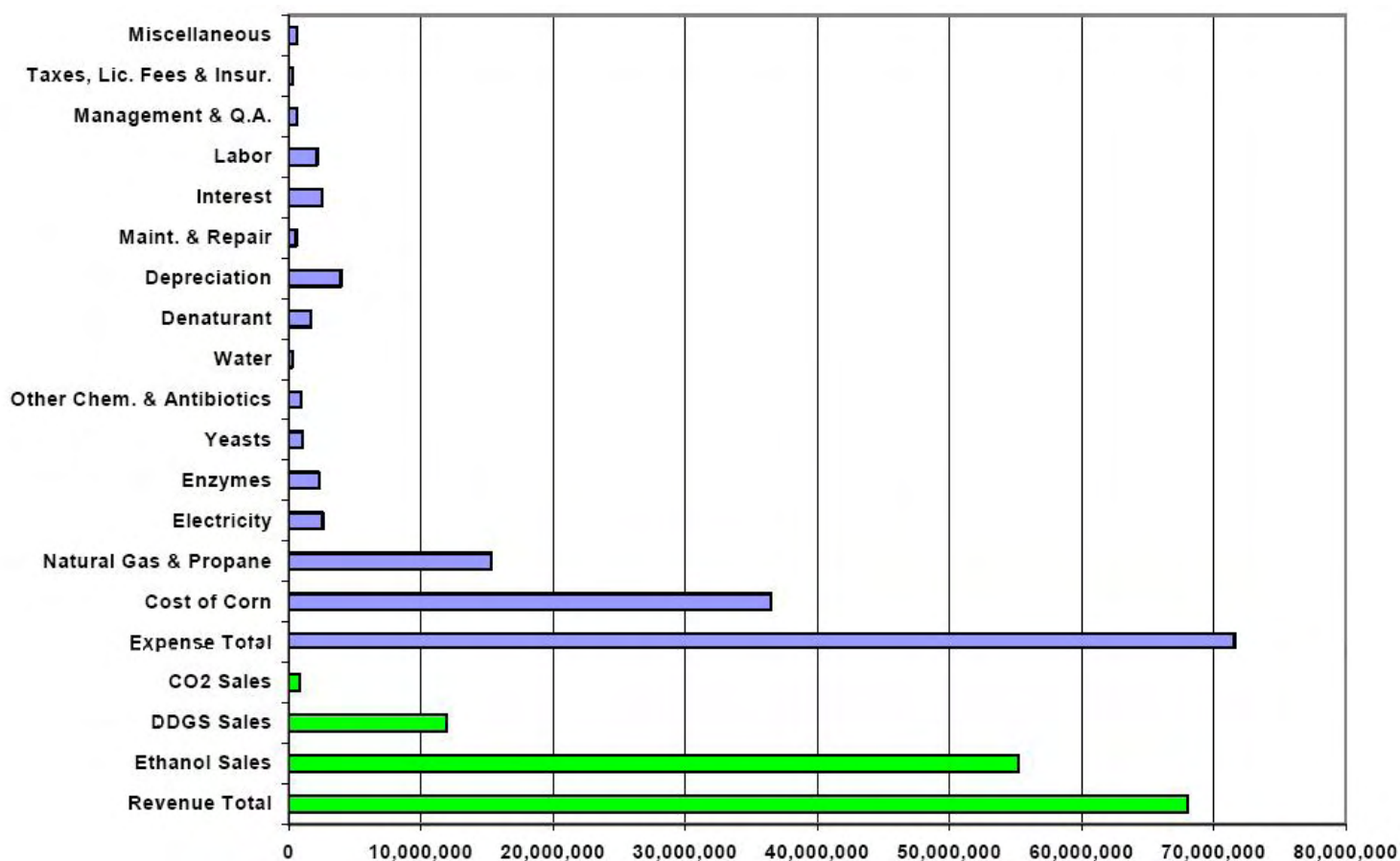
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Bioethanol economics (Corn)

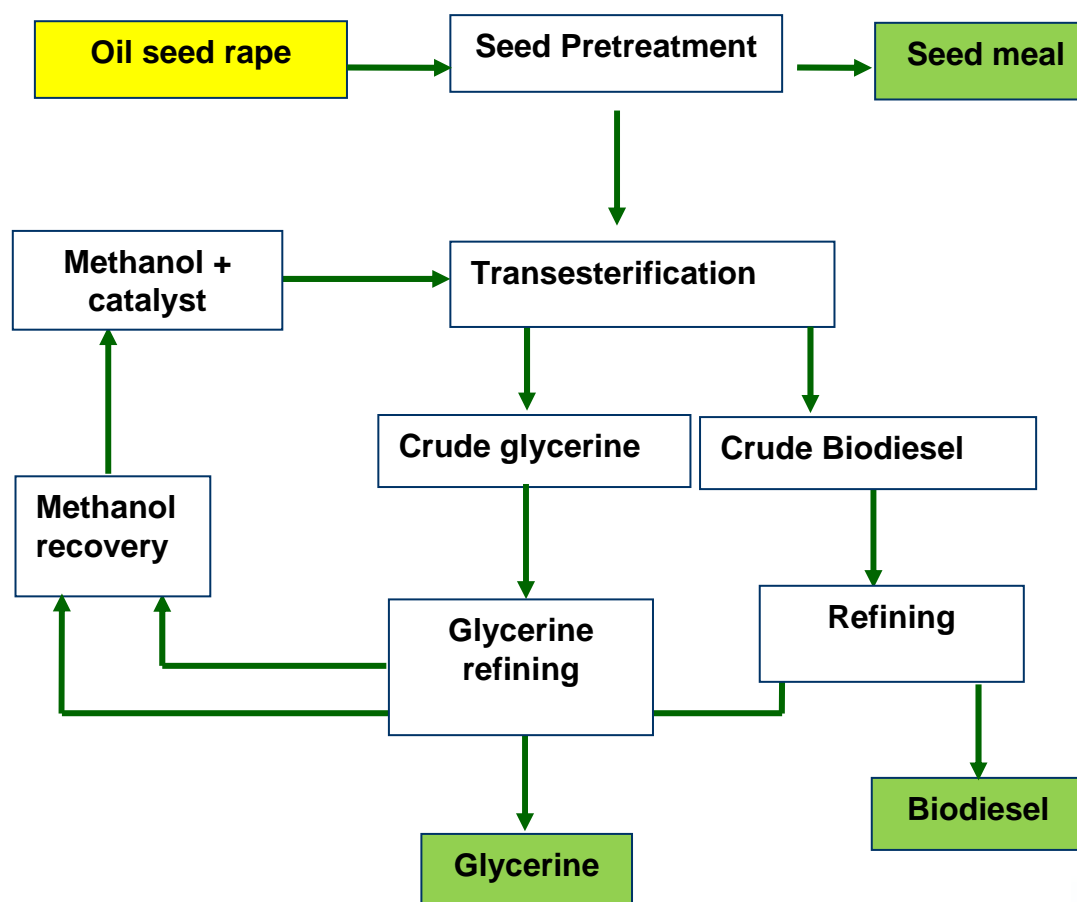


Average data from six US bio-ethanol plants - 2008



Phase 1 Biorefinery (biodiesel)

(Fixed processing capabilities)



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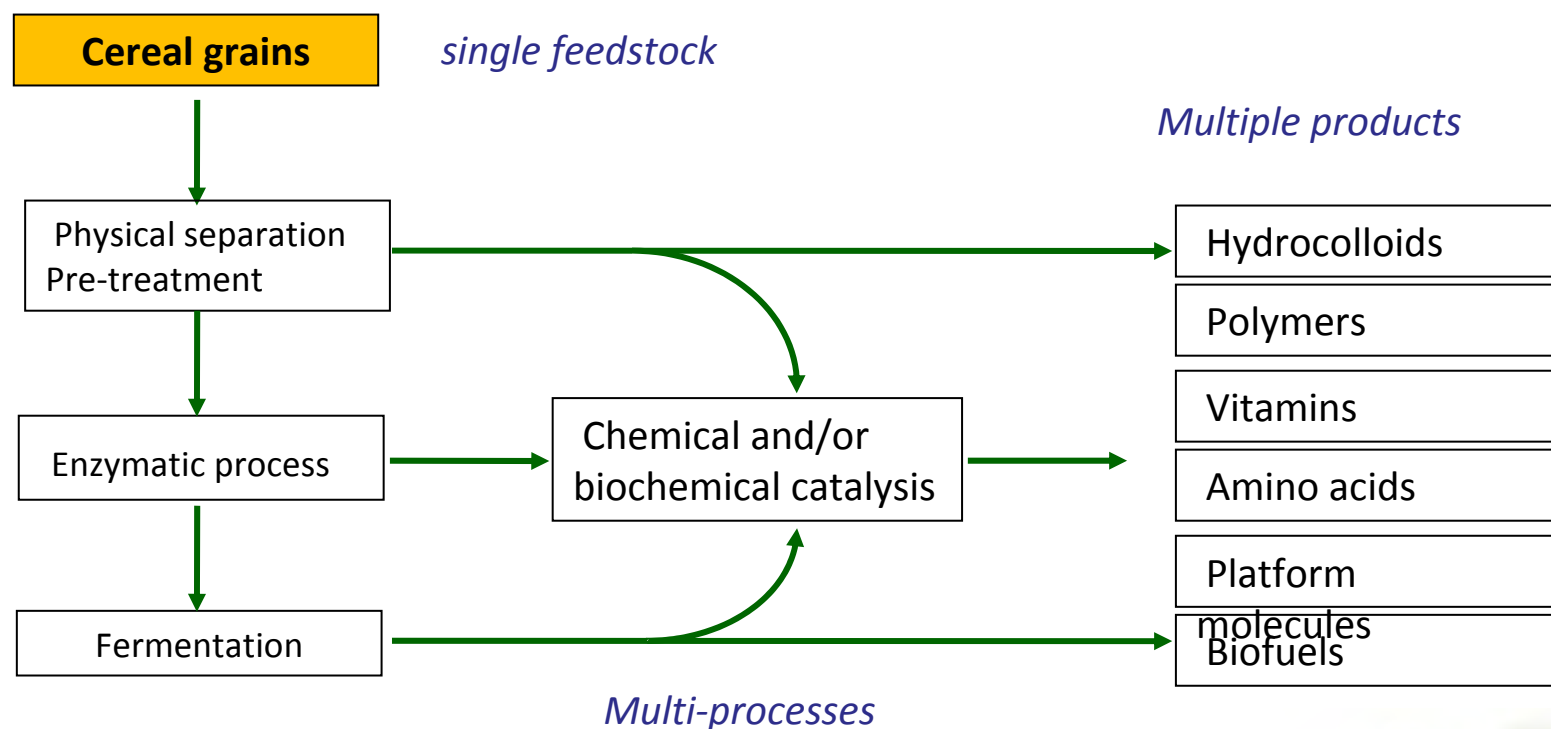
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Phase II Biorefinery

(Flexible processing capabilities – single source)



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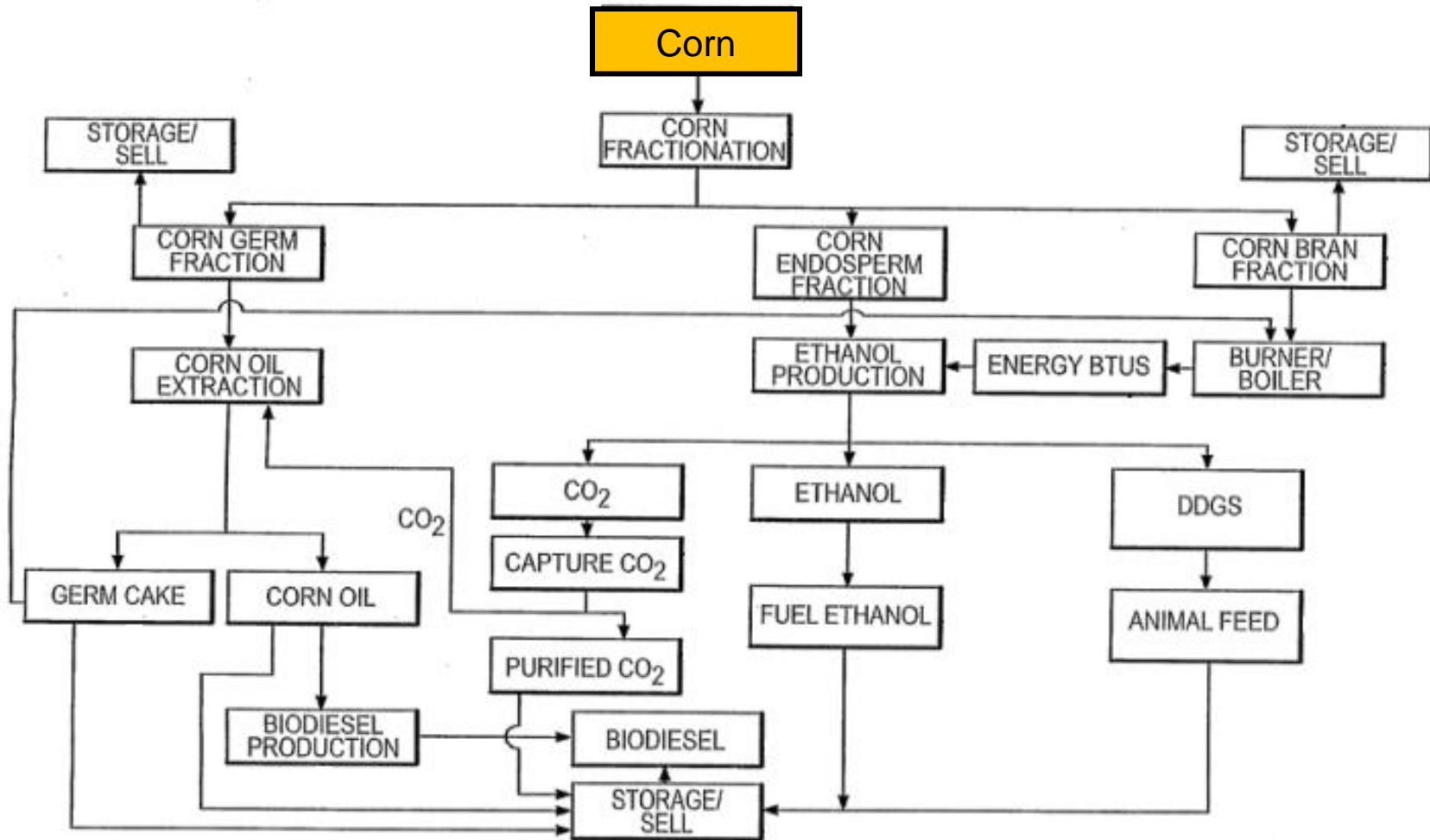
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Phase II Biorefinery

(Flexible processing capabilities – single source)



Biorefinery patent: WO2008020865

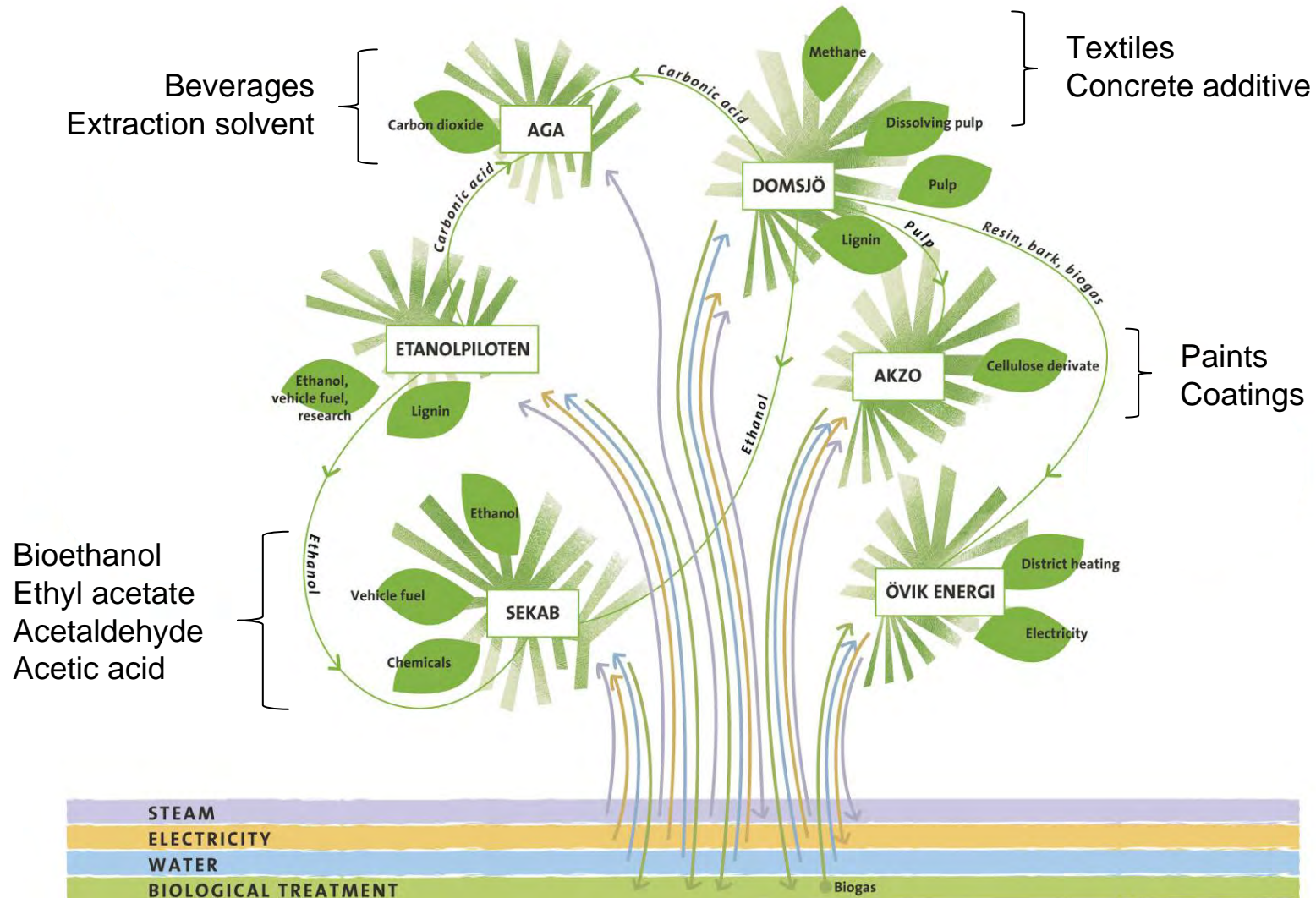
Phase III Biorefinery

- Most developed biorefinery
 - Mix of biomass feedstocks
 - Wide range of products
 - Combination of technologies
- **The Whole Crop Biorefinery (WC-BR)** - cereal, maize, rape
- **The Green Biorefinery (G-BR)** - green biomass such as grass, lucerne and clover
- **The Lignocellulose Feedstock Biorefinery (LCF-BR)** - dry lignocellulosic biomass such wood, straw, corn stover, etc.
- Phase III biorefineries are mostly still in research and development



Phase III Biorefinery

LCF-BR – Processum (Sweden)



Whole Crop Integrated Biorefineries

FRAMEWORK 7 - AREA ENERGY.3.3: BIOREFINERY (Ends May 2010)

Expected impact:

- Expand range and volume of bio-products on the market
- Improve the economics of bio-refinery plants
- Optimising their energy and environmental performance
- Enhance the cost-competitiveness of bio-fuels.
- Deployment of integrated bio-refineries is expected beyond 2020.

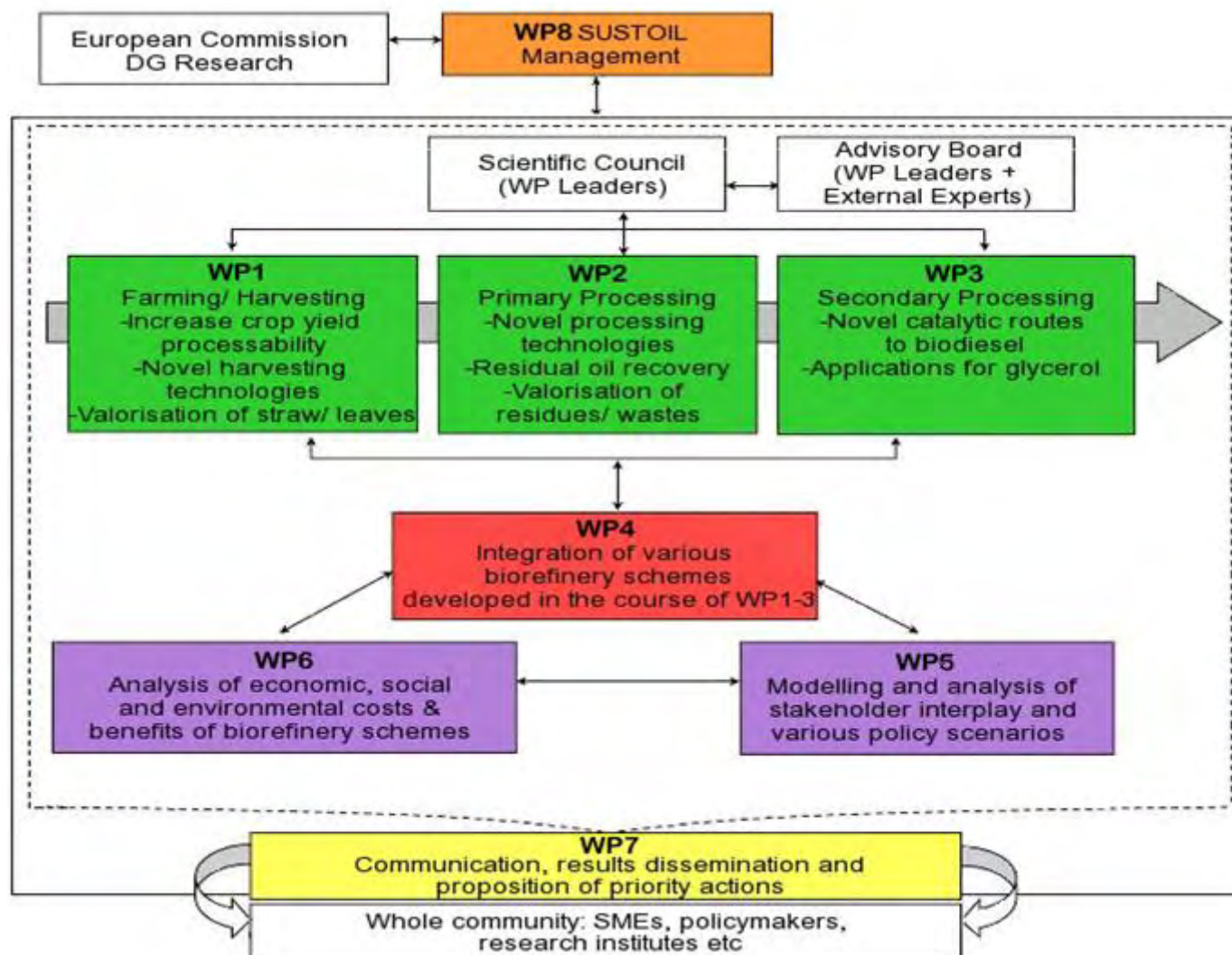
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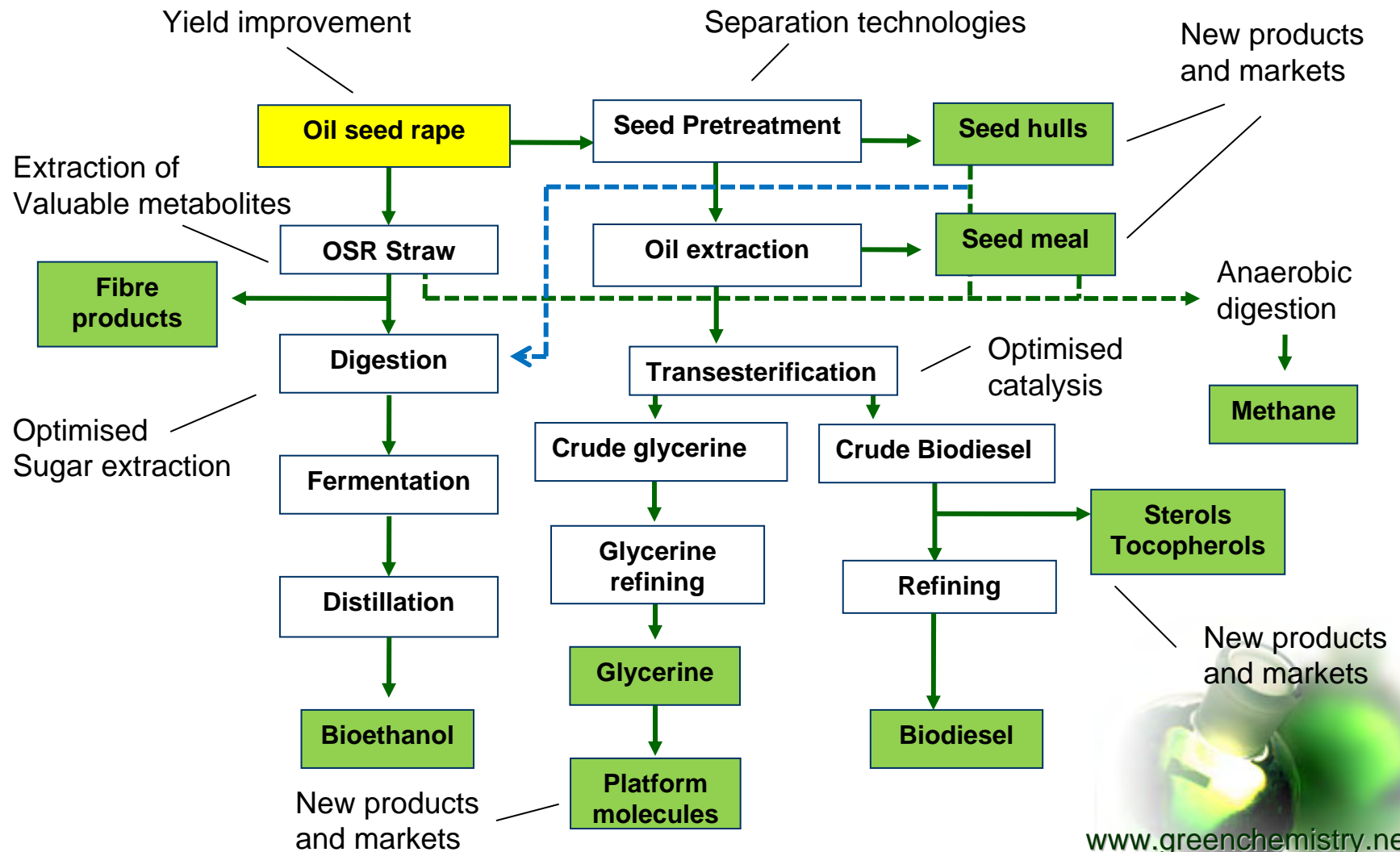
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Whole Crop Integrated Biorefineries



- Research
- Industry
- Networking
- Education

“SUSTOIL” Bio-refinery (Biodiesel from OSR)



“SUSTOIL” Bio-refinery (Biodiesel from OSR)

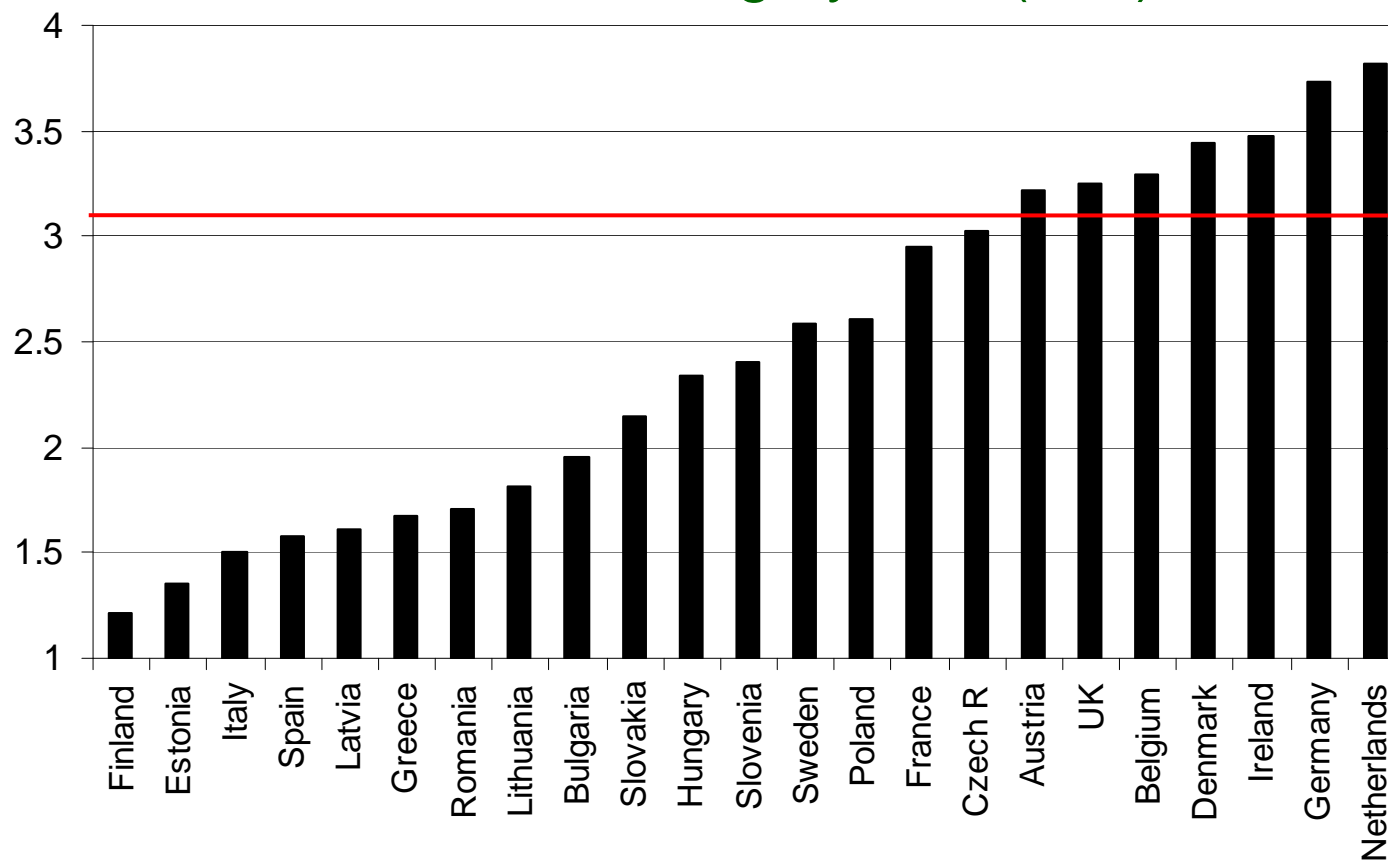
- EU is the largest producer (18mt)
- 70% of all oilseeds
- Average EU yield 3-3.3 t/ha
 - China & Canada = 1.8 t/ha
 - India = 0.8 t/ha
- Realistic potential = 6.5 t/ha (Berry & Spink 2006)
- 9.2 t/ha where water not restricting
- Doubling yield in countries currently above EU average = extra 12.4 m tonnes



“SUSTOIL” Bio-refinery (Biodiesel from OSR)



EU average yields (t/ha)



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“SUSTOIL” Bio-refinery (Biodiesel from OSR)

Improving yield

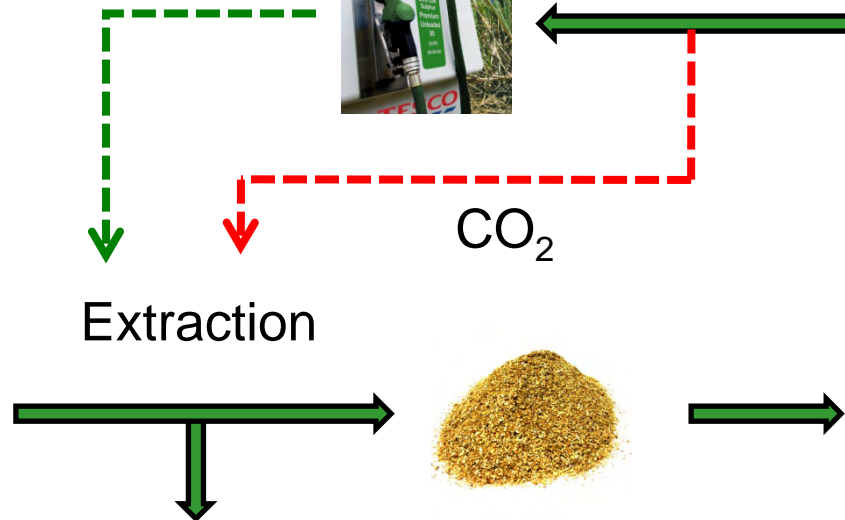
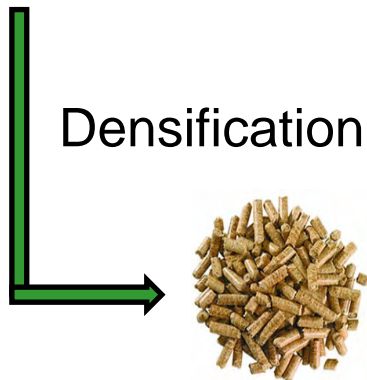
- Address Sulphur deficiency
- Maintaining rotational gaps (> 1 in 3)
- Increase seed number by optimising resource capture
 - Bring flowering forward
 - Reduce light interception by flowering canopy
 - Increase leaf area (photosynthetic area)
- Develop improved cultivars



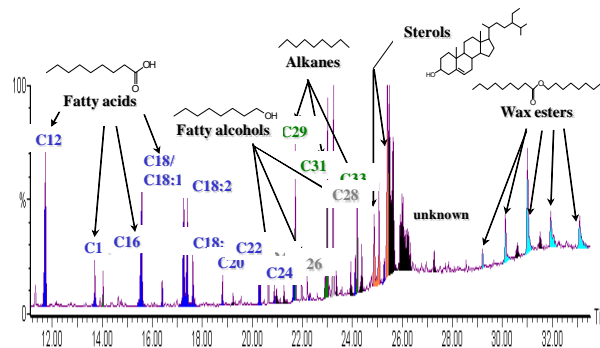
“SUSTOIL” Bio-refinery (Biodiesel from OSR)



Fermentation



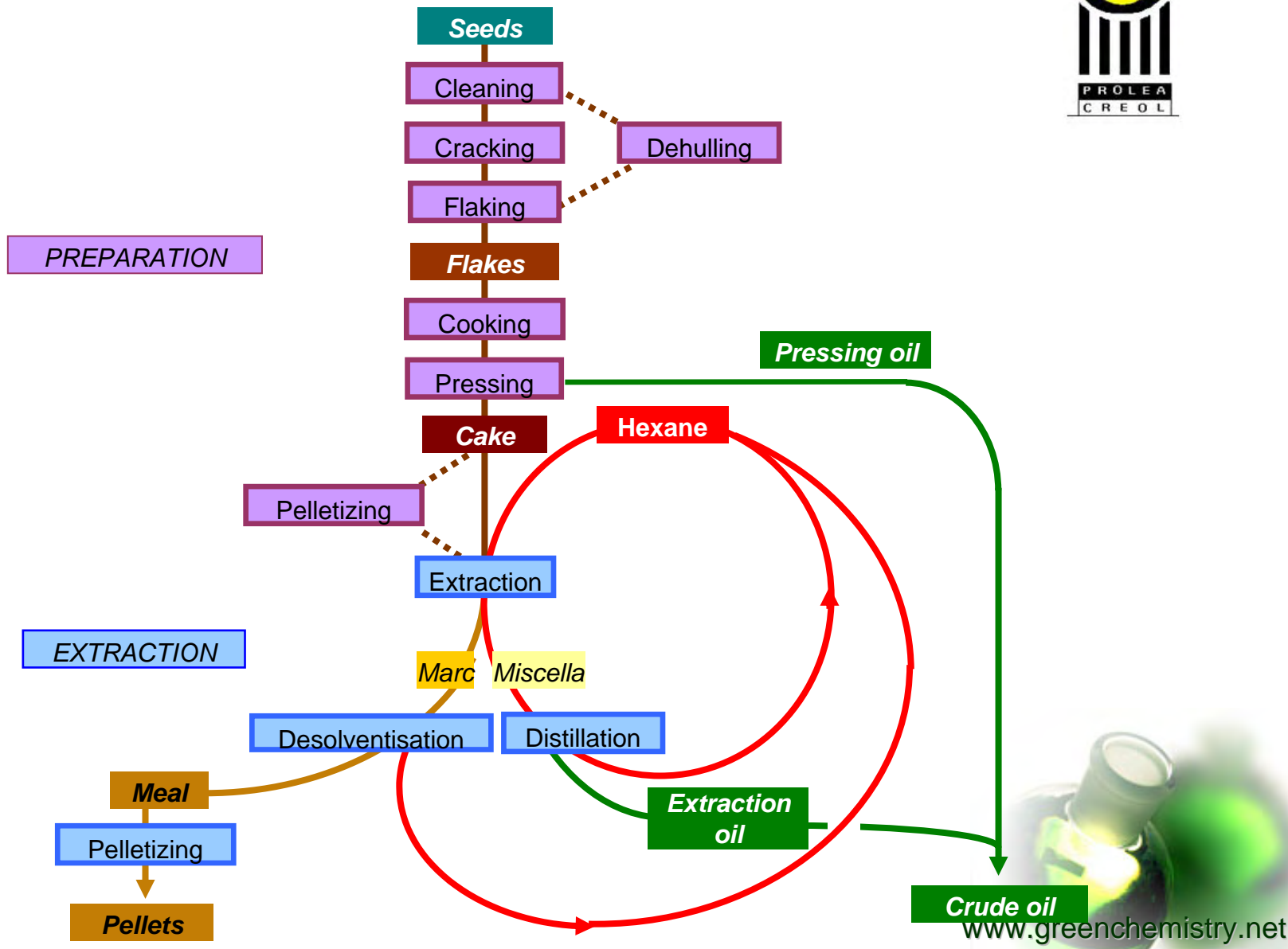
Digestion



Functional extracts



“SUSTOIL” Bio-refinery (Biodiesel from OSR)



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“SUSTOIL” Bio-refinery (Biodiesel from OSR)



Valorising seed hulls and meal

Hulls

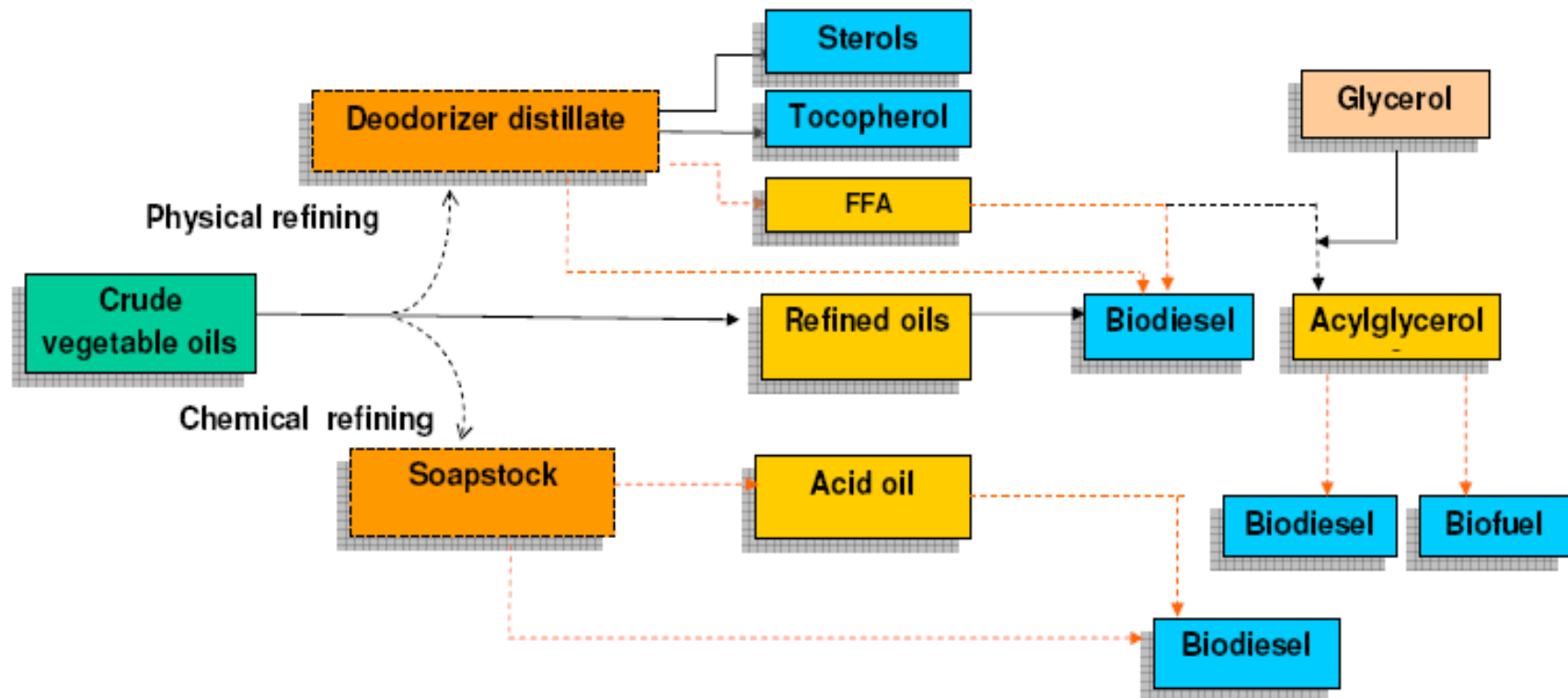
- Rapeseed 15 % of proteins - possible use as substitute of dehydrated alfalfa
- Lignocellulosic fraction - biofuels

Seed cake

- Proteins - 44 % of defatted kernel mass
- Phenolic compounds
- Oligosaccharides
- Glucosinolates
- Direct HTP thermoforming



“SUSTOIL” Bio-refinery (Biodiesel from OSR)



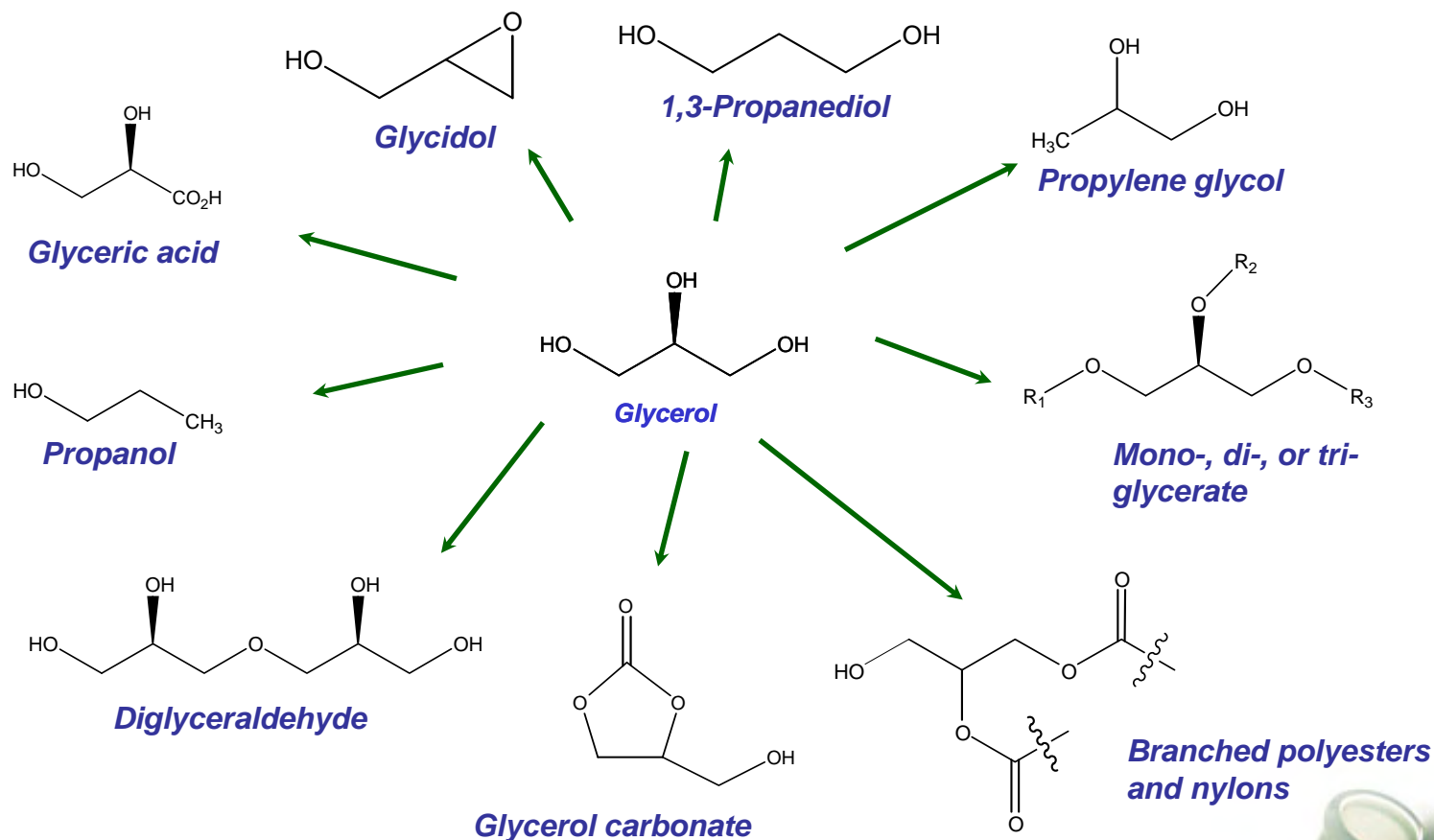
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Optimised biodiesel production and
by-product streams



“SUSTOIL” Bio-refinery (Glycerol as a C3 building block)



Applications: Humectant, plasticizer, emollient, thickener, solvent, dispersing medium, lubricant, sweetener, bodying agent, antifreeze, and processing aid.

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Summary

- Economic viability of Biorefineries can be substantially improved by diversification at all levels
- A wider range of feedstocks and products increases competitive advantage and financial security
- Some process technologies still need to be improved further but we are getting there
- SUSTOIL will provide information on improving existing process facilities and in the design of future biorefineries

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