CPBIS

Georgia Tech Institute of Paper Science and Technology

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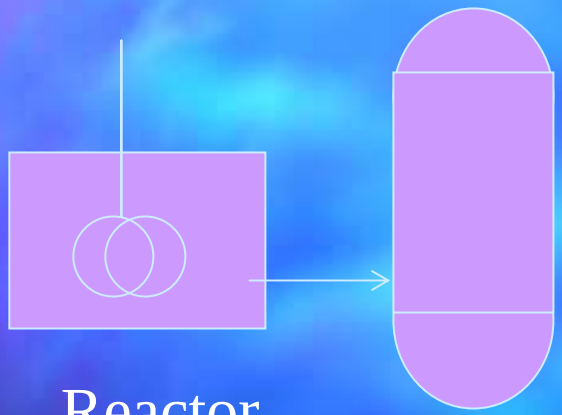
Panel
Evolving Industry Opportunities
New Processes - Biorefinery

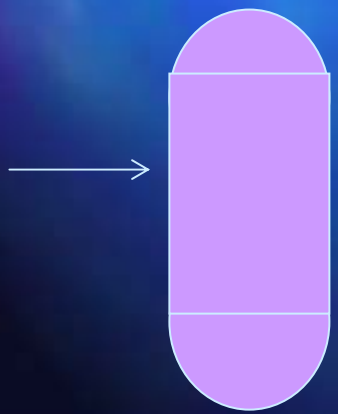
Systems Integration

System Integration at the Unit Level



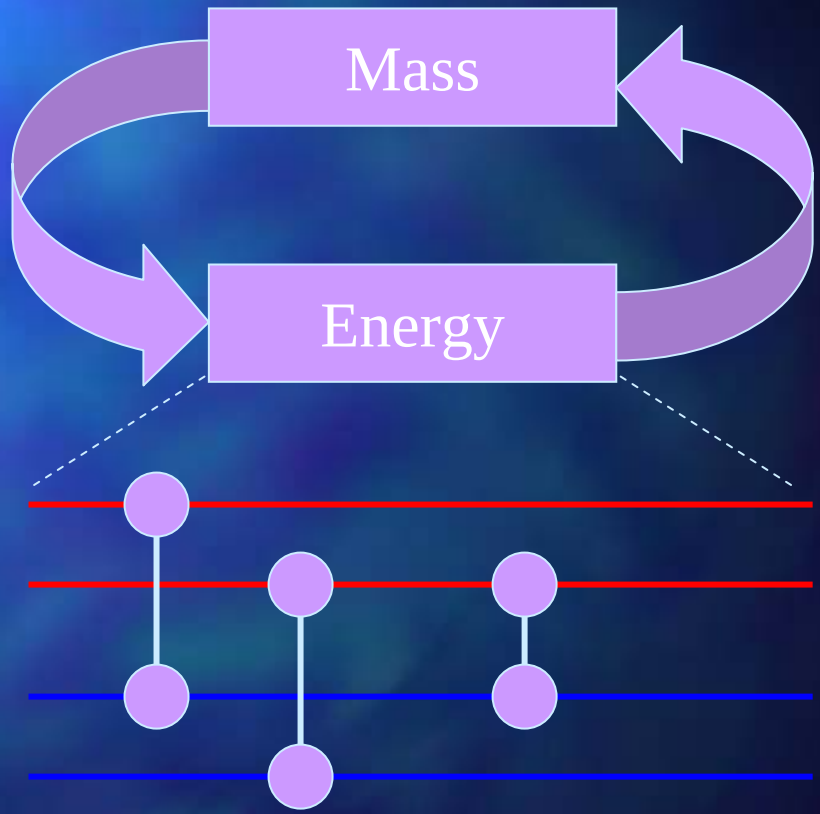
Reactor

Distillation



Reactive Distillation

Overall System Level Integration



Heat Exchanger Networks

Crude Oil Vs Biomass

Relatively Homogeneous Single Phase Liquid with “narrow” range of carbon numbers (C_2-C_{20}) accounting for bulk of mass.

Distillation as key separations operation

Occurs in dense geological timescale reservoirs with gas and solid removal at point of extraction to make thermodynamically stable.

Large scale bulk transportation possible

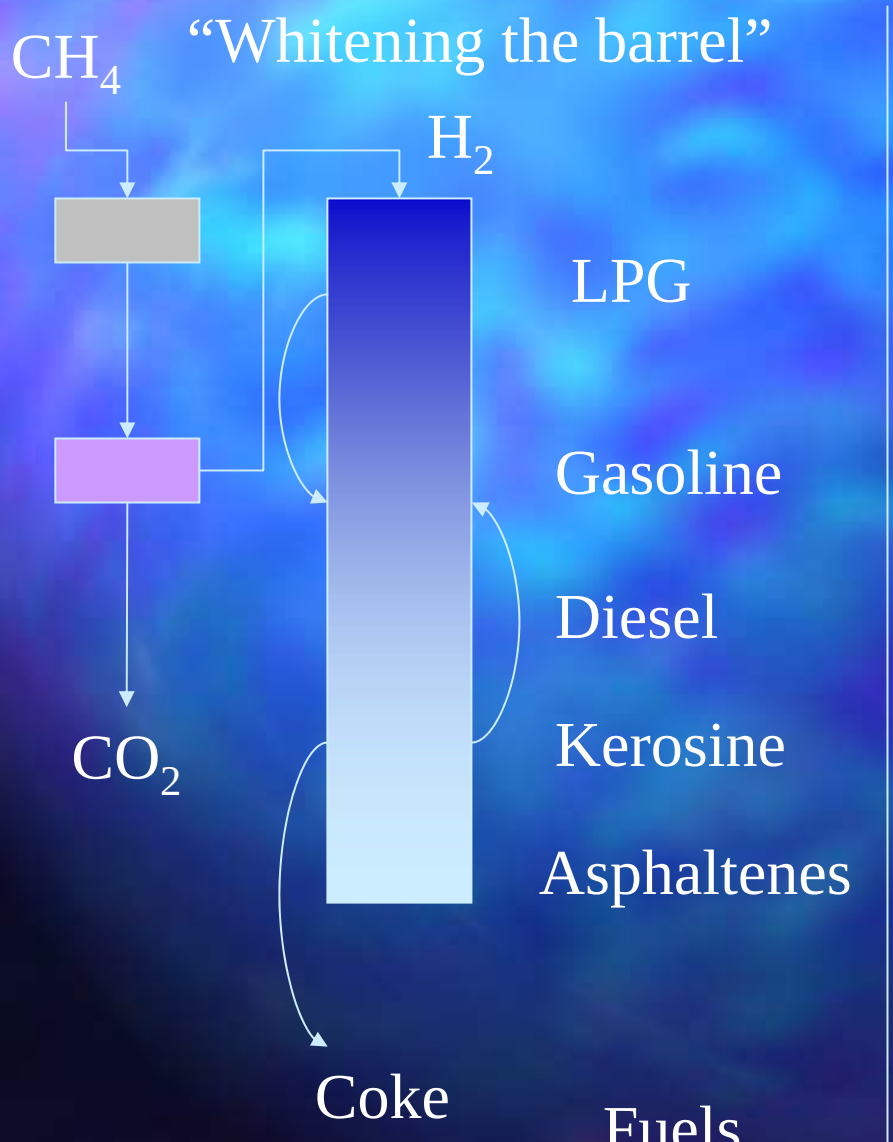
Solid polymeric system of heterogeneous monomers segregated into multiple phases and physical structures.

No single easy separation operation

Occurs in relatively distributed reservoirs that regenerate over short to medium time periods.

Flexible, local transportation infrastructure

Hydrocarbon Refinery Integration



ethylene

butane

benzene

toluene

xylene

Molecular bottlenecks

Hydrogen management

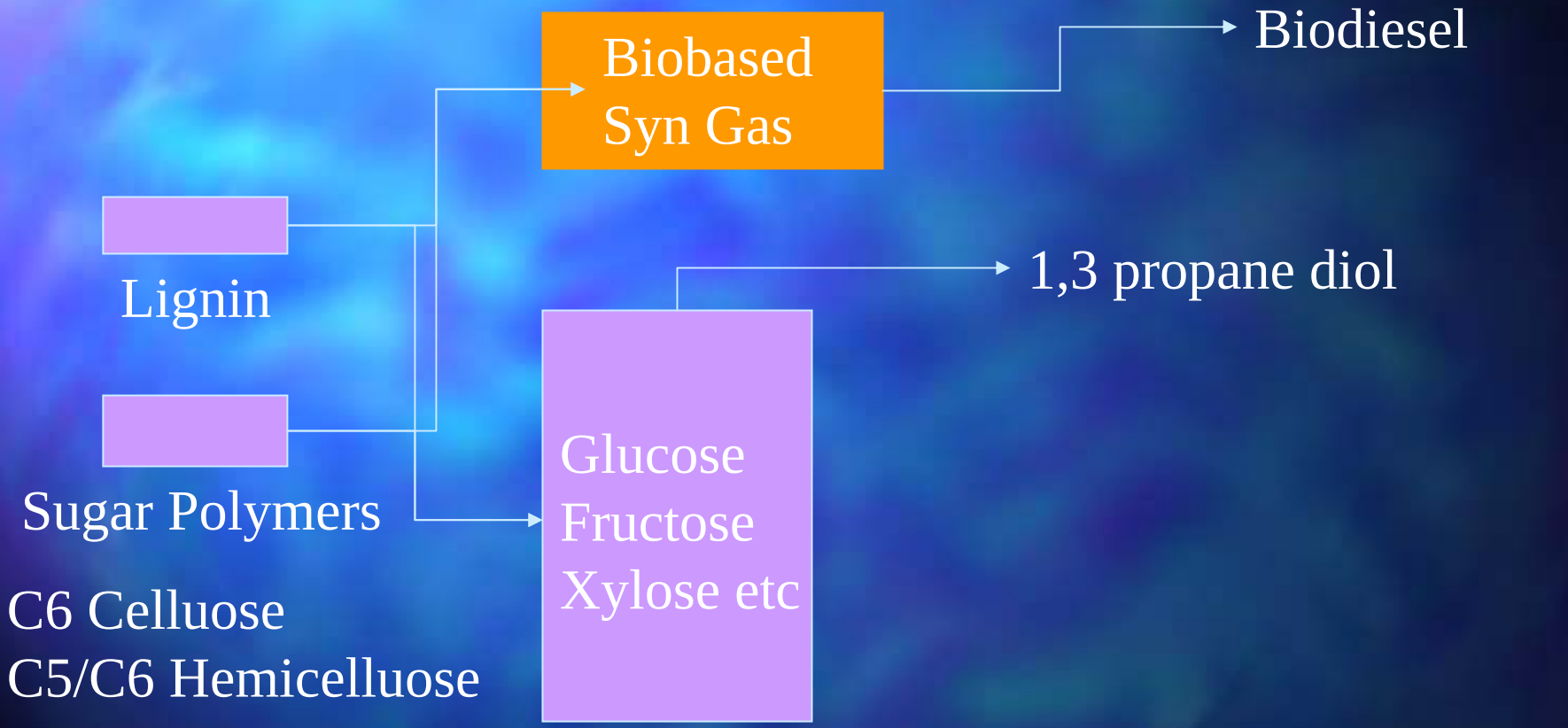
Carbon management

Energy management

Saturation Management

Biomass Refinery Types

Thermochemical Refinery



Sugar-based refinery

Secondary Chemicals

Molecular Bottleneck

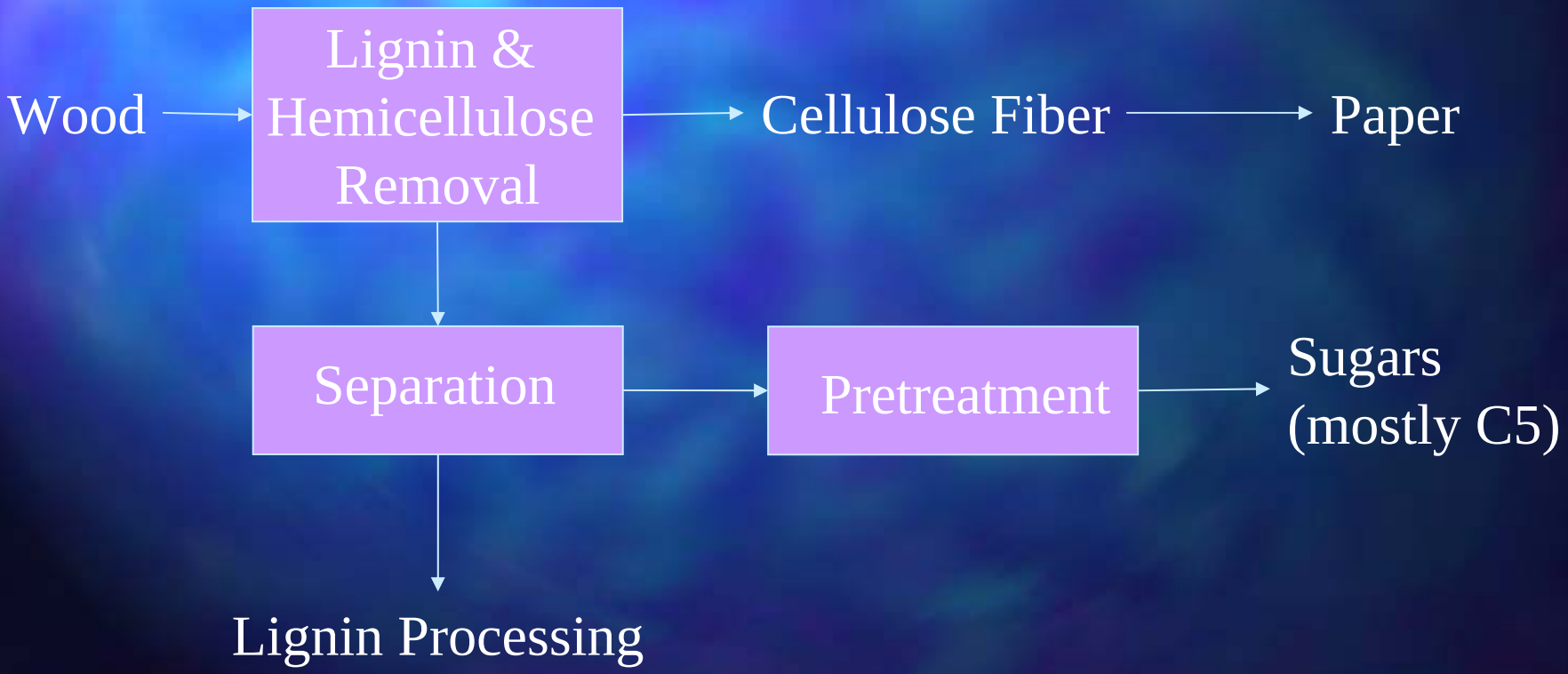
Wood Sugar Biorefinery

The use of cellulose for ethanol rather than fiber misses the point.

The hemicellulose sugars are not particularly desirable

The lignin is not particularly desirable

The energy available from sugar fermentation is low value



Wood Thermochemical Biorefinery

Mass of hemicellulose & lignin carried through the process.

Complex, high temperature combustion system

Efficient heat recovery possible & necessary

Product clean up necessary with high gas volumes and low contaminant concentrations.

Can combine unit operations at the unit level - chemical recovery, syn gas generation, biomass gasification.

My Opinion

Thermochemical conversion seems most attractive option for wood biorefineries - uncompetitive with corn biomass for sugar biorefineries.