Techno-Economic Assessment of Processes that Produce Jet Fuel from Plant-Derived Sources

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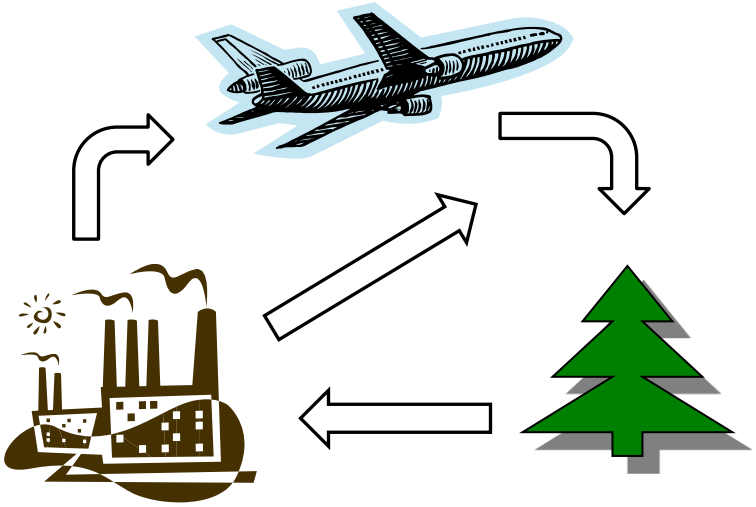
Content

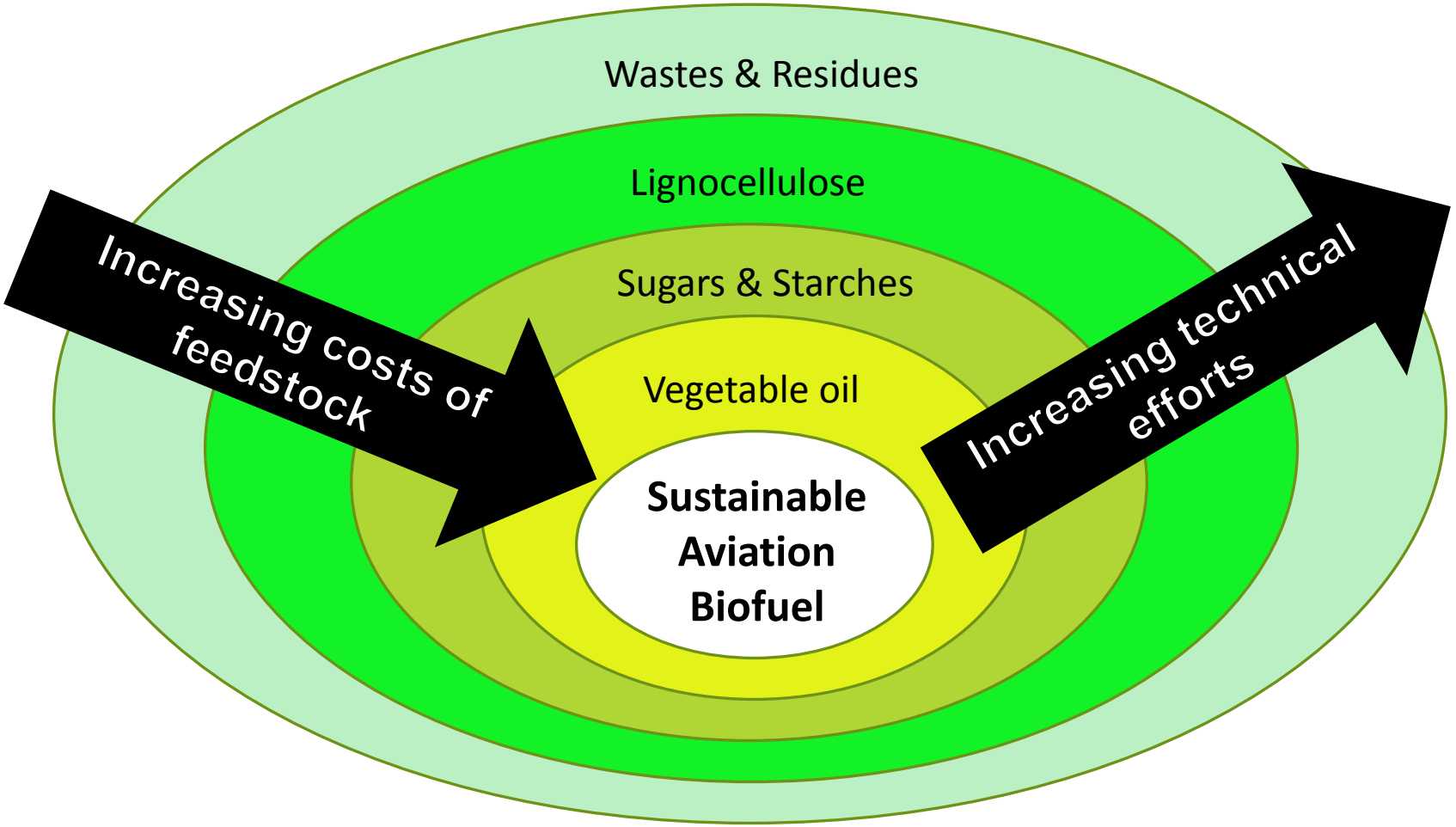
- Motivation
- Feedstock, product
- Objectives
- Investigated processes
- Approach
- Results
- Conclusions

Project motivation

- High consumption of Jet fuel
- Conventional Jet Fuel - high GHG emissions
- Non-fossil processes - low GHG emissions
- Closed carbon-cycle

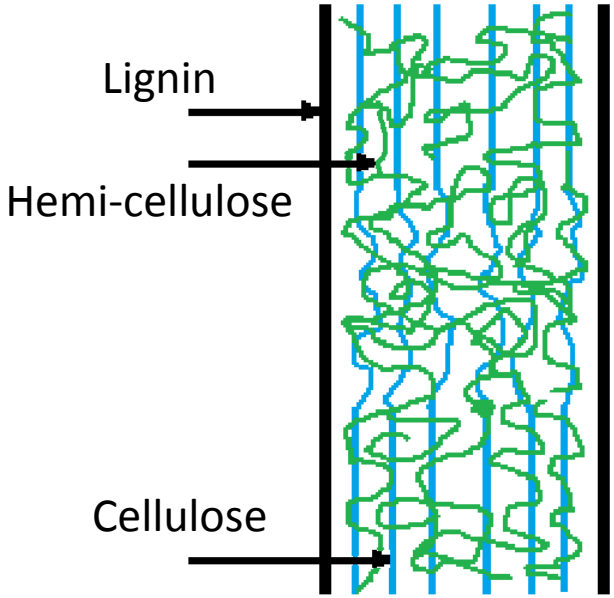


Feedstock


Wastes & Residues
Lignocellulose
Sugars & Starches
Vegetable oil
Sustainable Aviation Biofuel
Increasing costs of feedstock
Increasing technical efforts

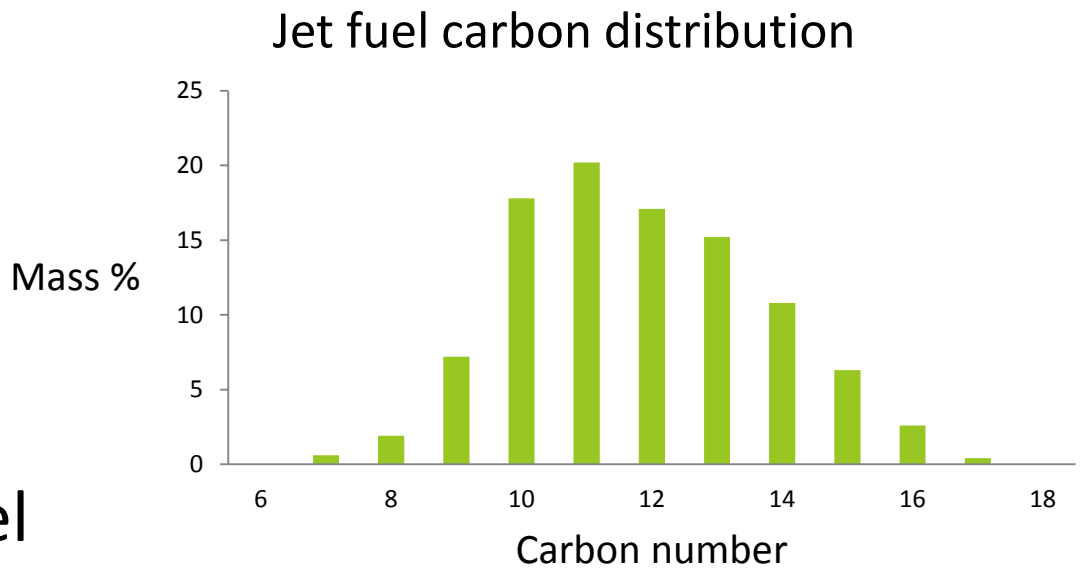
Lignocellulose

- Cellulose, hemi-cellulose and lignin
- Sources
  - Forest products
  - Energy crops
  - Wastes



Jet fuel

- Mixture of hydrocarbons



- “Drop-in” jet fuel

Objectives

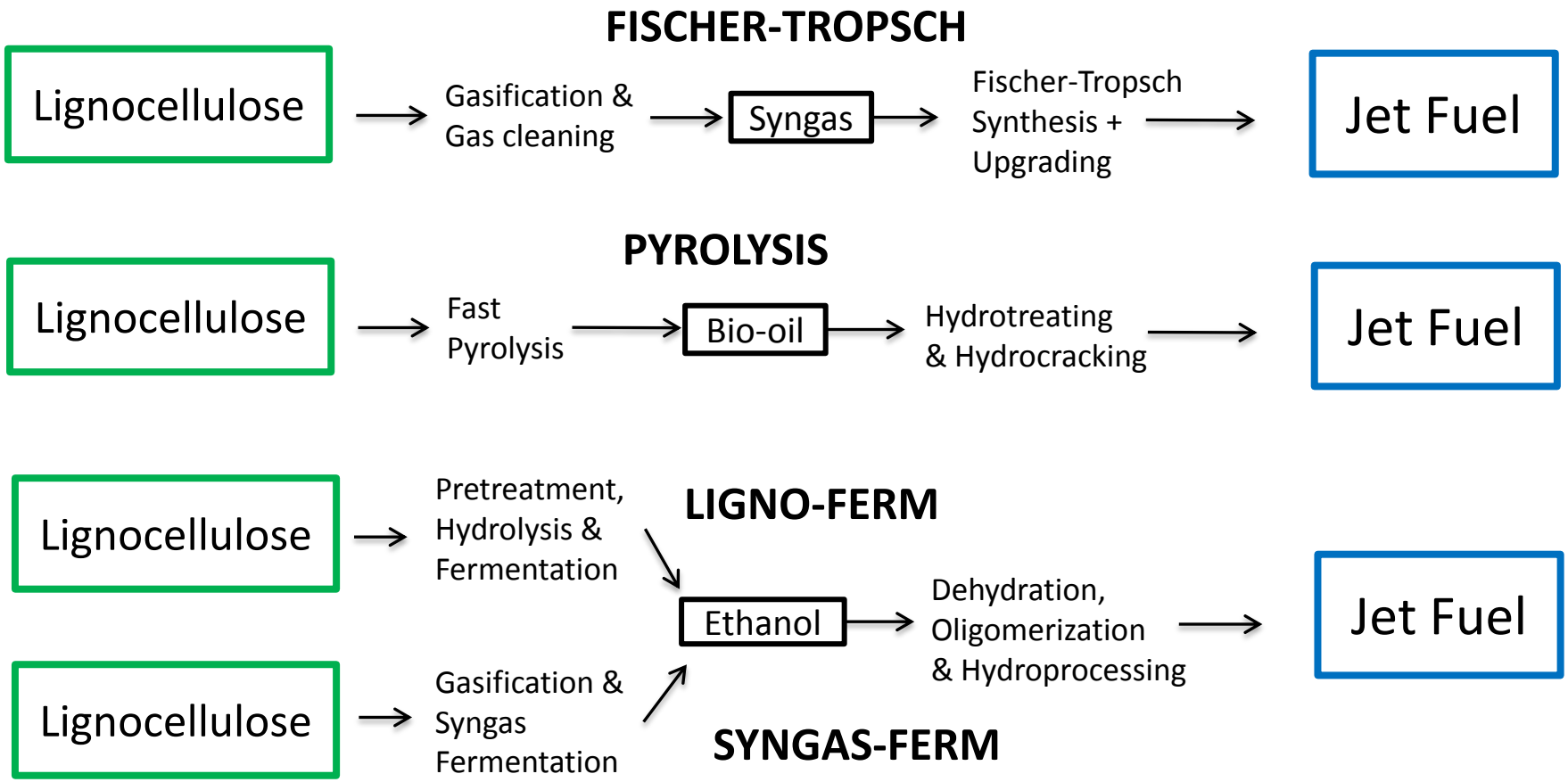
Main Objective:

- Compare lignocellulose to jet fuel processes

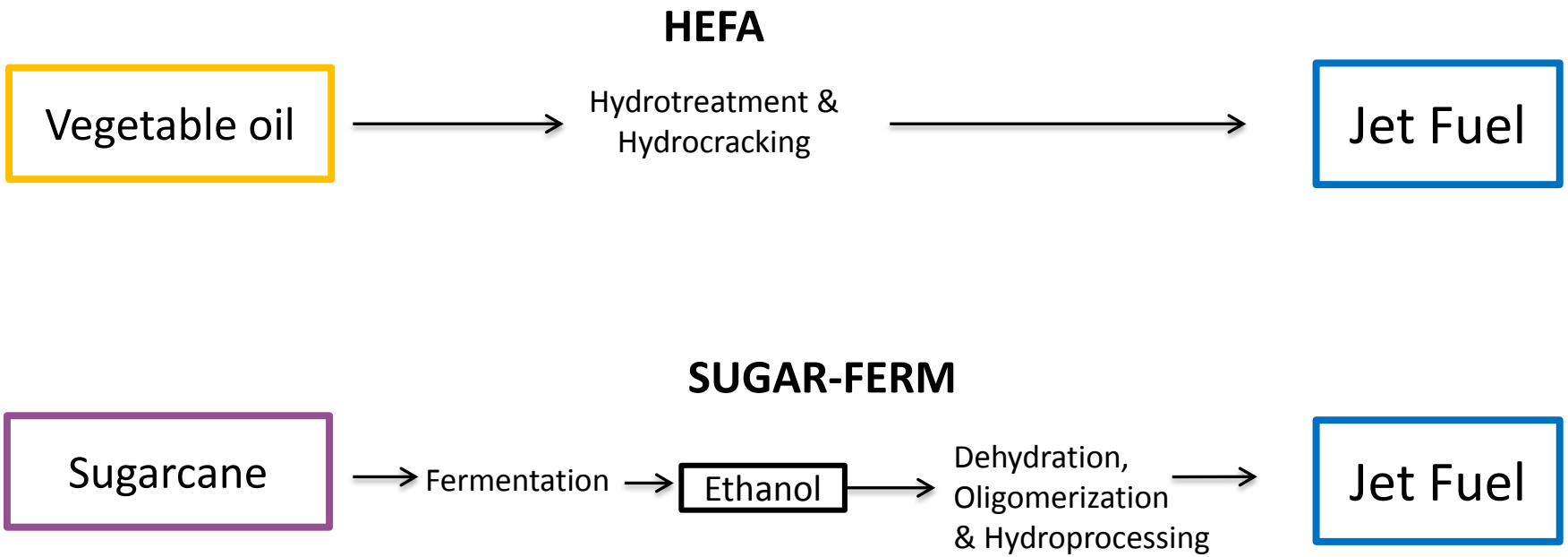
Minor Objectives:

- Compare plant-derived jet fuel production processes
- Commercial feasibility of lignocellulose to jet fuel processes

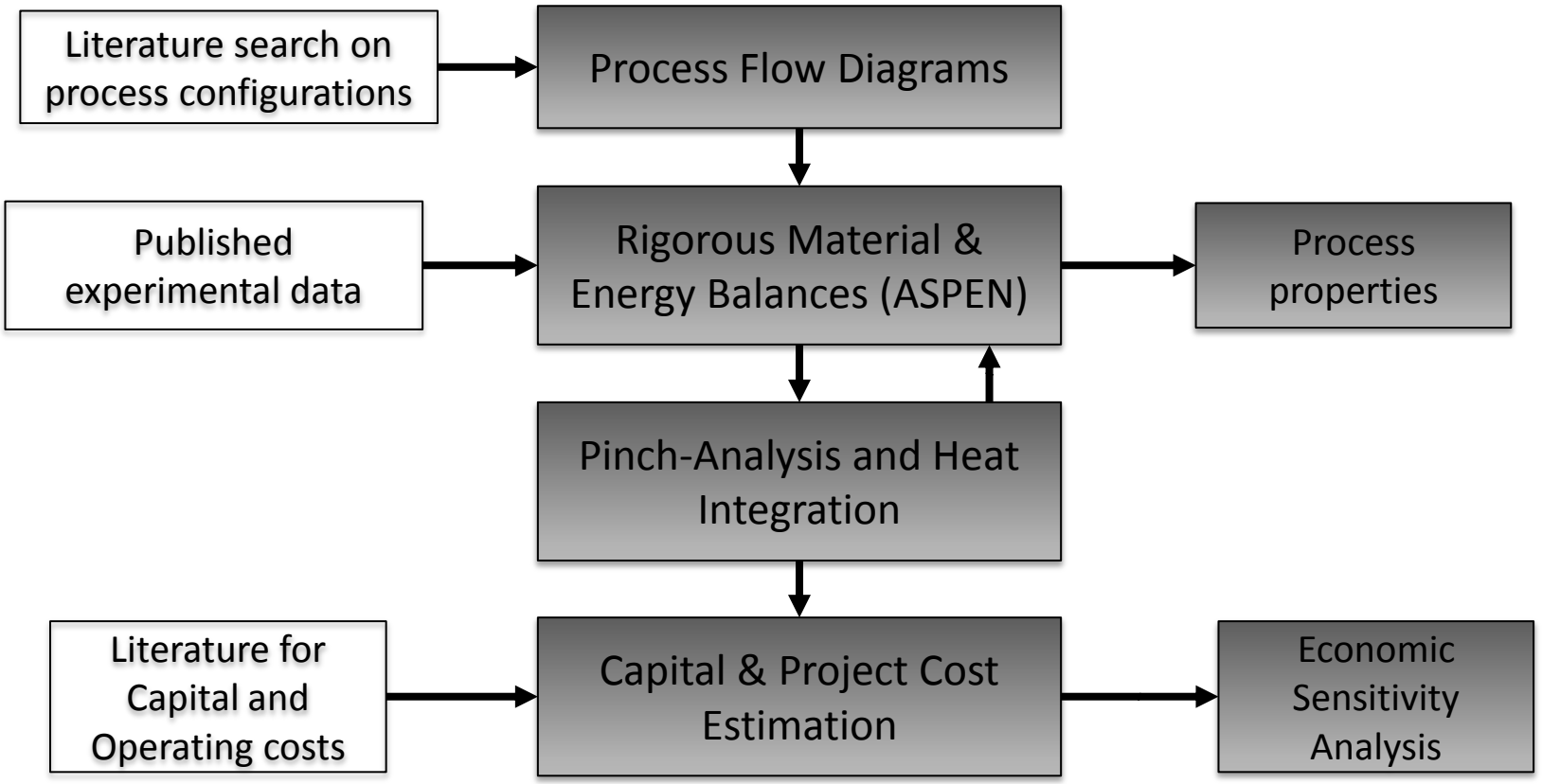
Lignocellulose-to-Jet processes



1G-to-Jet processes

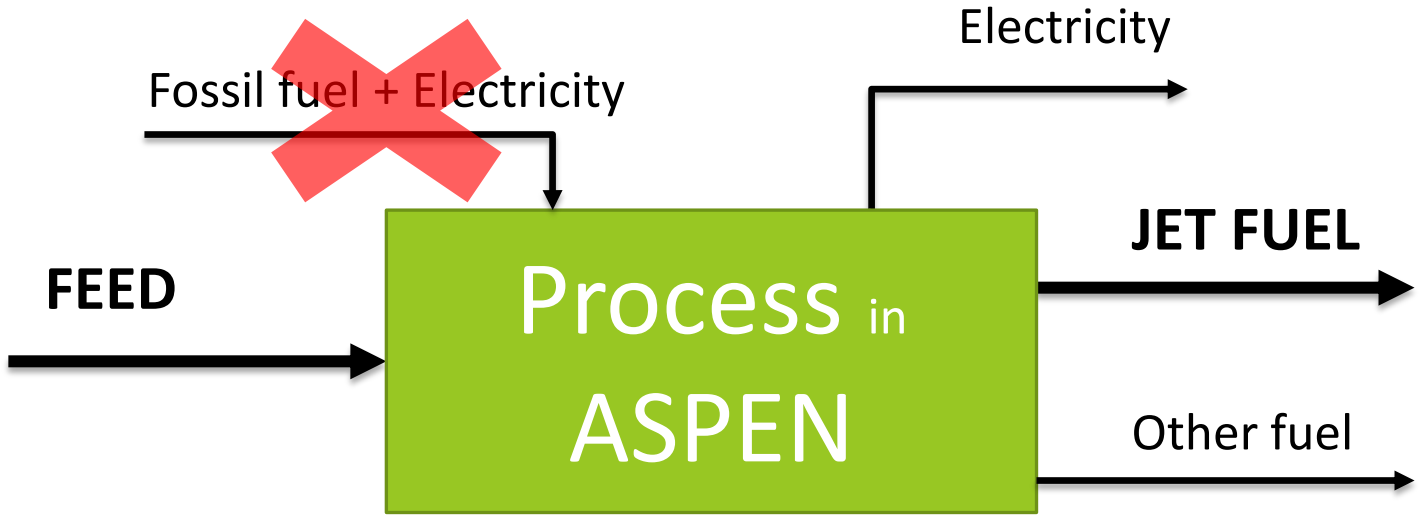


Approach


Literature search on process configurations
Process Flow Diagrams
Published experimental data
Rigorous Material & Energy Balances (ASPEN)
Process properties
Pinch-Analysis and Heat Integration
Literature for Capital and Operating costs
Capital & Project Cost Estimation
Economic Sensitivity Analysis

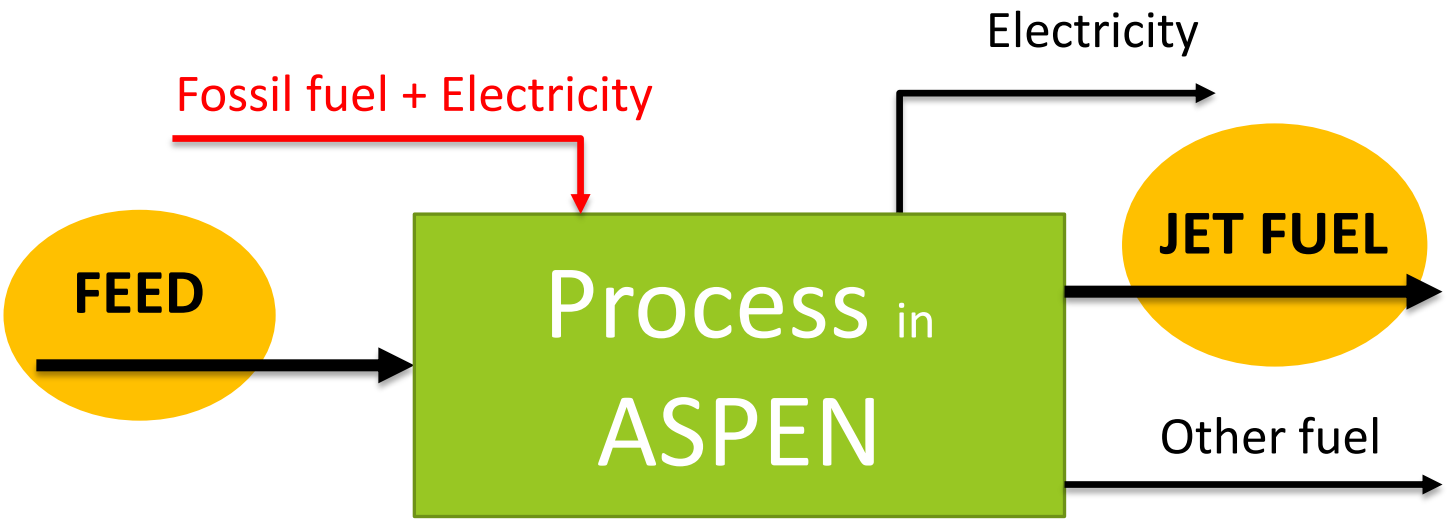
ASPEN Simulation

- Mass and Energy balances

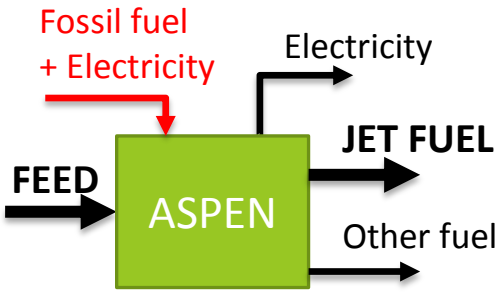


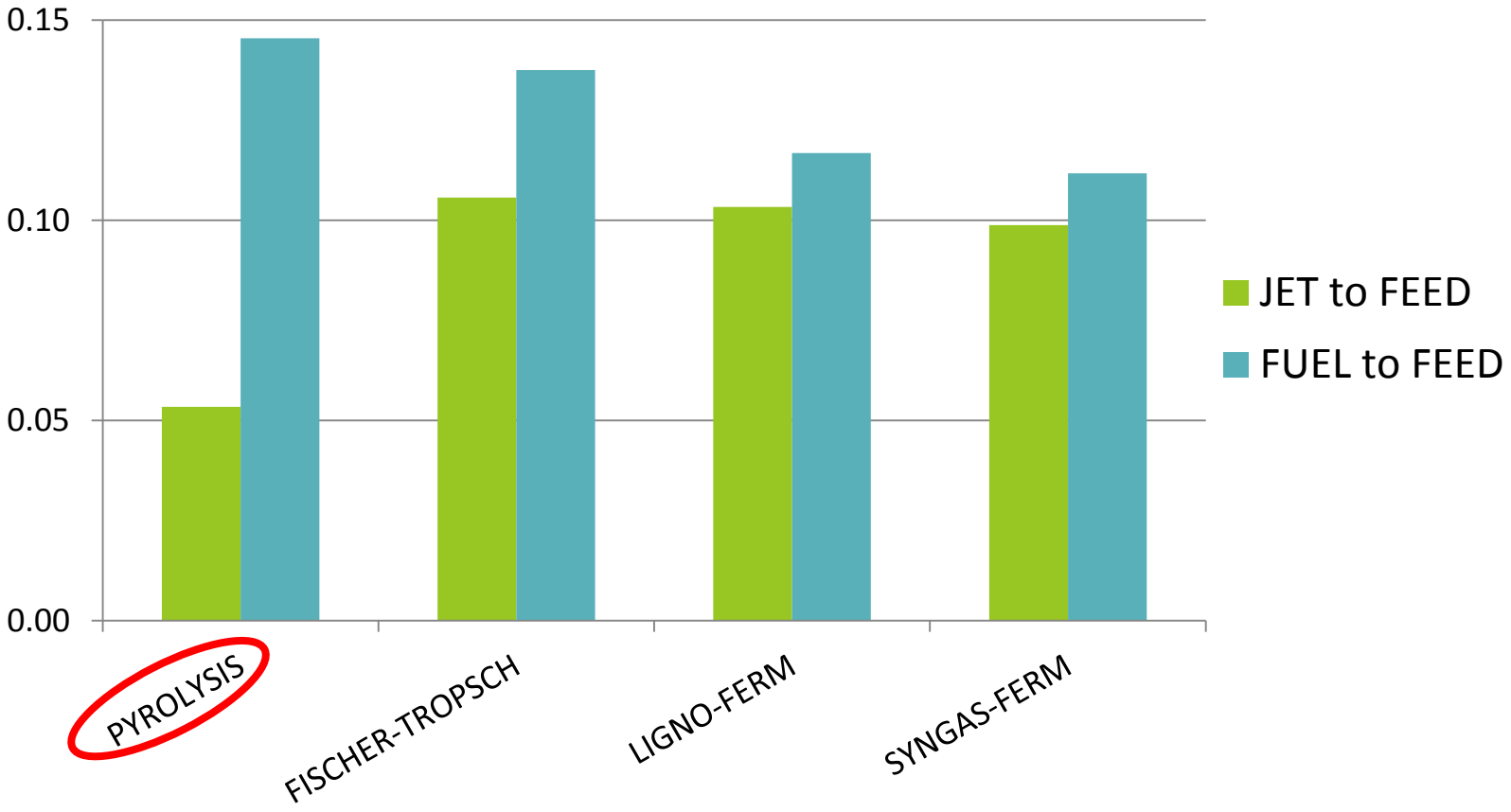
aspentech

Mass ratios

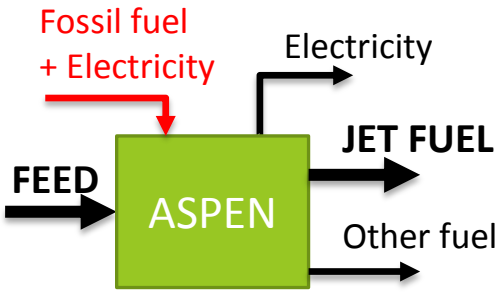

Electricity
Fossil fuel + Electricity
FEED
Process in ASPEN
JET FUEL
Other fuel

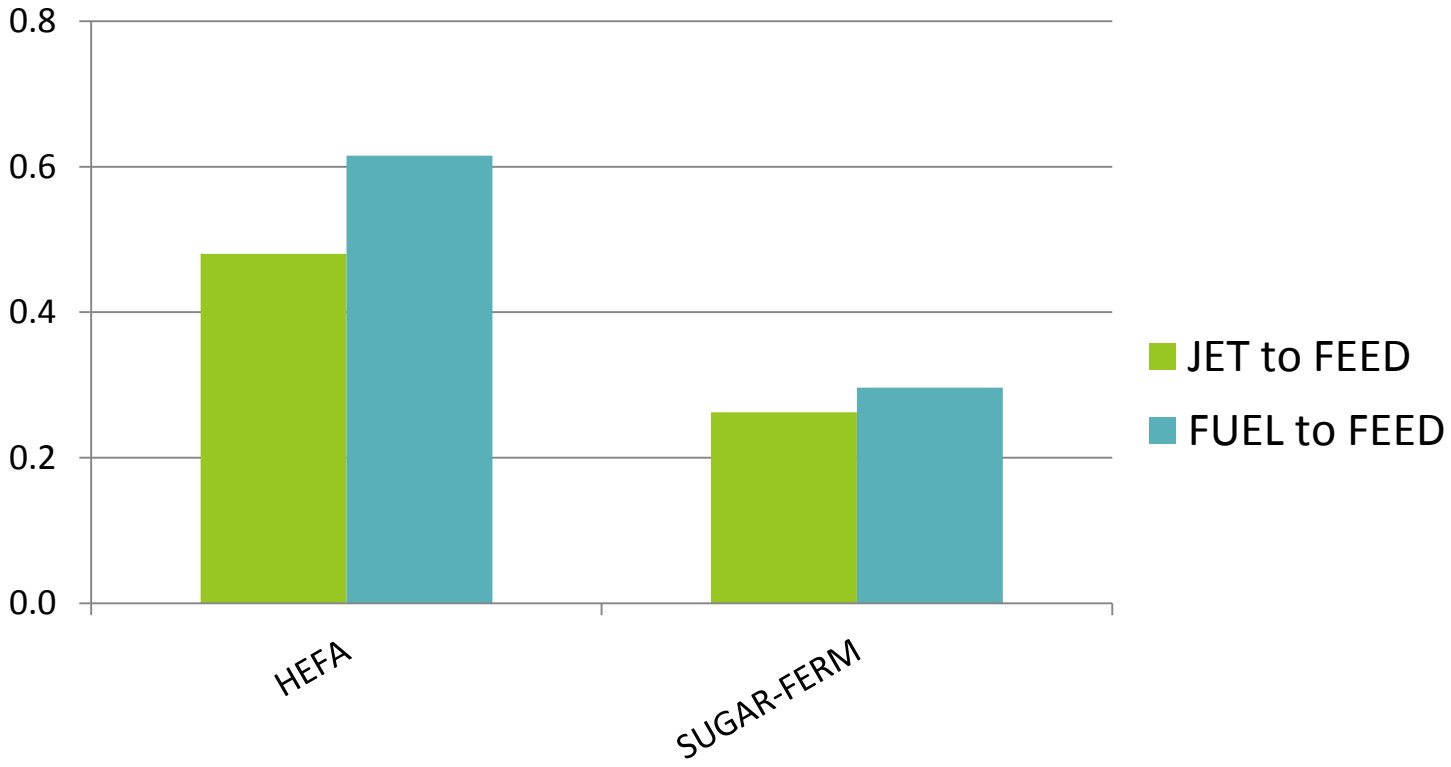
Mass ratios


Fossil fuel
+ Electricity
Electricity
JET FUEL
FEED
ASPEN
Other fuel

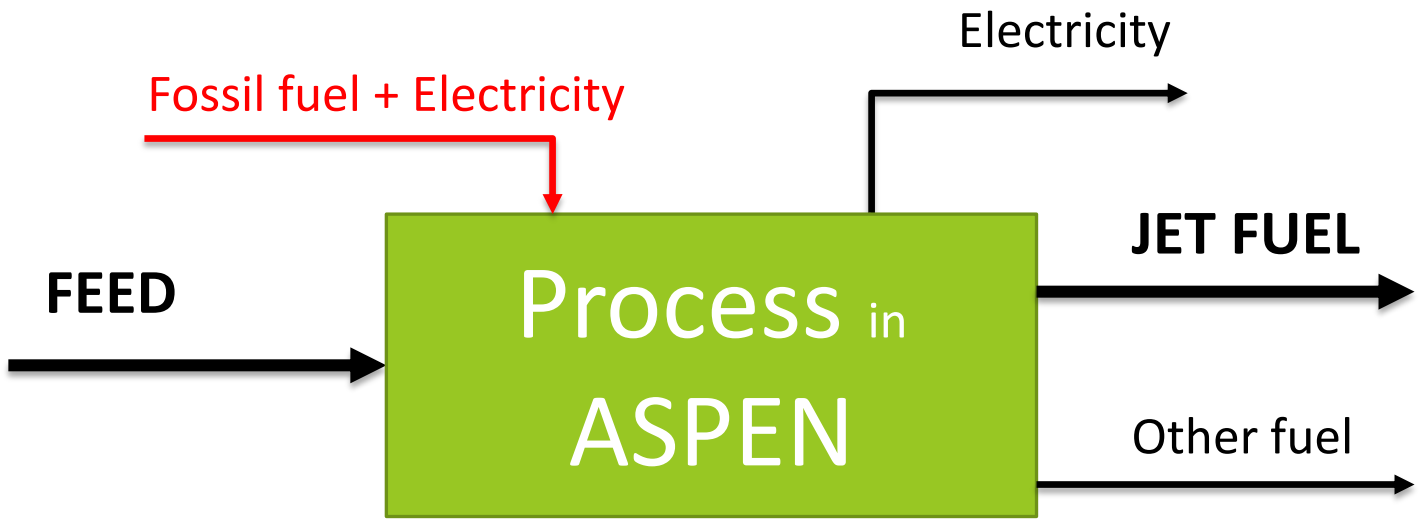

0.15
0.10
0.05
0.00
PYROLYSIS
FISCHER-TROPSCH
LIGNO-FERM
SYNGAS-FERM
JET to FEED
FUEL to FEED

Mass ratios

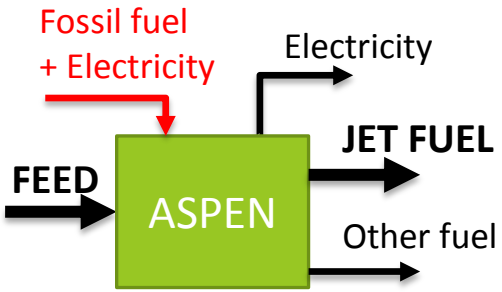

Fossil fuel
+ Electricity
Electricity
JET FUEL
FEED
ASPEN
Other fuel

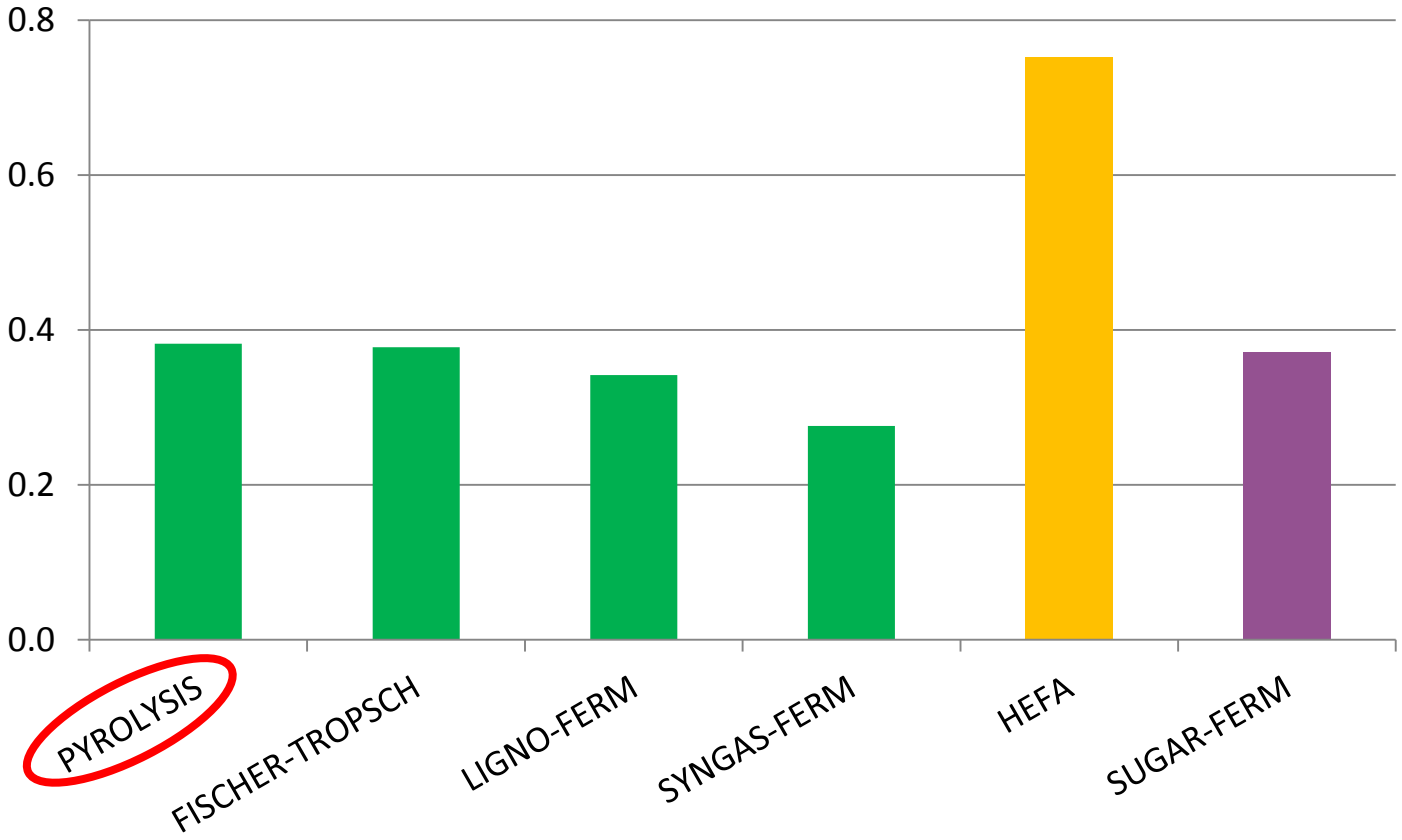

0.8
0.6
0.4
0.2
0.0
HEFA
SUGAR-FERM
JET to FEED
FUEL to FEED

Overall Energy Efficiencies

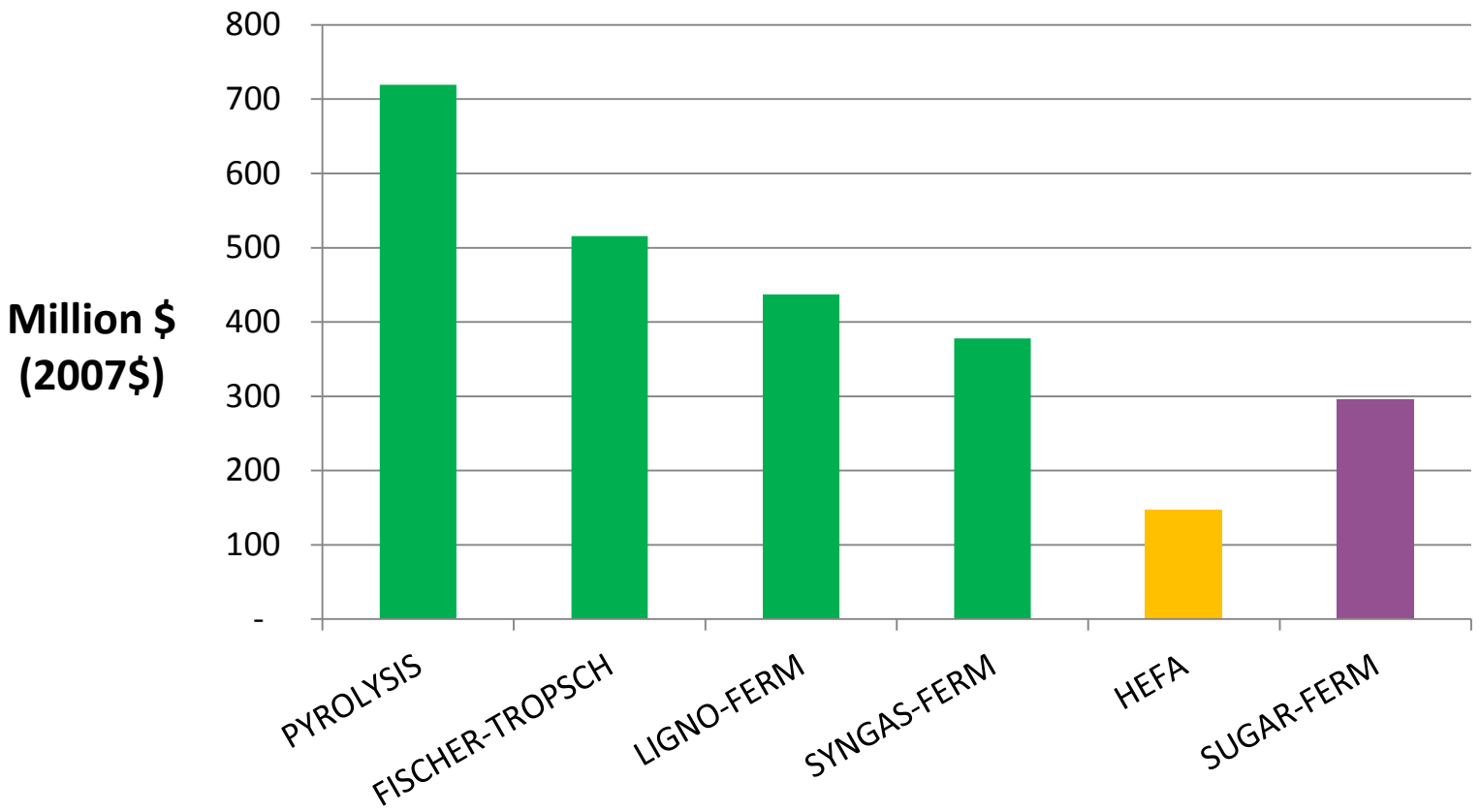


Overall Energy Efficiencies

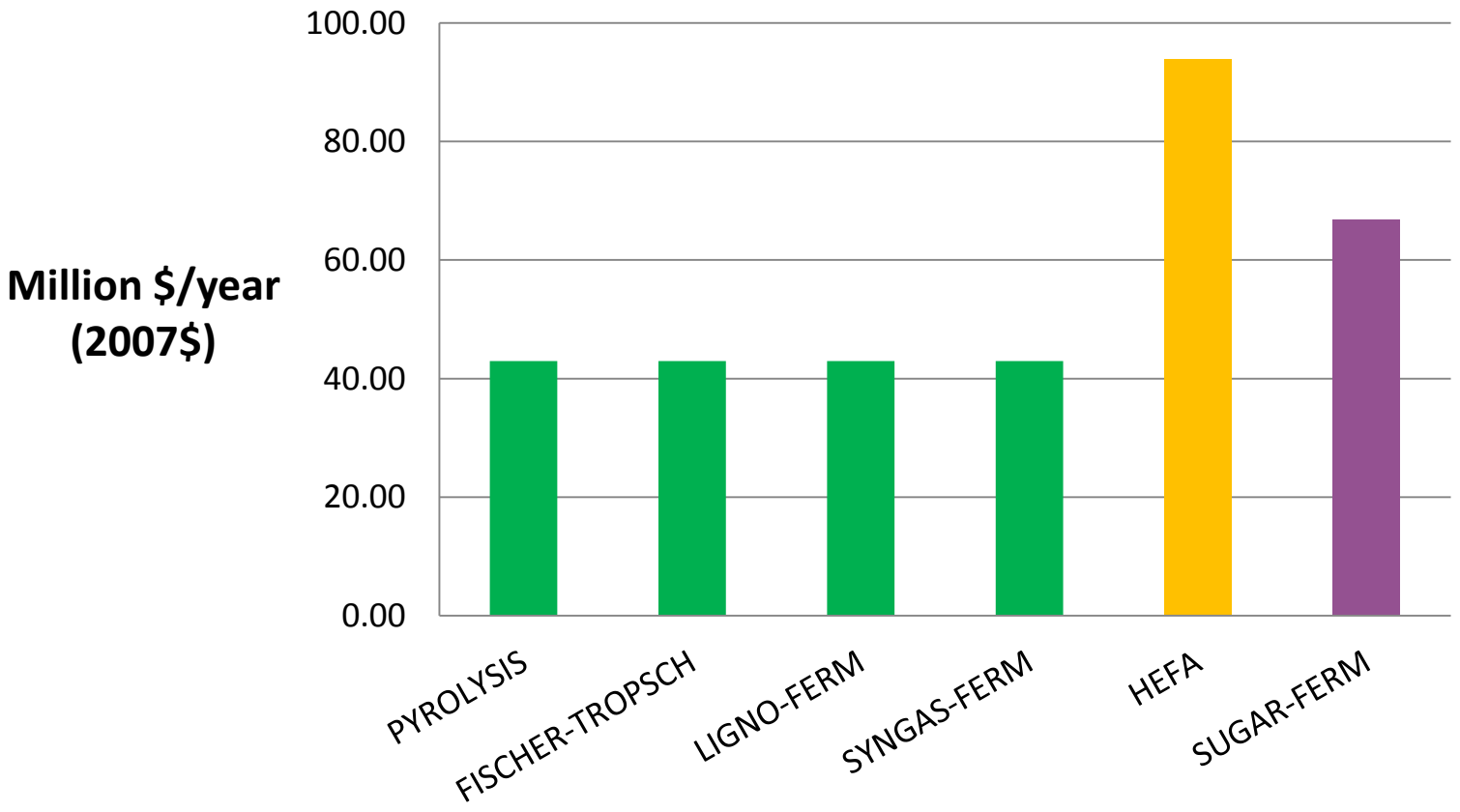




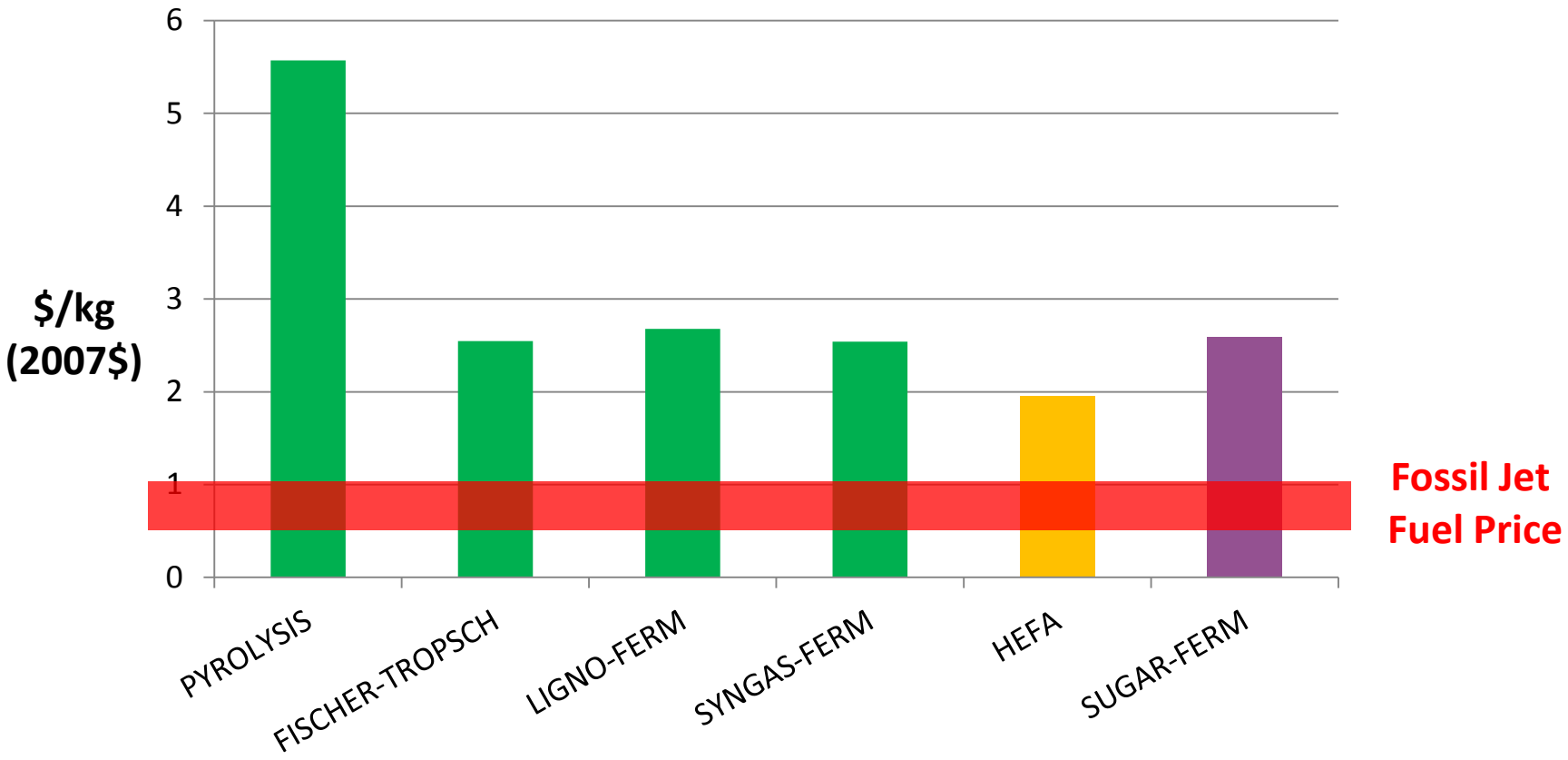
Process Capital Cost



Feedstock Cost



Minimum Jet Selling Price



Conclusions (thus far)

- Lignocellulose – promising for jet fuel
- No outright winner
- Biogenic jet fuel is expensive!
- Further investigate GHG emissions

Further work

- Economic sensitivity analysis
- Comparison of processes

Acknowledgements

- CRSES