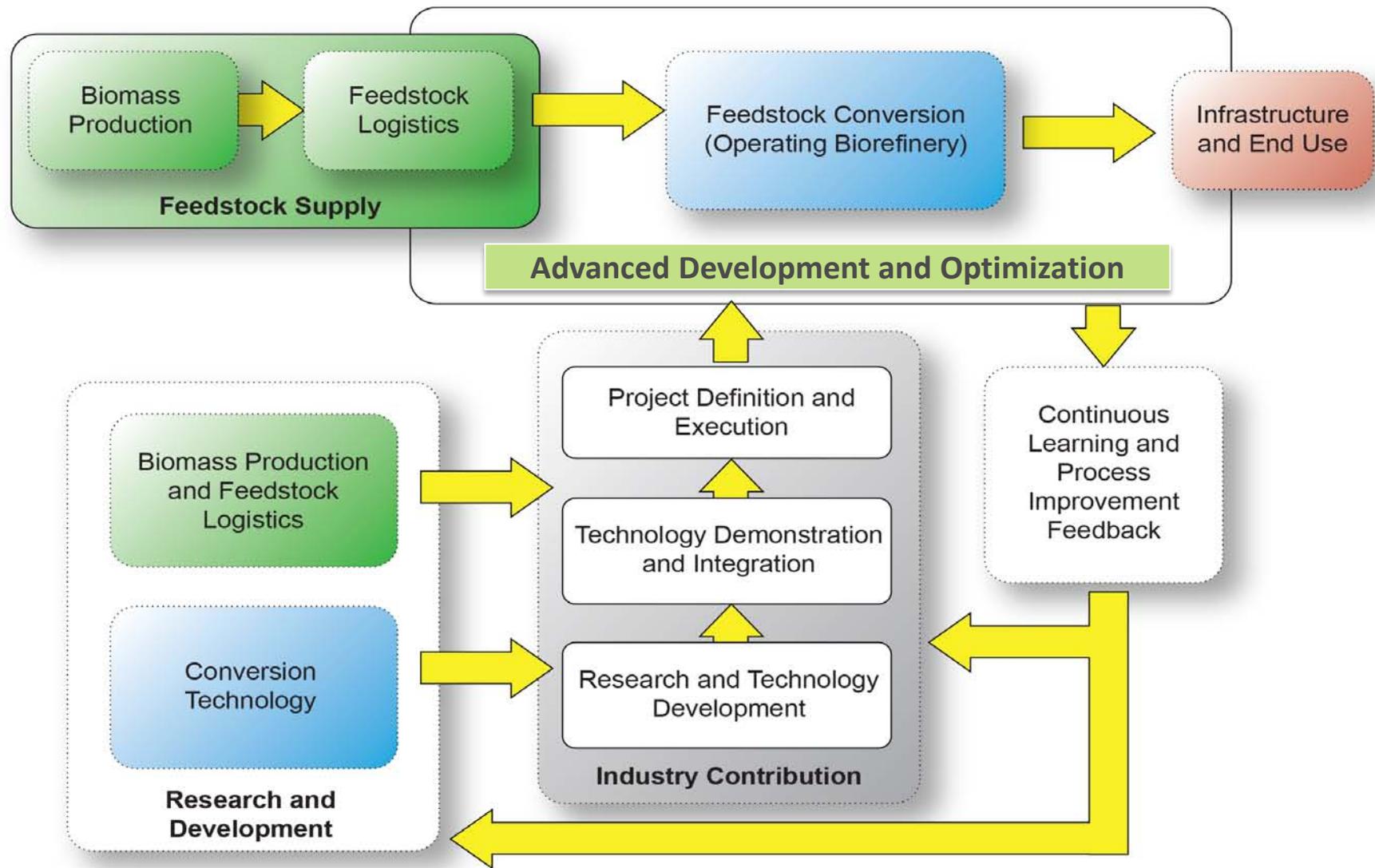


ADO Workshop
December 12 and 13, 2017

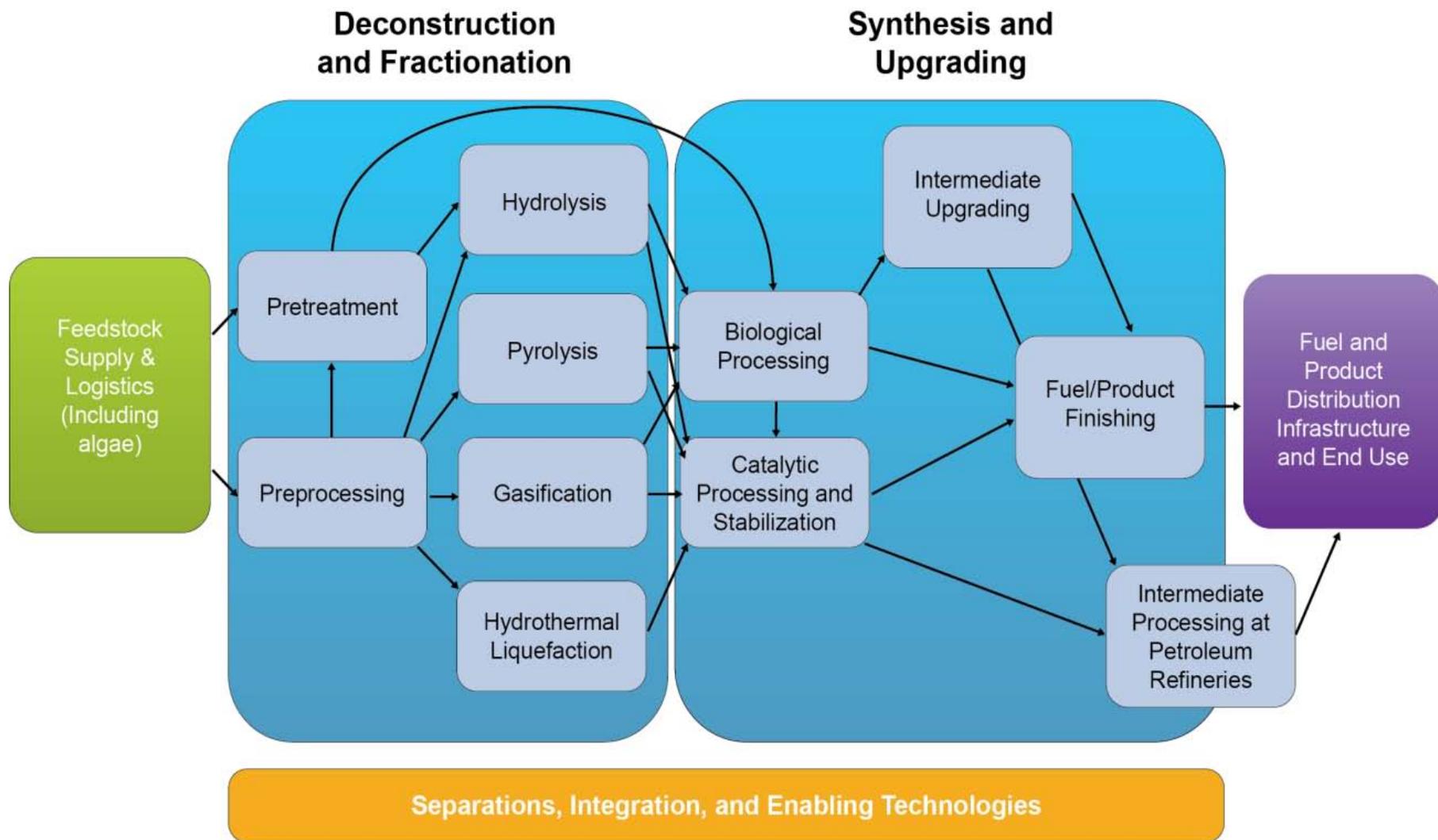
Thermochemical Conversion
Liz Moore
ADO Technology Manager

Scope of Advanced Development and Optimization



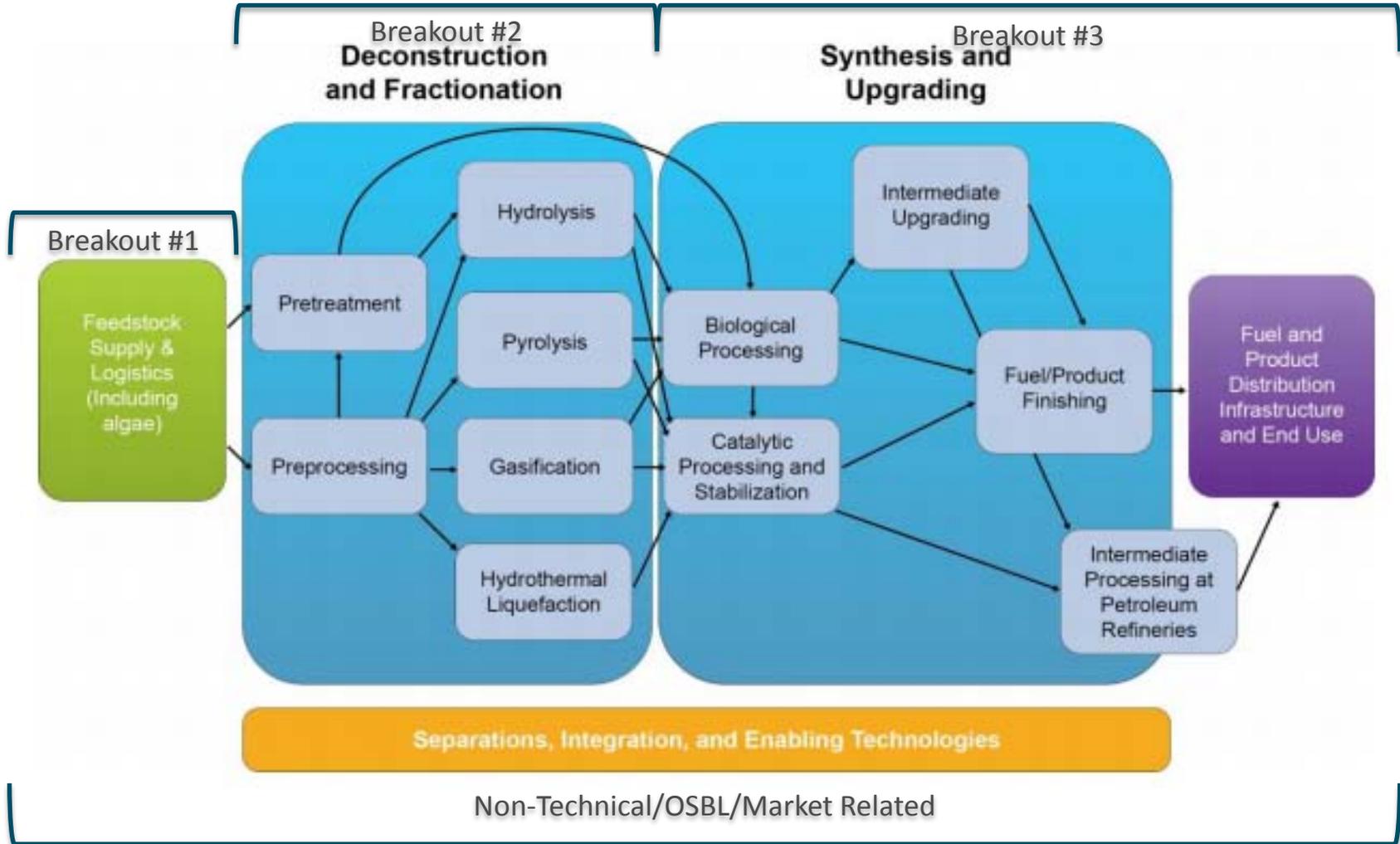
Reference: MYPP

Conversion Pathways from Feedstocks to Products



Reference: MYPP

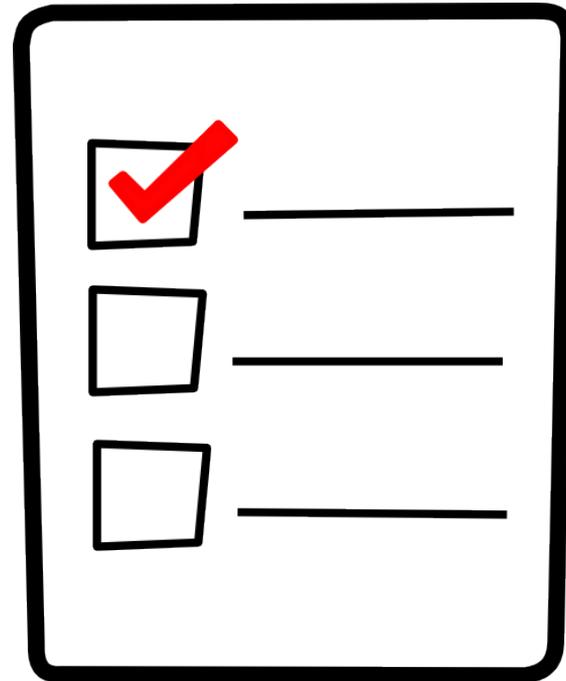
Breakout Session Topics:



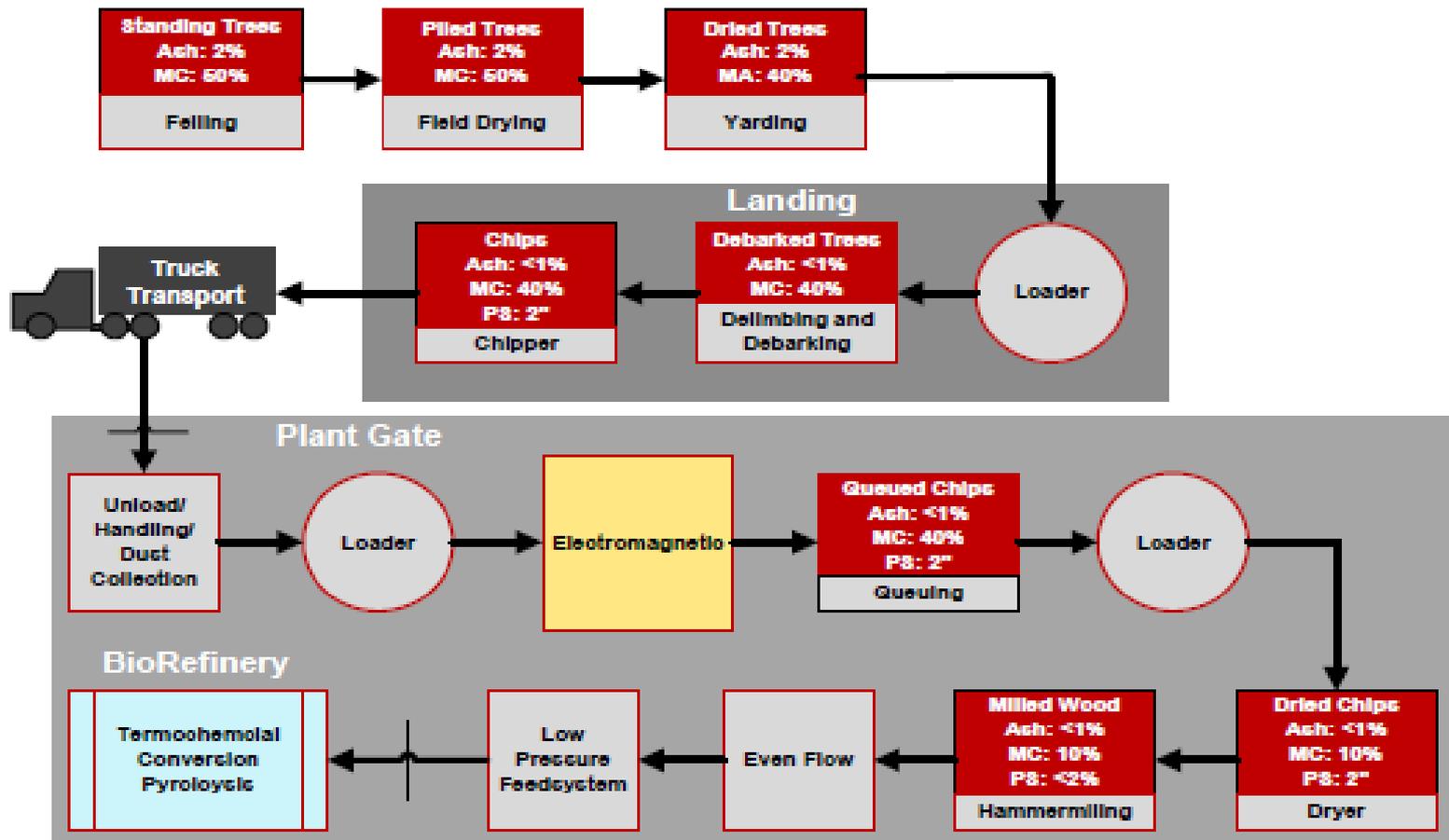
High Temperature Conversion

Feedstock Logistics High Priority Challenges

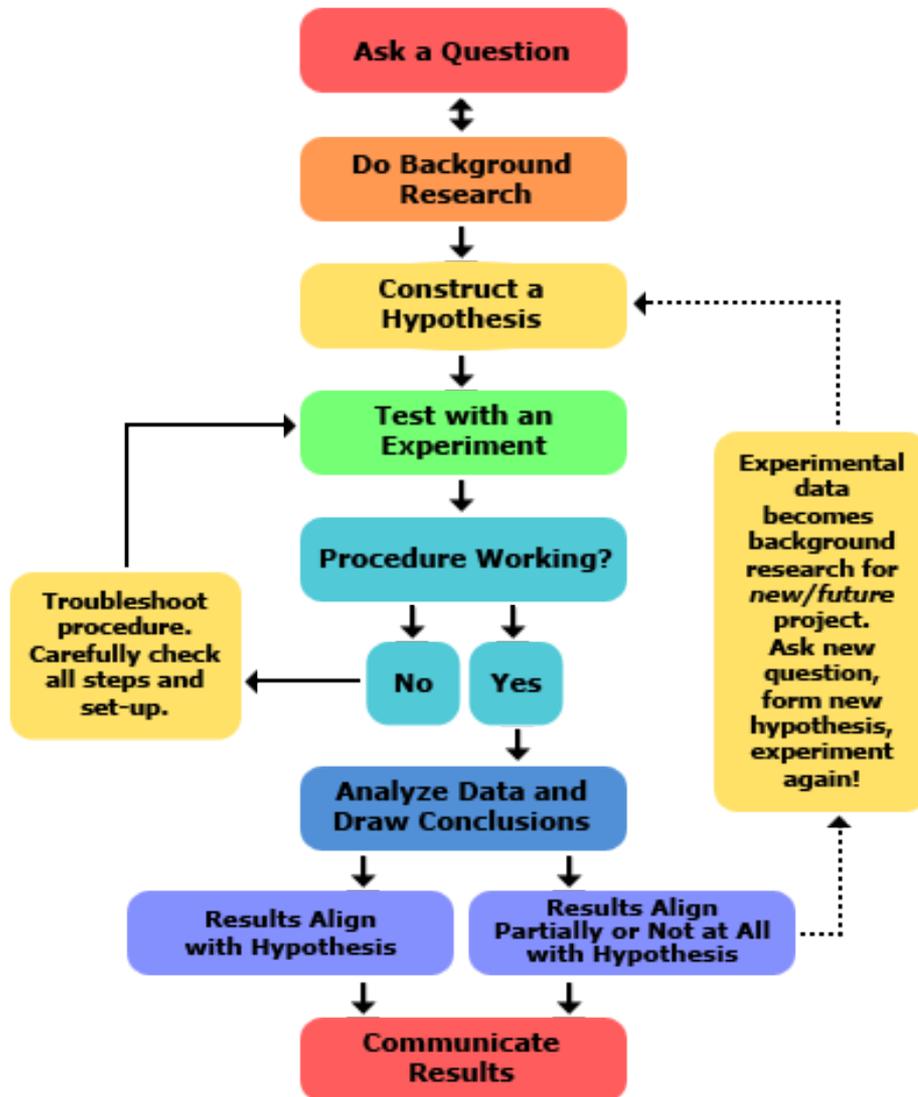
- Feedstock characterization/specification/preprocessing
 - What specifications exist?
 - How to measure real-time?
- Crossing high temperature/pressure thresholds
 - Lock hoppers, augers, etc...
 - Formatted feedstocks
- Verifying RIN/RFS compatibility
 - Using blended feedstocks
 - Technical and regulatory concerns
- Durable materials of construction
 - Balance CapEx vs. OpEx
-
-
-



Example Feedstock Logistics Flow Diagram:



Back to Basics:

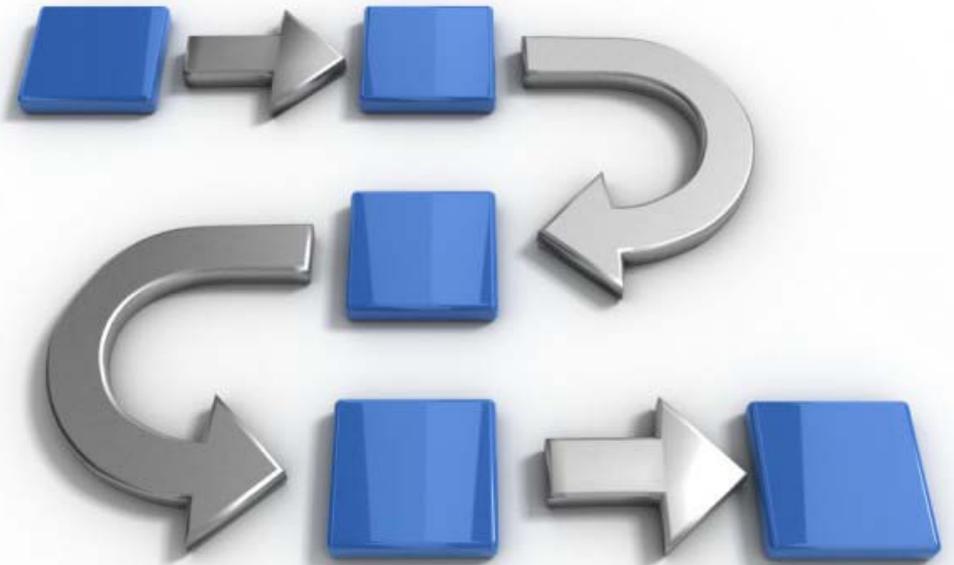


- What is the underlying unknown with each challenge?
- Do we know what the key parameters are?
- Can we measure them?
- What correlations may exist?
- What can we control?
- Are the solutions industrially relevant?

High Temperature Conversion

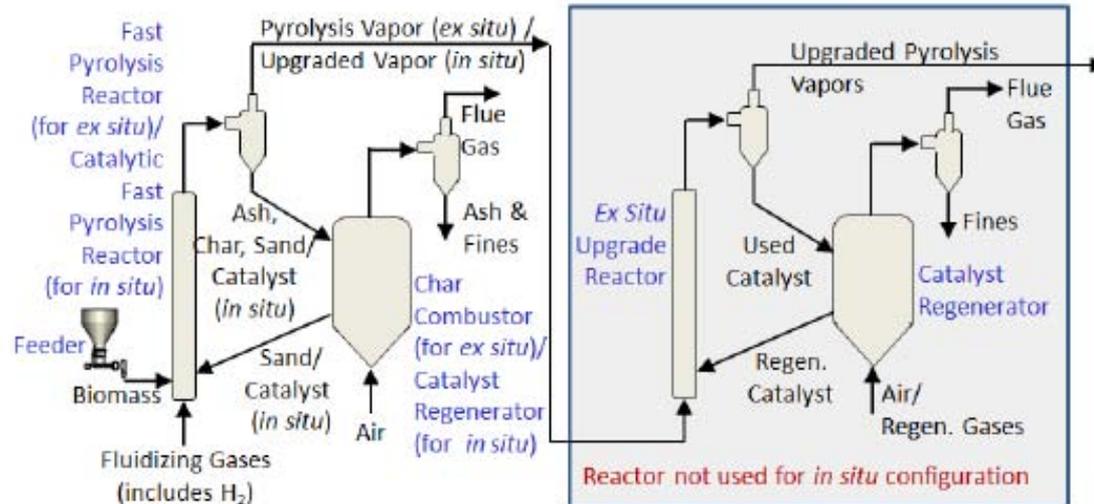
Deconstruction & Fractionation Challenges

- Continuous ash, char, and tar removal at system conditions
- Intermediate characterization, clean-up, and stabilization
- Durable materials of construction
- Separations (all phases)
- Catalytic deconstruction
- Heat transfer
-
-
-

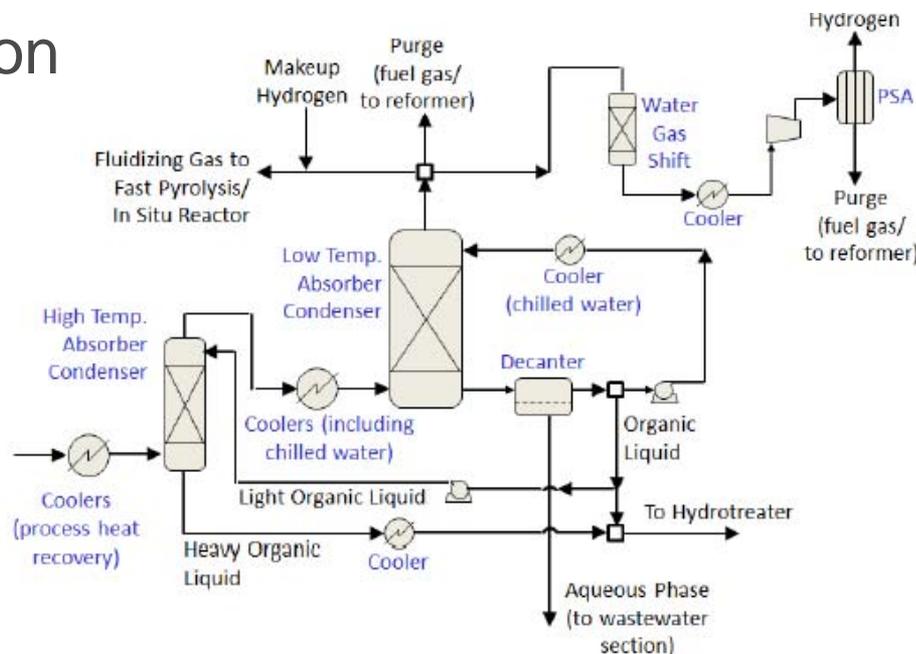


Example Pyrolysis & Stabilization Flow Diagram:

Deconstruction



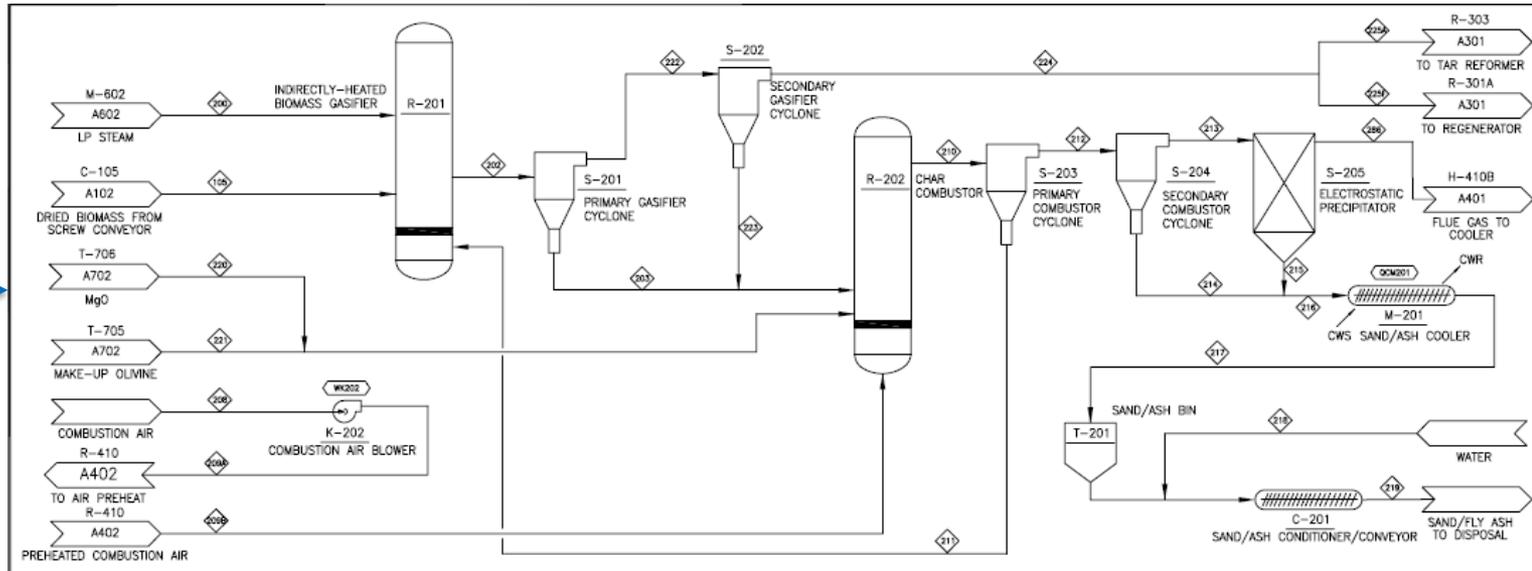
Stabilization



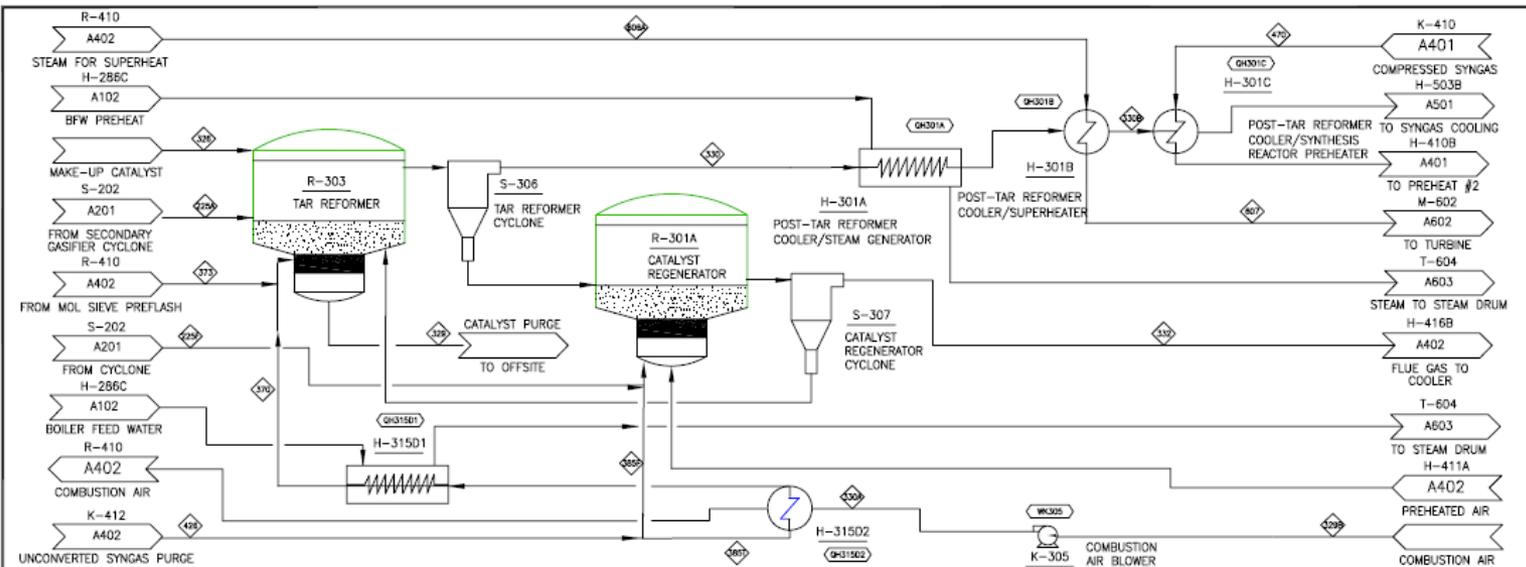
Process Design and Economics for the Conversion of Lignocellulosic Biomass to Hydrocarbon Fuels
Thermochemical Research Pathways with *In Situ* and *Ex Situ* Upgrading of Fast Pyrolysis Vapors
<https://www.nrel.gov/docs/fy15osti/62455.pdf>

Example Gasification & Clean-up Flow Diagram:

Gasification

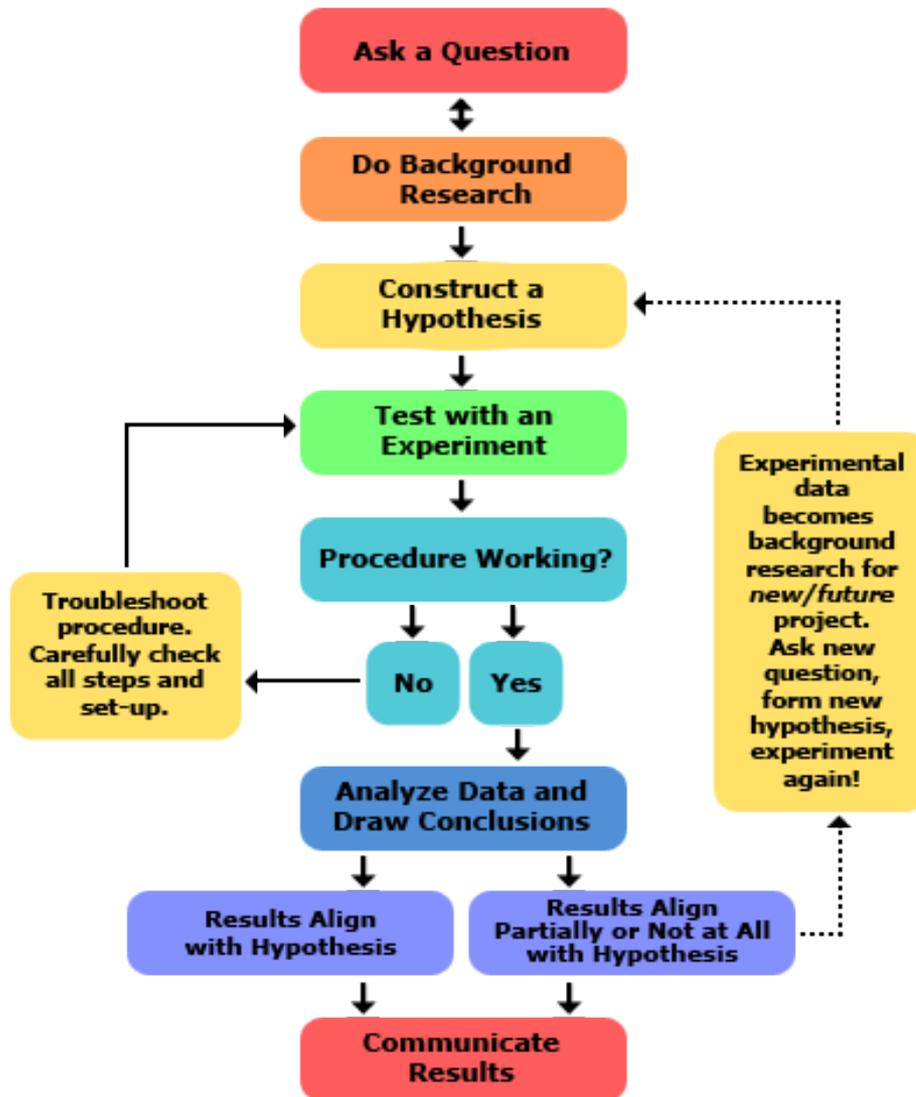


Tar Reforming (Clean-up, Compression)



Thermochemical Ethanol via Indirect Gasification and Mixed Alcohol Synthesis of Lignocellulosic Biomass
<https://www.nrel.gov/docs/fy07osti/41168.pdf>

Back to Basics:



- What is the underlying unknown with each challenge?
- Do we know what the key parameters are?
- Can we measure them?
- What correlations may exist?
- What can we control?

High Temperature Conversion

Synthesis & Upgrading Challenges

- Hydrogen efficiency & availability
- Product certification
- Durable materials of construction
- Distributed processing
- Catalyst selectivity & availability
-
-
-

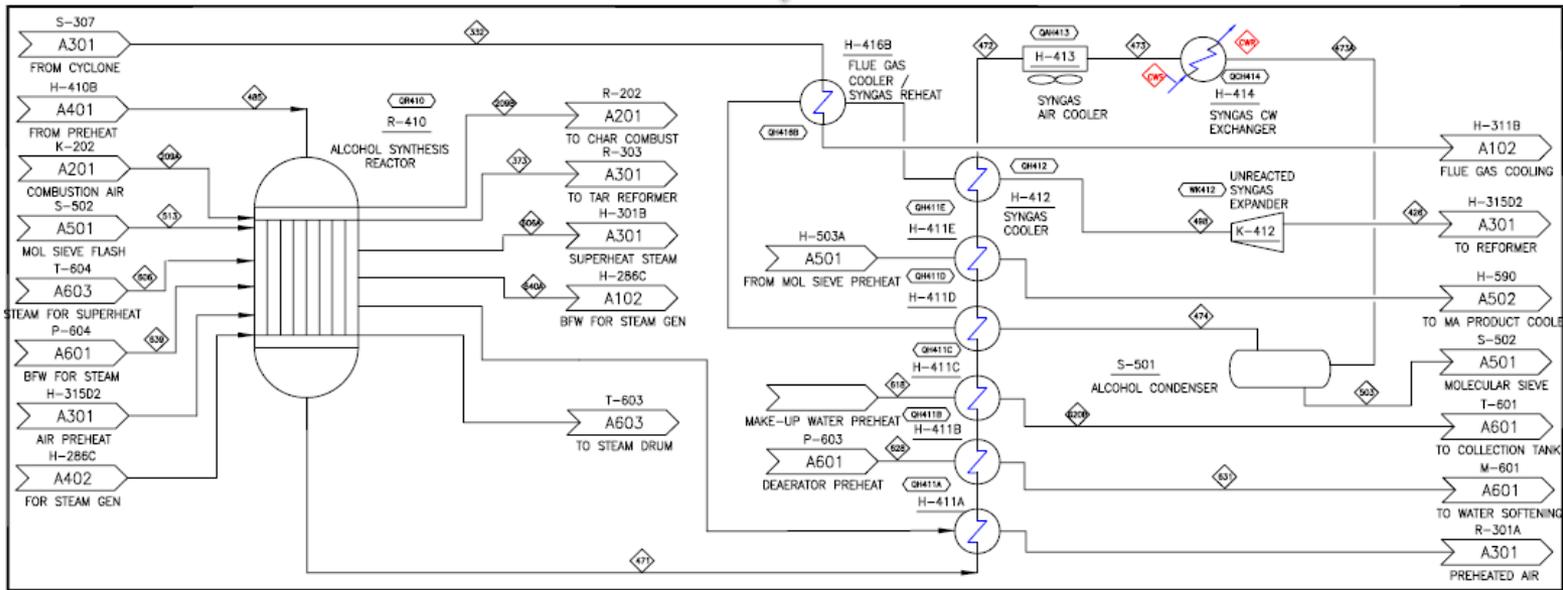
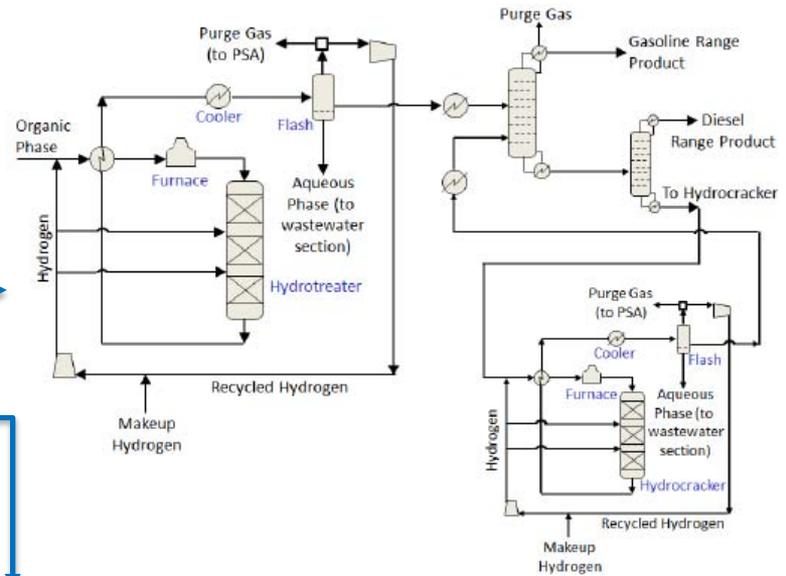
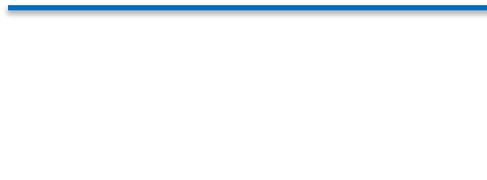


Example Hydrotreating & Fuels Synthesis Flow Diagrams:

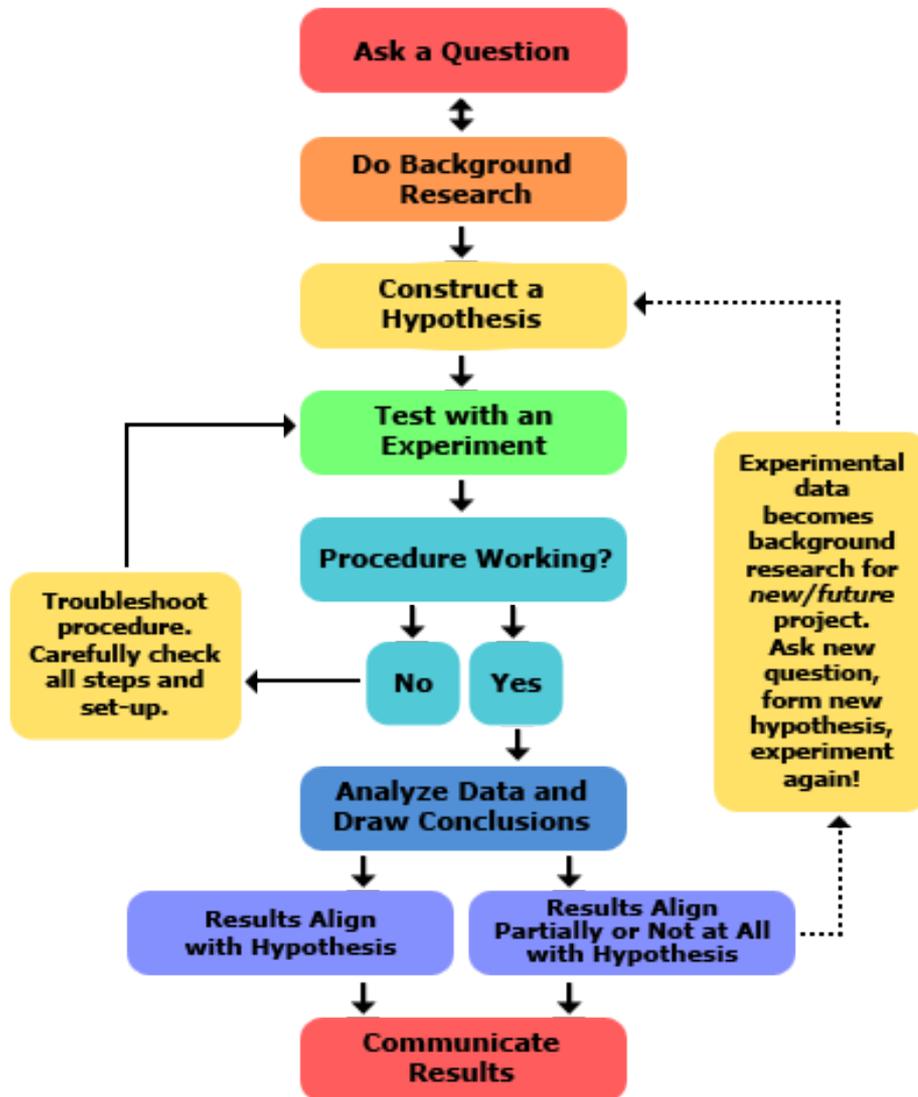
Hydrotreating



Alcohol Synthesis
(also, ATJ, other)



Back to Basics:



- What is the underlying unknown with each challenge?
- Do we know what the key parameters are?
- Can we measure them?
- What correlations may exist?
- What can we control?