ADO Workshop
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Thermochemical Conversion
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Breakout Session Topics:

Breakout #1
- Feedstock Supply & Logistics (Including algae)

Breakout #2
- Deconstruction and Fractionation
  - Hydrolysis
  - Pretreatment
  - Pyrolysis
  - Preprocessing
  - Gasification
  - Hydrothermal Liquefaction

Breakout #3
- Synthesis and Upgrading
  - Intermediate Upgrading
  - Fuel/Product Finishing
  - Intermediate Processing at Petroleum Refineries
  - Fuel and Product Distribution Infrastructure and End Use

Separations, Integration, and Enabling Technologies

Non-Technical/OSBL/Market Related
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

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Example Feedstock Logistics Flow Diagram:

- Standing Trees
  - Ash: 2%
  - MC: 60%
  - Felling

- Piled Trees
  - Ash: 2%
  - MC: 60%
  - Field Drying

- Dried Trees
  - Ash: 2%
  - MA: 40%
  - Yarding

- Chips
  - Ash: <1%
  - MC: 40%
  - P8: 2"
  - Chipper

- Debarked Trees
  - Ash: <1%
  - MC: 40%
  - Deliming and Debarking

- Loader

- Unload/Handling/Duct Collection

- Plant Gate
  - Loader
  - Electromagnetic
  - Queued Chips
    - Ash: <1%
    - MC: 40%
    - P8: 2"
    - Queuing

- BioRefinery
  - Termochemical Conversion Pyrolysis
  - Low Pressure Feedsystem
  - Even Flow
  - Milled Wood
    - Ash: <1%
    - MC: 10%
    - P8: <2%
    - Hammermilling
  - Dried Chips
    - Ash: <1%
    - MC: 10%
    - P8: 2"
    - Dryer

Feedstock Supply System Design and Analysis
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

[Diagram of processes involving arrows and blocks]
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
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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)
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