

Washington Bioenergy Research Symposium

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ZeaChem Inc.**



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ZeaChem - A Cellulosic Technology Company

Biorefinery Technology

- Cellulosic based technology converts biomass into **fuels and chemicals**, competitive with \$50/bbl oil⁽¹⁾
- Basis of technical advantage, **135 gal/BDT**, low cost, 40% improvement over direct routes to ethanol
- Known processes, flexible feedstock, efficient production - no GMOs or enzymes
- \$25 mm DOE award for demo plant

Demonstrated Success



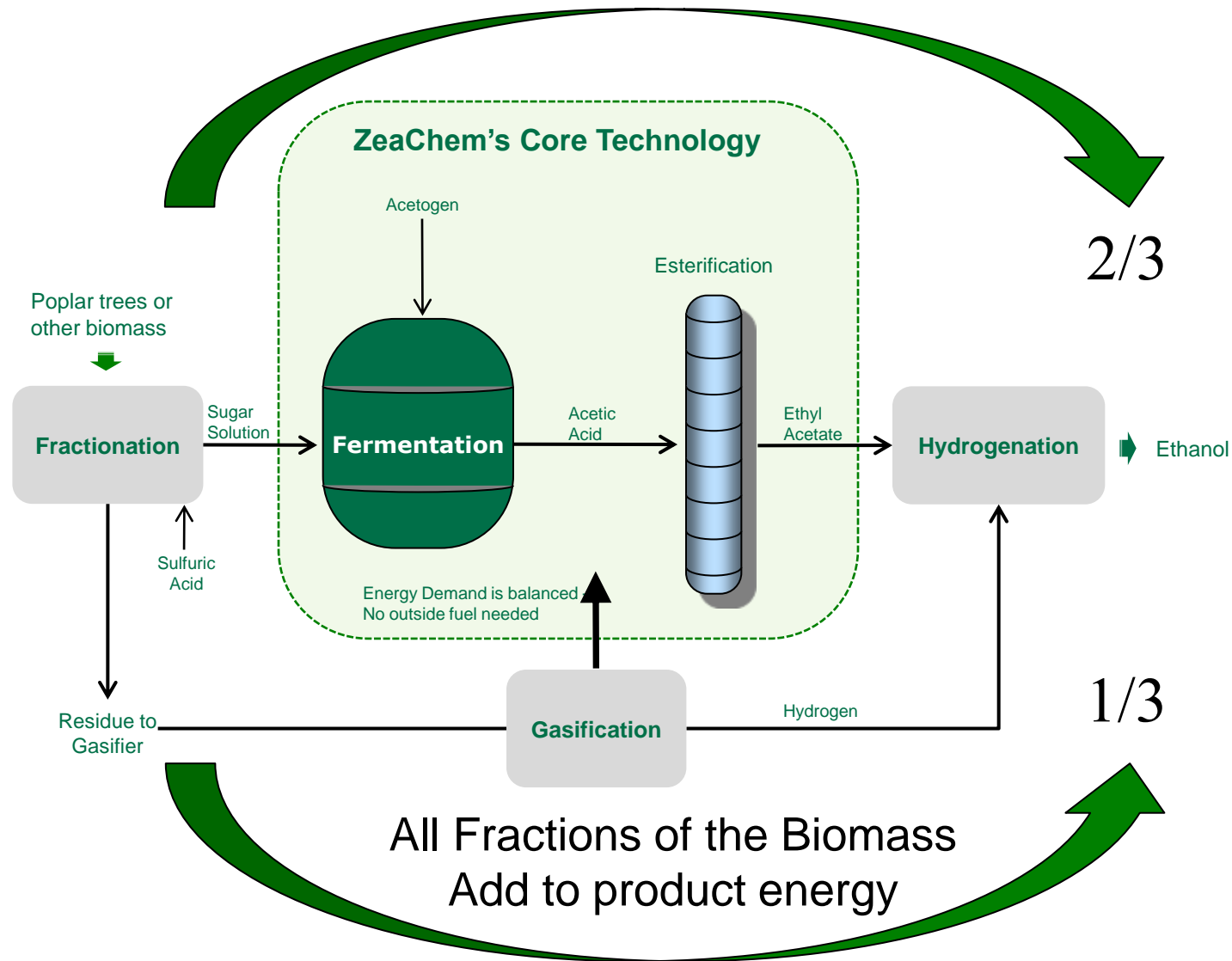
Demonstrated scale up of 10,000x lab results

- Successful fermentation **scale-up**
- Scaled and operated the **entire process** stepwise

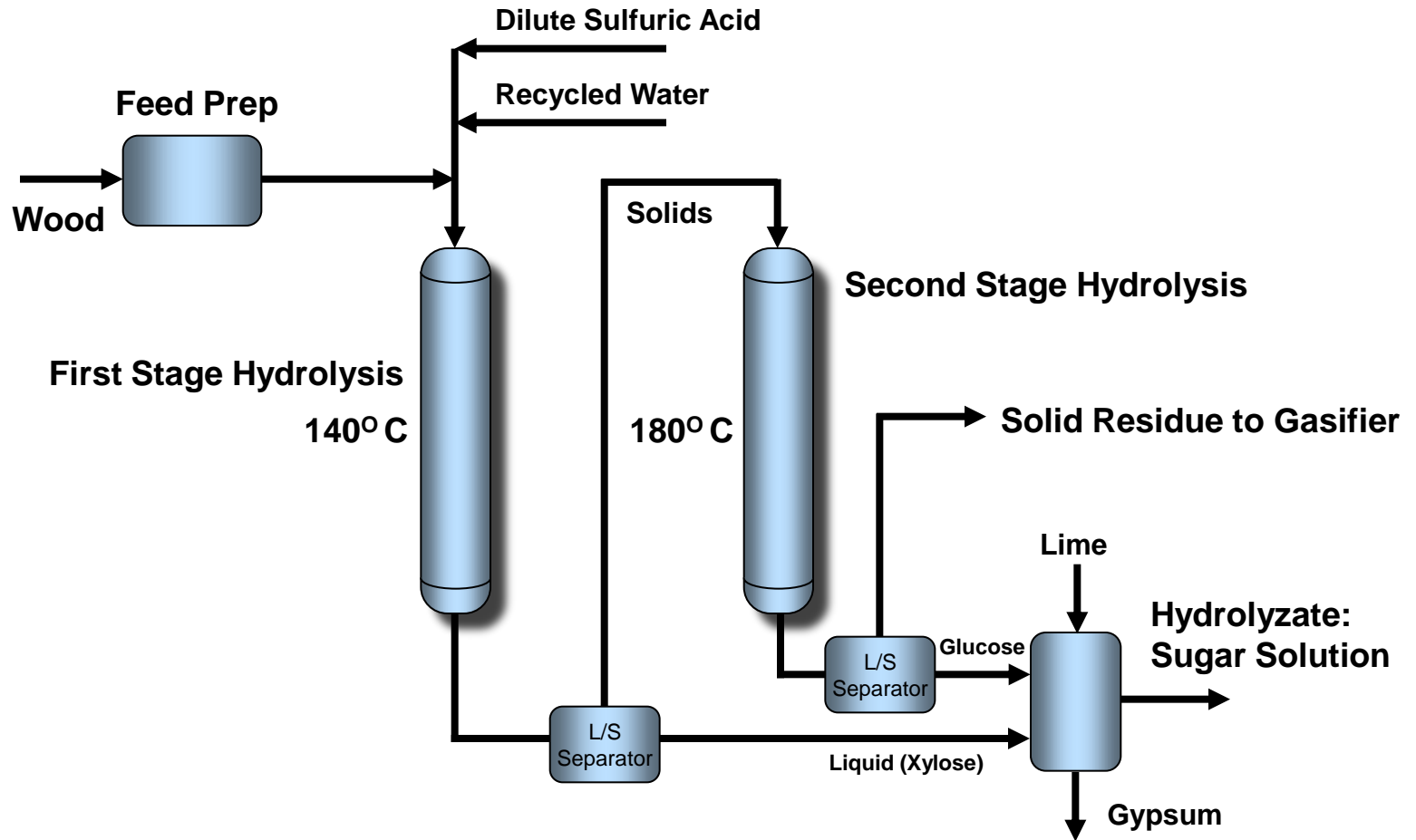
(1) Without subsidies. Assuming net cellulosic production credit, ZeaChem is competitive with \$20/bbl oil.

ZeaChem's Process: Best of Biochemical & Gasification

- ✓ High yield
- ✓ No CO₂
- ✓ No enzymes
- ✓ No GMO
- ✓ Known technologies
- ✓ Feedstock flexibility
- ✓ No outside energy demand
- ✓ Net energy ratio > 10 vs. 1.4 for corn



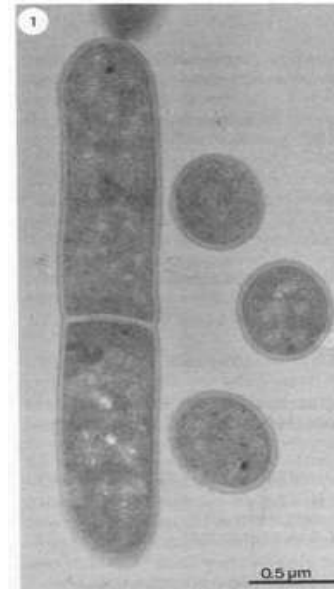
Dilute Acid Hydrolysis – The Madison Process



The Acetogen – A New Industrial Fermentation

- Naturally occurring organism
- Uses C5 and C6 sugars
- Tolerates biomass breakdown product
- Nearly 100% carbon efficient
 - Produces no CO₂
- Homofermentative – produces only acetic acid
- Thermophilic – operates at nearly “sterile” 60 C
- Minimal defined media
- Stable organism (not GMO) – no mutation

“Nature’s Proven and Most Efficient Biomass Conversion Path”

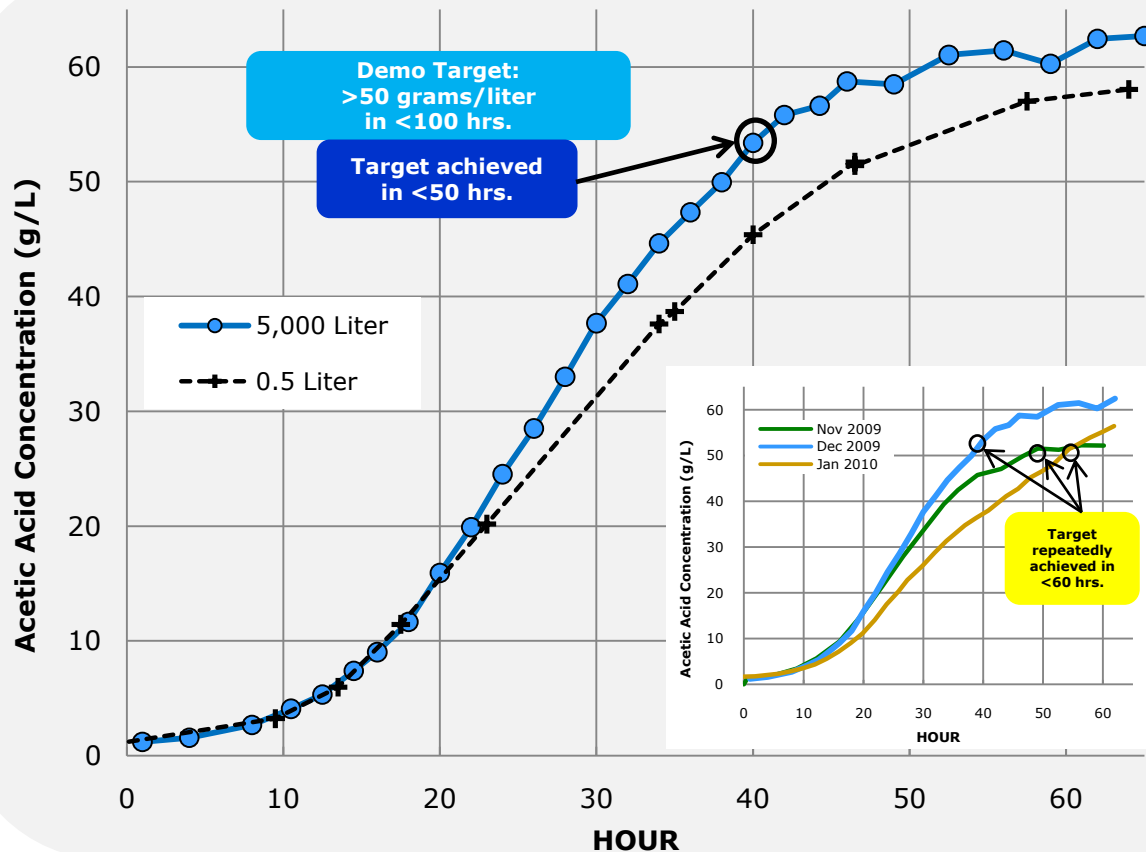


Acetogen
Bacteria: *Moorella thermoacetica*



Termite
Acetogen is naturally occurring organism. Found in the digestive tract of termites, among others

Demonstrated Scale-up Success



Scale-up
Control



- 10,000x Scale-up
- Repeated numerous times

- Multiple vendor trials
- Glacial Acetic Acid, 99+% pure

ZeaChem's Vertically Integrated Strategy

Tree Farm Model Works Today:



Energy Farm of the Future:



Established Industry

Low, Fixed Cost

Technological Advantage

Low Working Capital

- Greenwood is a leading player in the tree farm industry
- Proven growing, harvesting and land acquisition methods
- Yield/acre improvements possible, multiple varieties available
- ZeaChem's acetogen can convert all the sugars in poplar
- Deal effectively with breakdown products from poplar wood
- Short rotation means fewer assets tied up in trees
- "Stored on the stump"

Boardman Demo Plant

Overview

- Located in Boardman, Oregon
- Strategically located next to feedstock
- Land/Feedstock available for 1st commercial ethanol plant

Progress to Date

- Started construction
- Process unit testing complete
- Official groundbreaking June 2nd, 2010

Next Steps

- Construction complete Q3 '11
- Operational Q4 '11
- **Integrate the wood to ethanol process**



Demo Plant Design



Port of Morrow on Columbia River - Rail/Barge Access

ZeaChem's Technology Addresses Multiple Markets

Flexible Technology

Large Slate of Products

Multiple "Green" Applications

C₂

*Current Demo
Plant Build-out*

- Acetic Acid
- Ethyl Acetate
- Ethanol
- Ethylene

C₃

In Lab

- Propionic Acid
- Propanol
- Propylene
 - Chemicals
 - Fuels

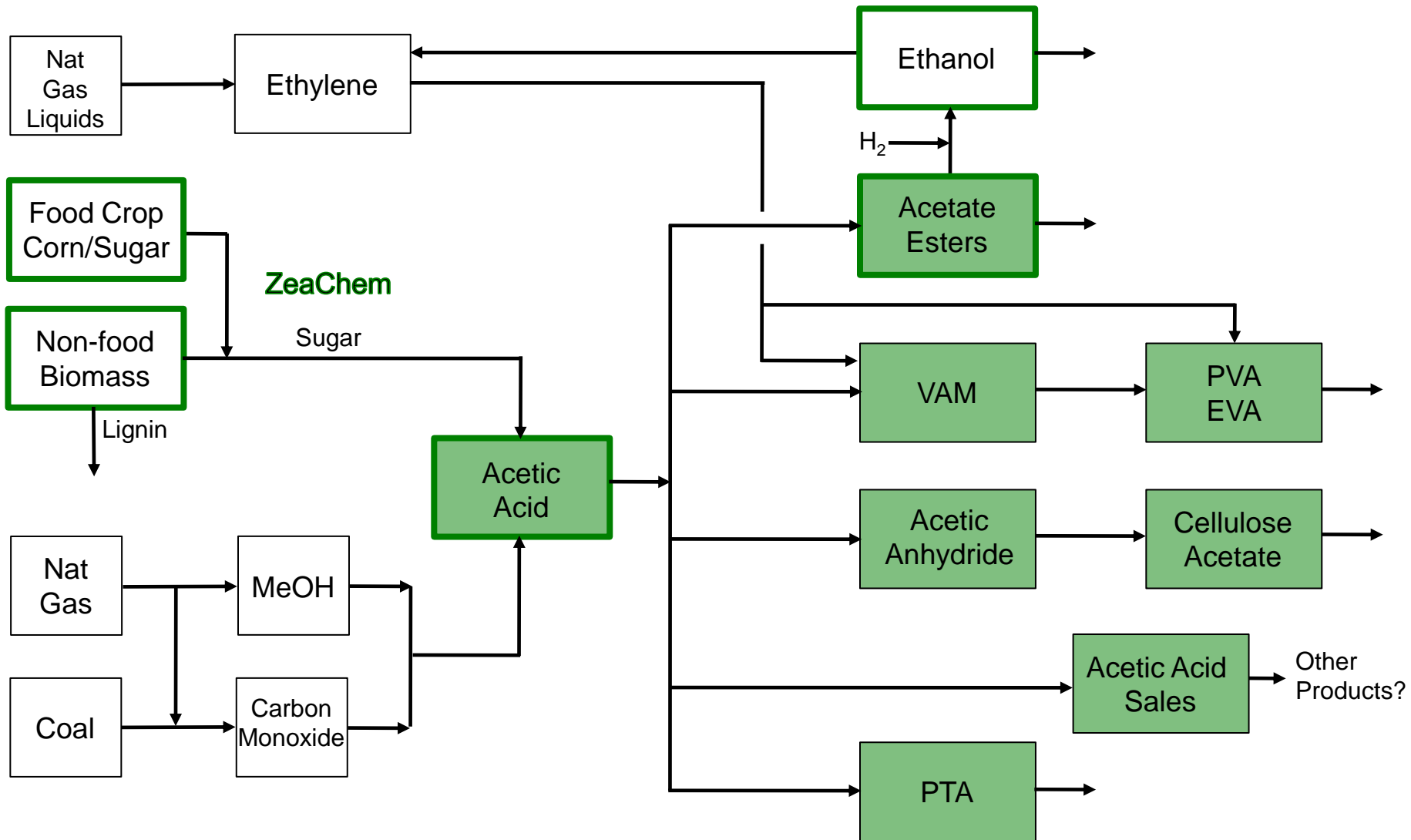
C₄ & C₆

*On-hold
pending C3*

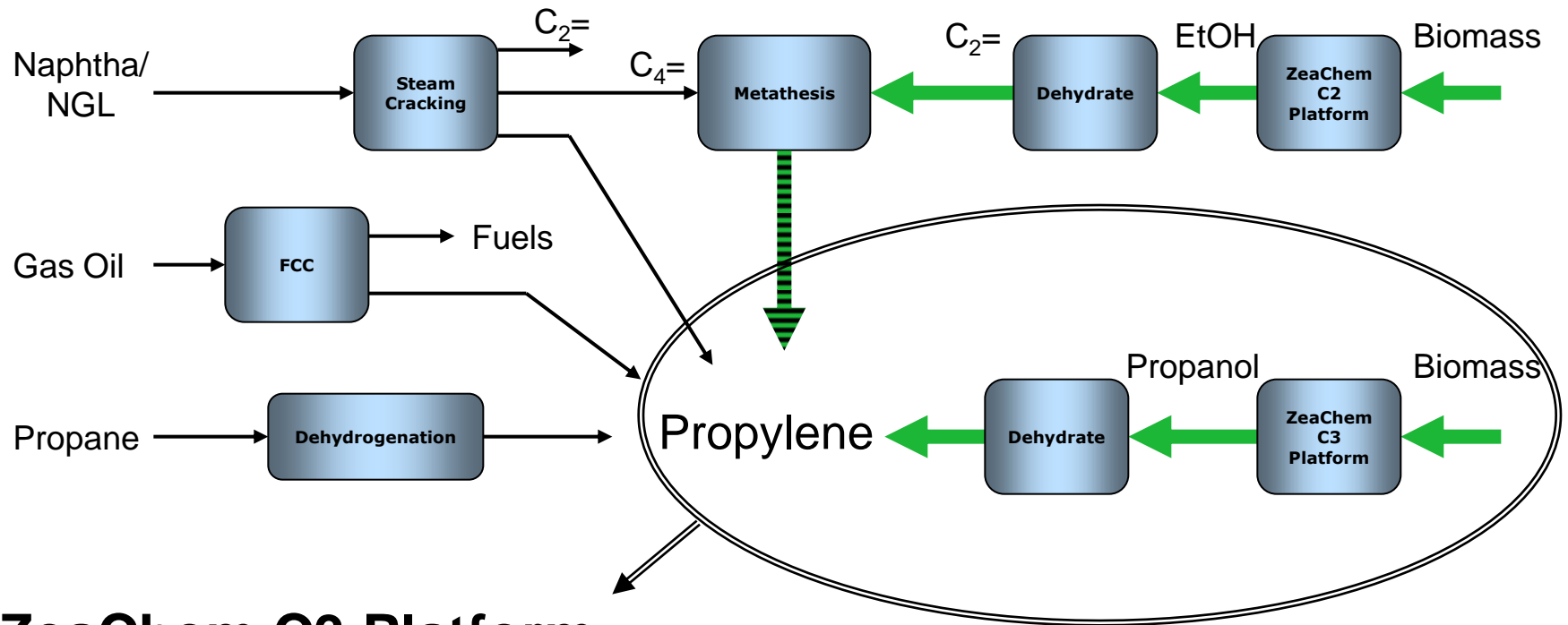
- Butanol (C₄)
- Hexanol (C₆)
- Both serve fuels/chemicals markets



Complementary Value Chain for C2



C3 Platform Routes to Propylene



ZeaChem C3 Platform:

- Chemicals, polymers, polymer gasoline and diesel
- Competitive Economics
- 100% "Green"
- On-Purpose Production
- Stable Supply Chain
- No price Volatility
- **Just Change the Organism – Everything Else Stays the Same**