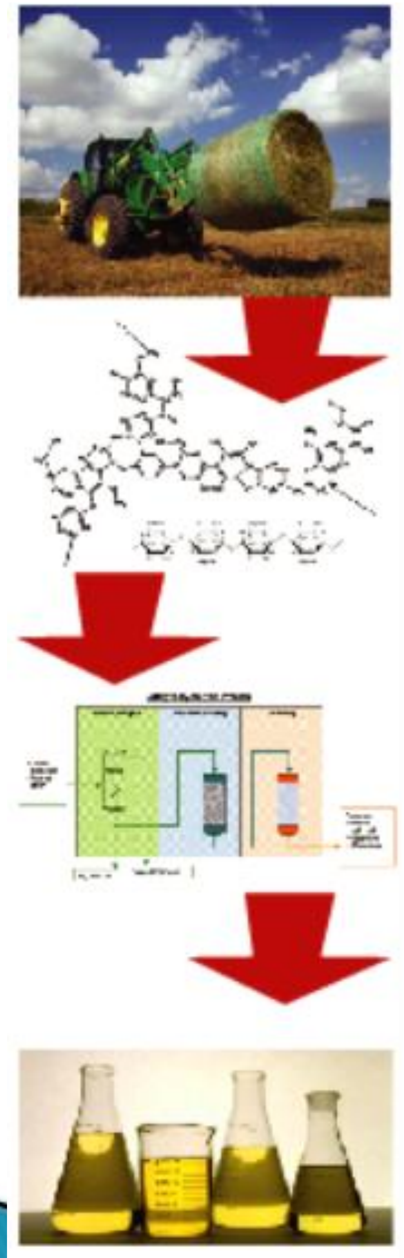


Liquid Phase, Catalytic Conversion of Biomass to Bio-Jet

BIO Pacific Rim Summit on Industrial Biotechnology & Bioenergy

October, 2012

Mercurius Biofuels

turning biomass into value...

Biofuels Categories

Mercurius Biofuels

Mercurius: lower left quadrant.

- Liquid phase = lower volumes
- Catalytic = faster

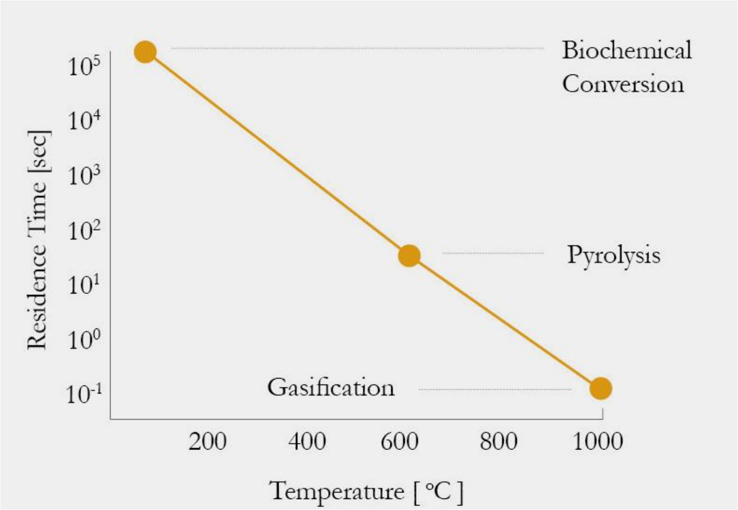
	Liquid phase	Gas phase
Fermentation	Amyris Solazyme Gevo Traditional Ethanol	LanzaTech Coskata INEOS Bio
Catalytic conversion	Virent Traditional Biodiesel **Mercurius**	KiOR Enerkem Envergent Anellotech Dynamotive

Modified from Biofuels Digest, 4/18/2011

Time is Money

Mercurius Biofuels

- Liquid Phase
- Catalytic
- Short Residence Time
- Feedstock Flexible



- 0.90 $/Gal OpEx
- 3-5 $/GPY CapEx

REACH Technology

Mercurius Biofuels

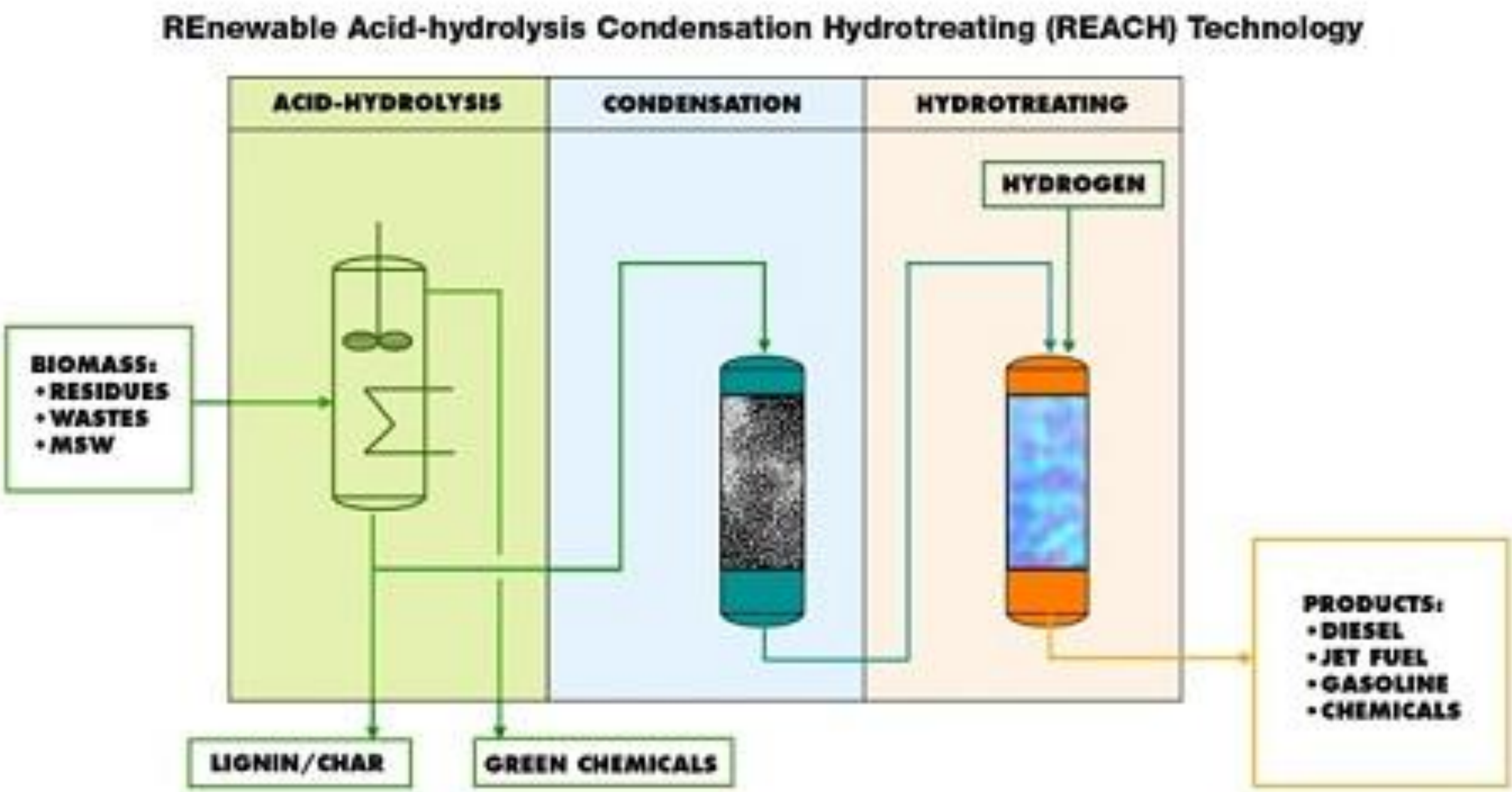
Renewable Acid-hydrolysis Condensation Hydrotreating

• Acid-hydrolysis – breaks down biomass to non-sugar intermediates.

• Condensation – combines molecules to customize carbon chain length.

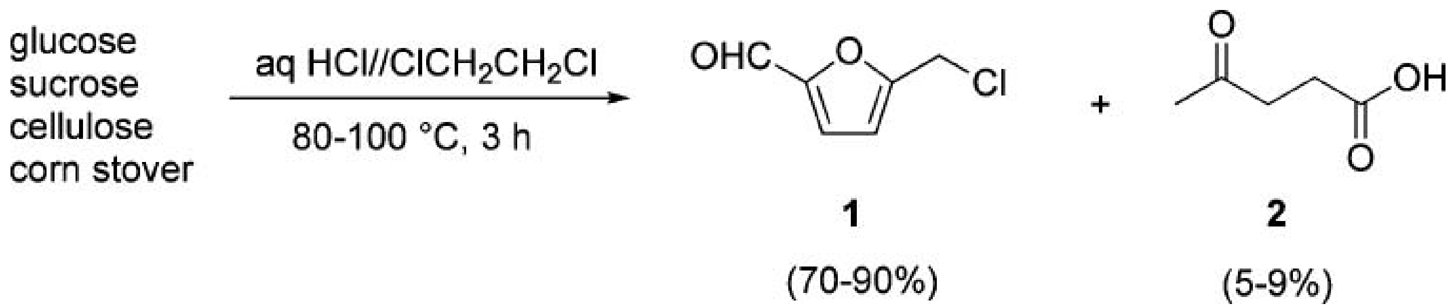
• Hydrotreating – deoxygenates to drop-in hydrocarbon fuel.

REACH Block Flow

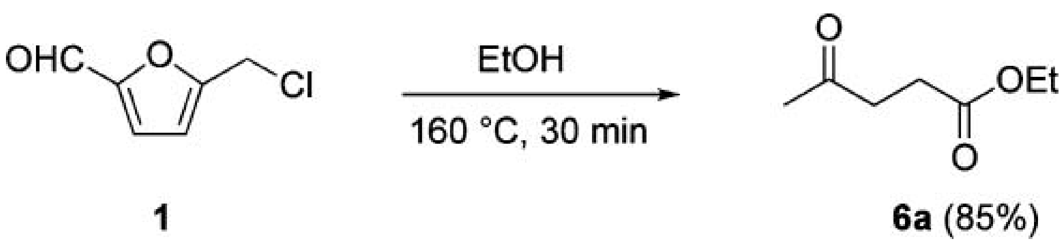


Key Hydrolysis Reactions

Chloromethylfurfural (CMF) production based on patent by Dr Mark Mascal, University of California - Davis

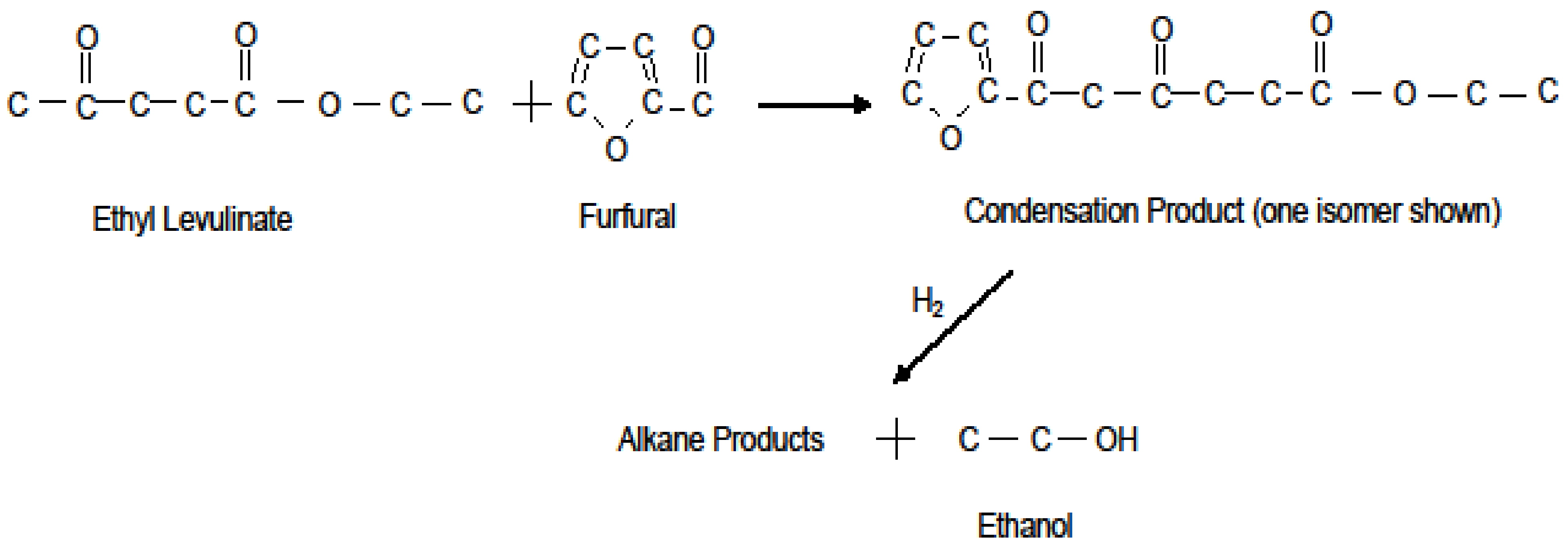


One reaction to convert CMF into a compound suitable for Condensation reactions:



1 = chloromethylfurfural (CMF)
2 = levulinic acid (LA)
6a = ethyl levulinate (EL)

Condensation & Hydrotreating Reactions



Fuel Products

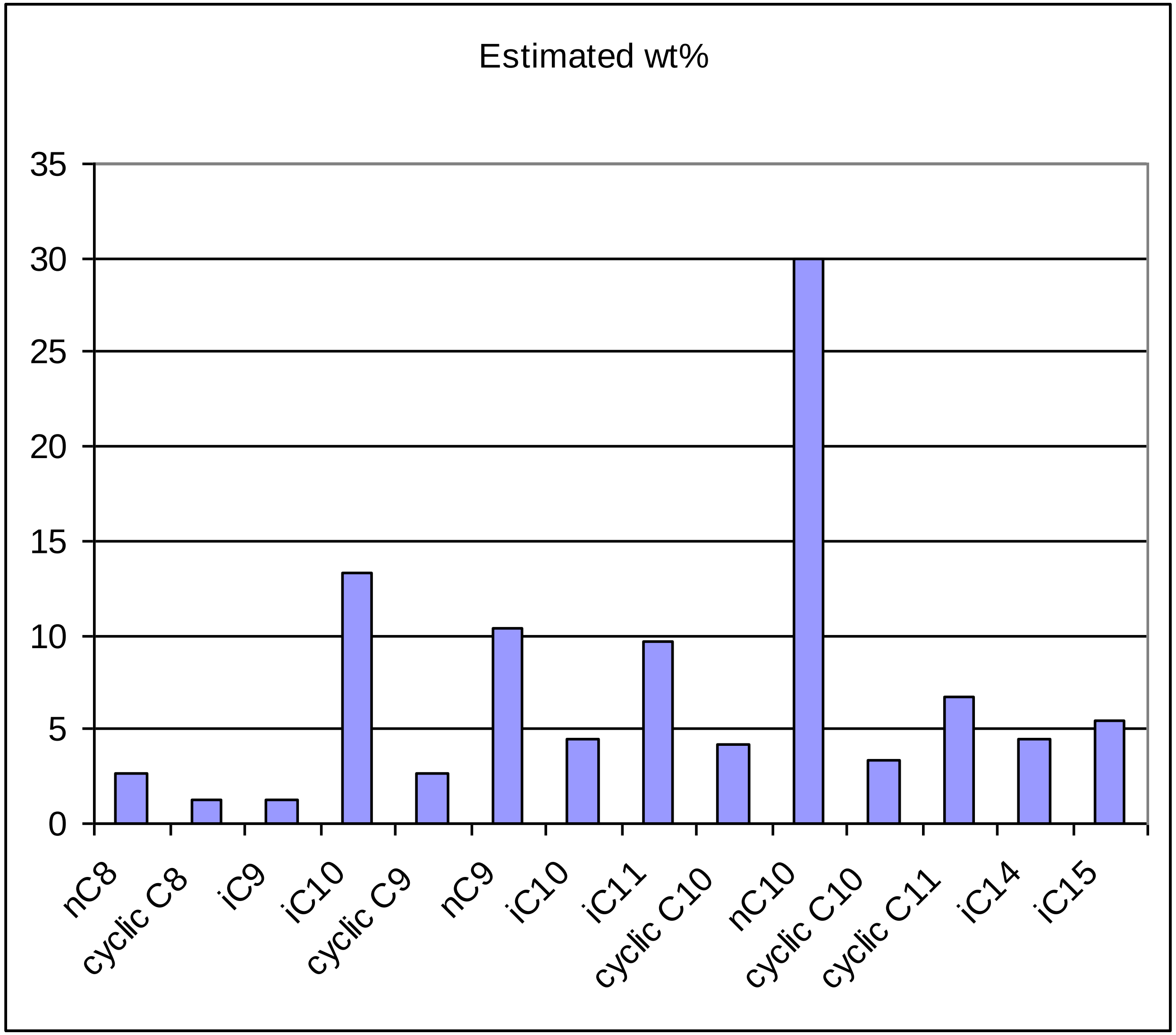
Cellulosic Jet Fuel / Diesel

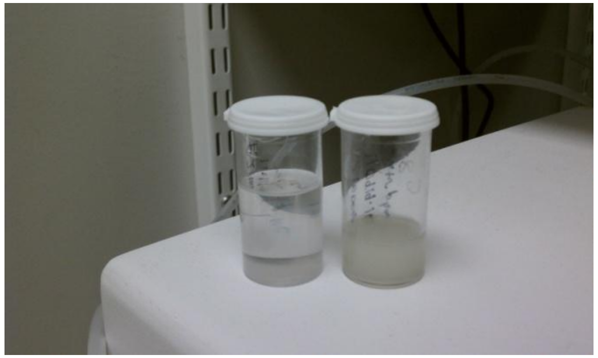
- Remove all oxygen for hydrocarbon fuel product.
- Total number of carbons will range from 8 to 15.
- Iso, cyclic, and normal alkanes for freeze point control.

Optional - Cyclic Ether Diesel (CED)

- A mixture of compounds with at least one 4 carbon cyclic ether
- Total number of carbons will range from 8 to 15.
- Additive with high cetane with low temperature flow properties

Jet Fuel Composition



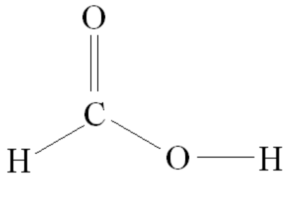


Freeze Point = - 48.4 C
JP-8 (Mil.) spec < -47 C

Byproducts

Ethyl Formate –or- Formic Acid

- Food safe fumigant/animal feed supplement
- Environmentally friendly de-icer
- Fuel cell feed



Formic Acid

Char

- Solid Fuel
- Fertilizer / Soil Enhancer
- Potential On-site Hydrogen Production

Optional Chemical Products

Ethyl Levulinate (EL)

- Many chemical uses: e.g. plasticizer production.
- Renewable home heating oil.

MeTHF

- Solvent uses.
- Extensively tested as P-series fuel blendstock.

Furfural

- Solvent for diene extraction
- Resin manufacturing

Scale-up Strategy

- Pilot/Demo of Hydrolysis: ~10 MTPD (metric tons per day).
  - Target Pilot/Demo start-up in 2013.
  - Partner with existing producer.

- Condensation / Hydrotreating Demo - existing reactor systems.

- Commercial Hydrolysis scale-up ~40:1 from Demo size.
  - US Department of Defense, Title III grant for military fuel
  - Other grants and loan/bond guarantees

Drivers for Adoption

Mercurius Biofuels

- Low Capital and Operating Expenses.
- Feedstock availability/cost.
- Product flexibility.
- Fuels match performance of petroleum products.
- Scalability of process.
- Co-location synergies.
- Beneficial to communities.
- Effective fossil CO_2 reduction.

Processing Advantages

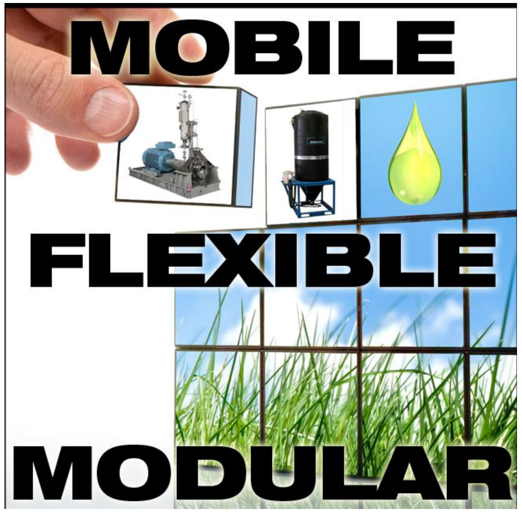
- Lower Capital and Operating Expenses.
- Feedstock / product flexibility.
- Fuels match performance of petroleum products.

Does not:

- Depend on sugar intermediates.
- Depend on enzymes or fermentation.
- Directly produce a CO_2 byproduct.

Technology Development Advantages

- Scalable
- Hydrolysis similar to pulp & paper technologies
- Condensation/Hydrotreating similar to petroleum refining technologies
- Chemical products provide high value during commercialization phase.
- No expensive genetic research



Co-location opportunities:

- Petroleum refinery
- Pulp and paper mill
- Ethanol plant
- Satellite preprocessing / central finishing

Partners

Mercurius Biofuels

- CSIRO – Process optimization research.
- Purdue University – scientific/engineering/aviation.
- Incitor – technology to scale-up CMF production.
- Pacific Northwest National Laboratory (PNNL).
- Haldor Topsoe – catalyst/hydrotreating technology.

Thank you.

Contact and information:

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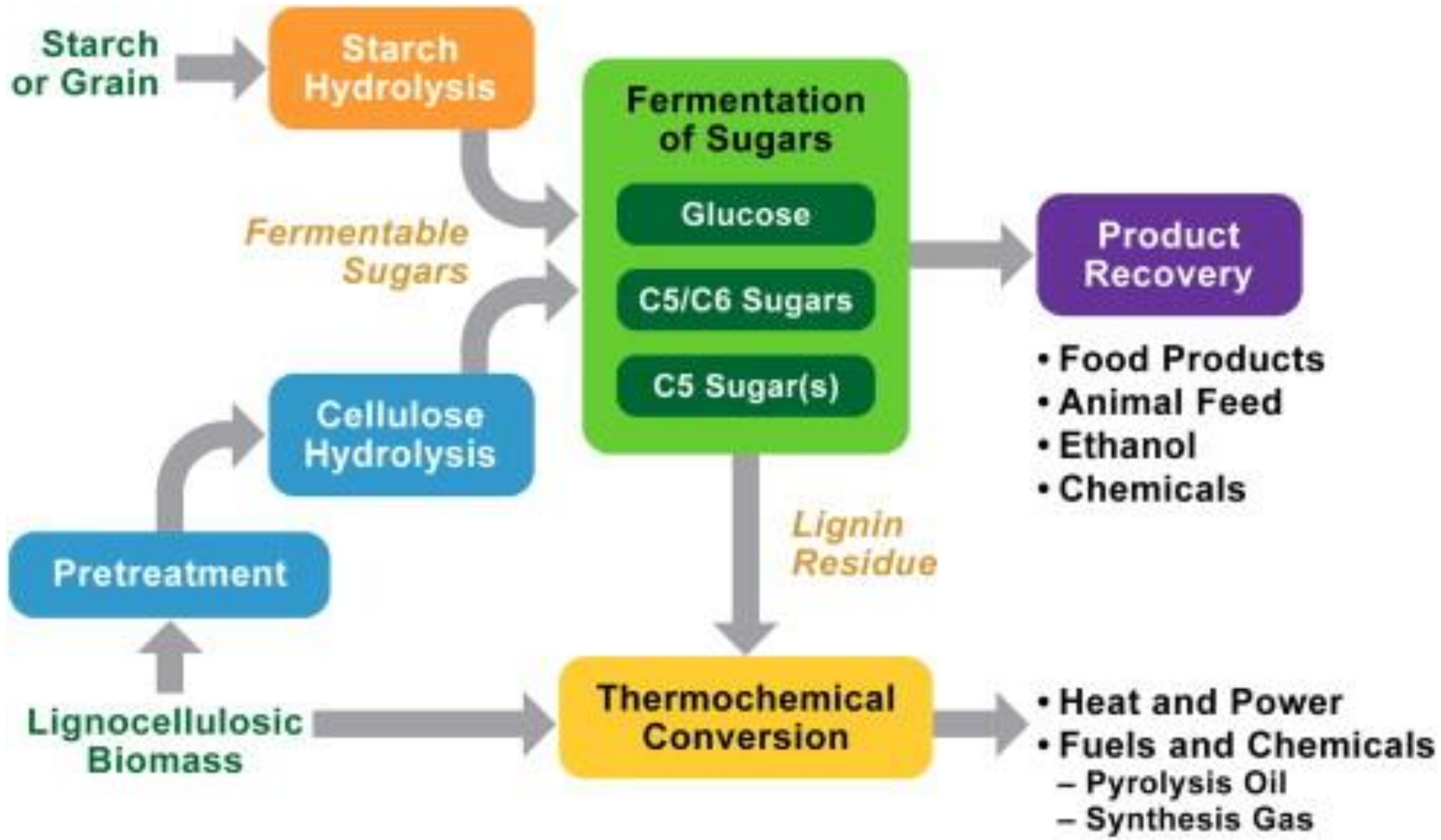
Phone: +1 360 941 7207
Email: karl@mercuriusbiofuels.com

www.mercuriusbiofuels.com

Traditional Cellulosic Technologies



Mercurius: not shown

Team

Management Team:

Karl Seck, President and CEO - Karl has nearly 30 years experience as a process engineer in the petroleum industry. He has a Bachelor of Science in Chemical Engineering from the University of Kansas.

Michael Vevera, Chief Financial Officer (CFO) – Michael has started-up and run successful companies in Japan and Australia. He has a degree in International Finance from Oregon State and a Masters in International Marketing from University of Technology, Sydney.

Knud Balslev, VP of Business Development – Knud has 25+ years of international business development experience. He has a BSC in Electronics from the Danish Technical University.

Board of Advisors:

Mark Mascal – Mark is a Professor of Chemistry at the University of California - Davis. He received his PhD from the University of London, Imperial College and was a Postdoctoral Fellow at the University of Strasbourg, France.

Clayton Wheeler – Clay is an Assistant Professor of Chemical and Biological Engineering at the University of Maine. He received his BS, MS and PhD degrees from the University of Texas at Austin.

Edwin Olson - Ed is a Senior Research Advisor at the EERC. He received his Ph.D. degree in Chemistry and Physics from the California Institute of Technology.

Capital and Operating Expenses

Mercurius Biofuels

	CapEx $/LPY	OpEx $/L
Mercurius Diesel/Jet	0.8 – 1.3	0.24
Cellulosic Ethanol	1.8 - 4	0.63
Fischer Tropsch Diesel	4 - 5	0.85

1. Cellulosic feed cost set at 50 $/BDT
2. Sources: NREL and other published information
3. OpEx estimates include byproduct sales
4. OpEx does not include Capital charges.