

Mr. Nace has spent 30 years as a commercial real estate developer and the past five years pursuing more diversified projects. He has specialized in health care related real estate, projects in complicated regulatory environments, green energy and other non-internet technology ventures. Until its recent sale, he was the managing general partner of BioSquare, a biotechnology research based, mixed- use real estate development in Boston, Massachusetts. Mr. Nace is the Chairman and CEO of Econox Technologies, LLC, a Georgia based company specializing in combustion efficiency technology. He is here today in his capacity as Managing Director of Maine BioProducts, LLC, a company pursuing the development of a forest biomass biorefinery in Maine. He has been working here in Maine for over 4 years and has been awarded an MTI Seed Grant and two Development Awards in conjunction with this project. Please welcome Paul Nace.....

# Biorefinery Development in the Northeast

October 18, 2007



# The Company

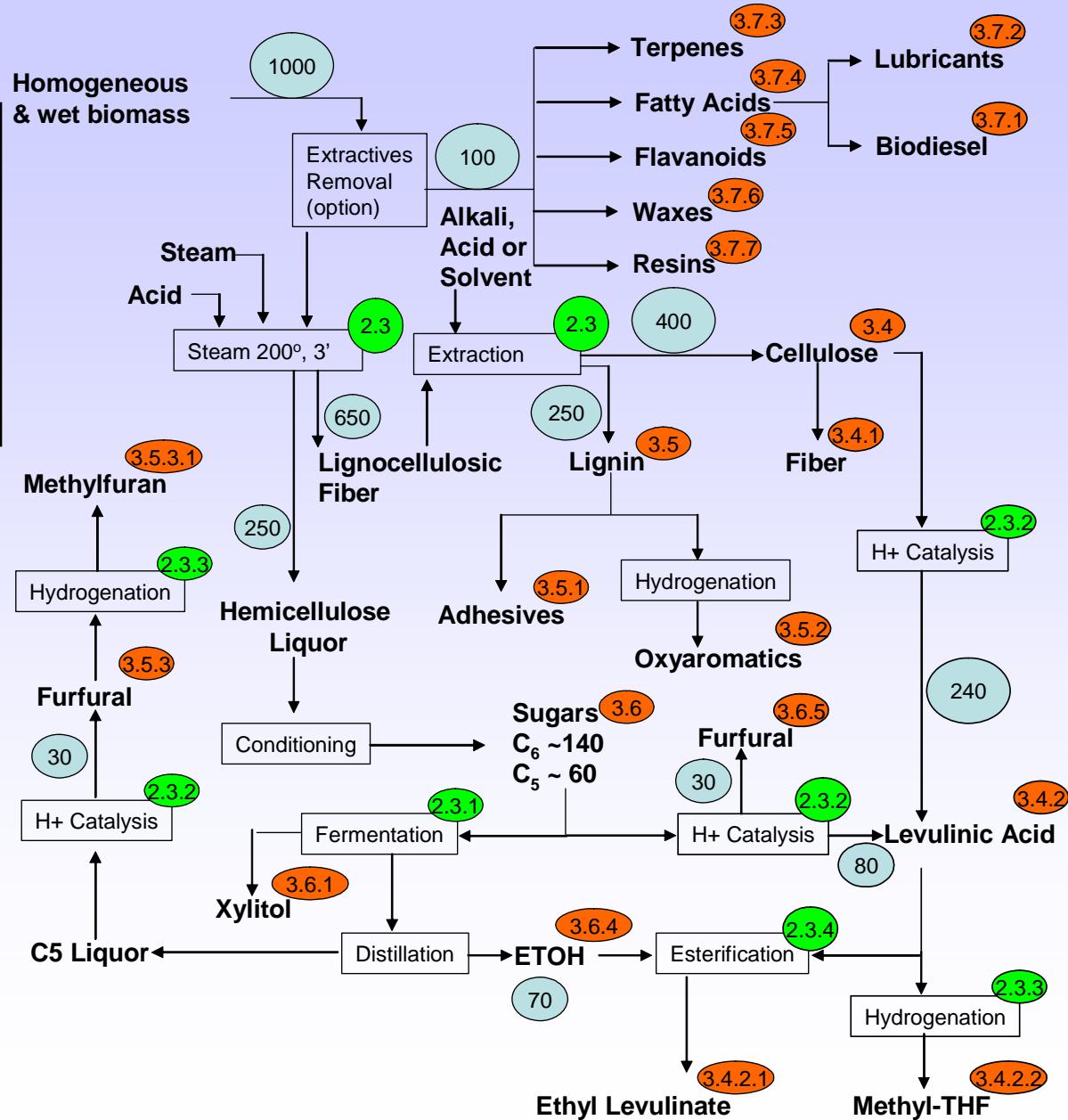
- Maine BioProducts is a biorefinery facilities development and management company.
- Company founded 2004 to pursue cellulosic biofuels and chemicals facility finance and development.
- MTI Seed Grant and 2 MTI Development Award recipient
- Matching funding from DOE



# What is a biorefinery?

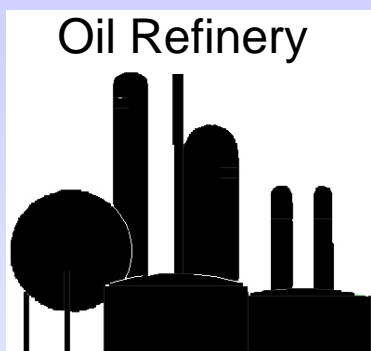


# Forest Biomass Biorefinery (Fractionation)



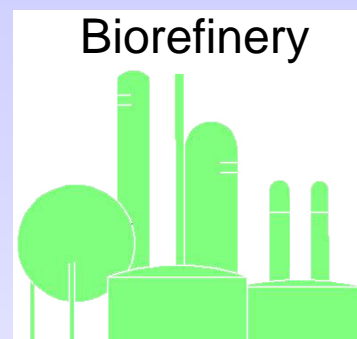
What is a biorefinery?

# An oil refinery analogy...



Crude oil

- Gasoline
- Naptha
- Kerosene
- Diesel
- Light oil
- Heavy oils



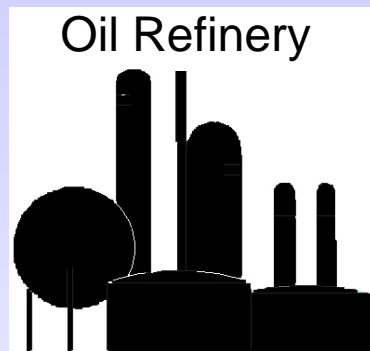
Biomass

- Levulinic acid
- High BTU char
- Commodity co-products
- Value added chemicals TBD



# Evolution of the biorefinery

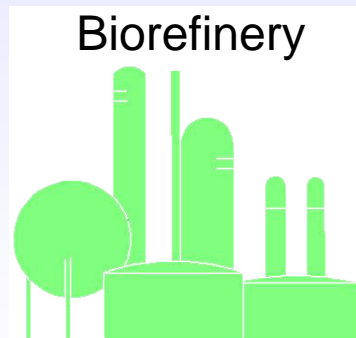
An oil refinery analogy



Crude Oil

- Gasoline (1892)
- Naptha
- Kerosene(1859)
- Diesel (1920s)
- Light Gas oil
- Heavy oil
- Aromatics

**Plastics,  
chemicals and  
pharmaceuticals**



Biomass

- Levulinic acid (LA)  
( ▶ biodiesel)
- High BTU char
- Acid byproducts  
(commodities)
- ???

**Plastics,  
chemicals and  
pharmaceuticals**



# **Commercial Levulinic Acid Biorefinery**





# Pilot Plant – Gorham, ME



The recent move of the Biofine Renewables Pilot Plant facility to the Gorham Industrial Park anchors the technology in Maine.



# Industrial Scale



- **Plant in Caserta, Italy**
- **50 TPD**
- **Validation of technology scaling**



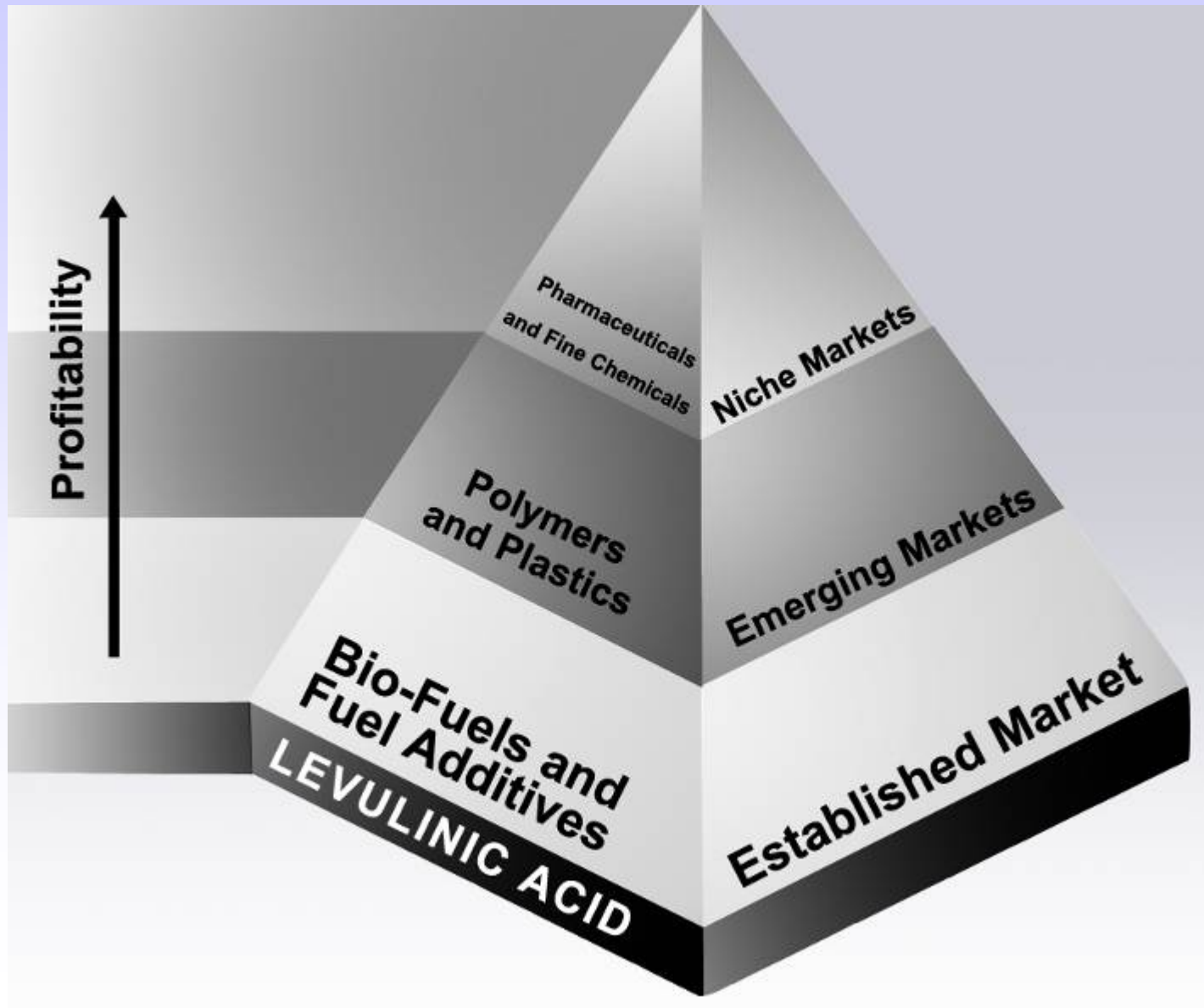
# Commercial Scale

1,000 dry ton per day (input) biomass fueled biorefinery, producing:

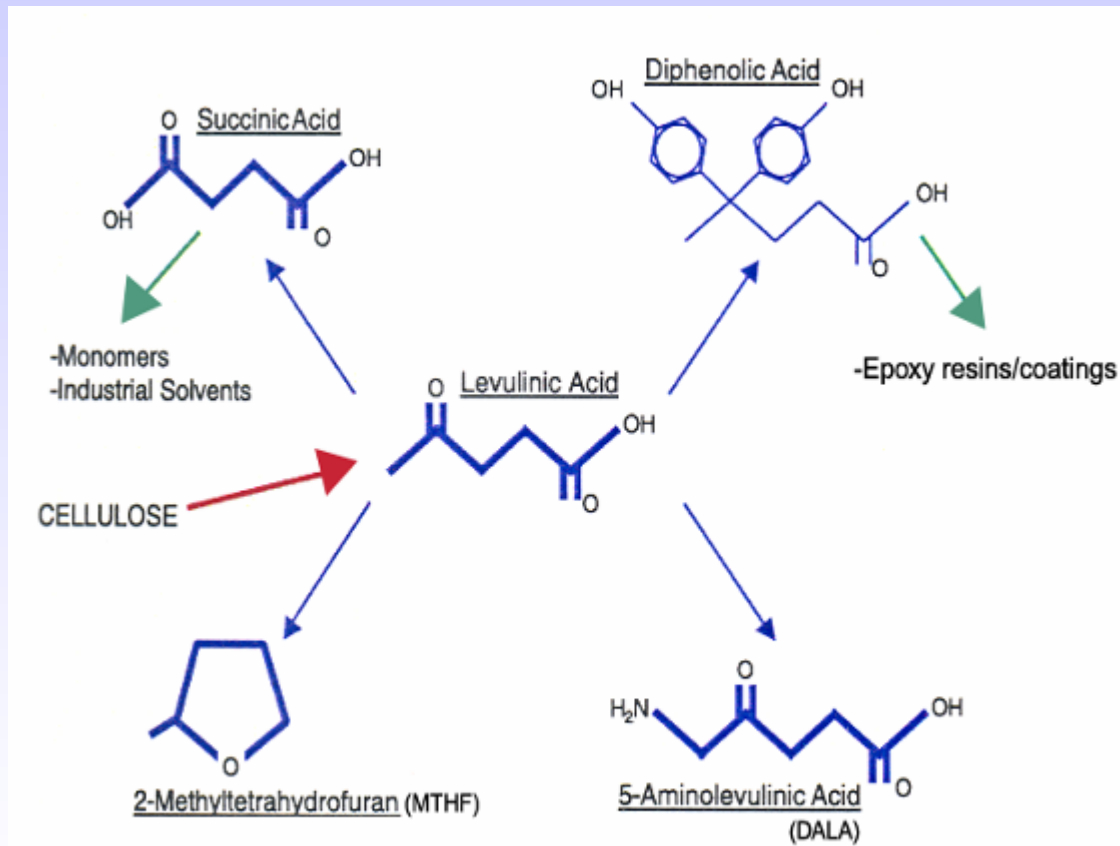
- Levulinic acid (via the Biofine process)
- Biofuels (Ethyl Levulinate or other esters)
- High BTU-value carbon-rich ‘char’
- Valuable co-products (formic acid, magnesium calcium formate)
- \$150M Capital Investment



# Product Pyramid



# Product Derivatives



Levulinic Acid (LA) can be further refined into:

- MTHF (a gasoline additive)
- Succinic Acid
- Diphenolic Acid
- DALA (a biodegradable pesticide)
- Intracellular polyesters (for biodegradable plastics)



# Locating a Biorefinery

- Access to wood resource
  - Feedstock availability
  - Harvesting infrastructure
- Large physical plant
- Transportation (highways, rail, water)



# Co-location Opportunities

Leveraging existing industrial assets can:

- Significantly reduce capital requirements for biorefinery development
- Improve revenue streams for collocation partners' existing facilities
- Shorten development timeline
- Provide ready markets for co-products



# Co-location Example

- Paper production facilities provide many potential location advantages for a levulinic acid facility.
  - 1) Wood handling
  - 2) Physical plant
  - 3) Steam
  - 4) Power
  - 5) Wastewater treatment





# Timeline

- Development takes time
- Expect delays

