BIOFINE TECHNOLOGY, LLC

NORA Conference
Newport, RI
09.25.2018



Biofine Technology

THE BIOFINE PROCESS

A proprietary, continuous, fast chemical refining process that enables the production of high value renewable chemicals and biofuels from cellulosic residues.

- Initial funding: Private funds, US DOE and NYSERDA
- Semi-works demonstration plant (presently UMO owned)
- 1999 Presidential Green Chemistry Challenge award
- Strong intellectual property portfolio (in-house/licensed)
- Key primary product: levulinic acid;
- Key derivative: ethyl levulinate (EL)
- Focus on biofuels - heating and jet fuel (NORA, Texaco, others)
- Longer term – sustainable derivative chemicals

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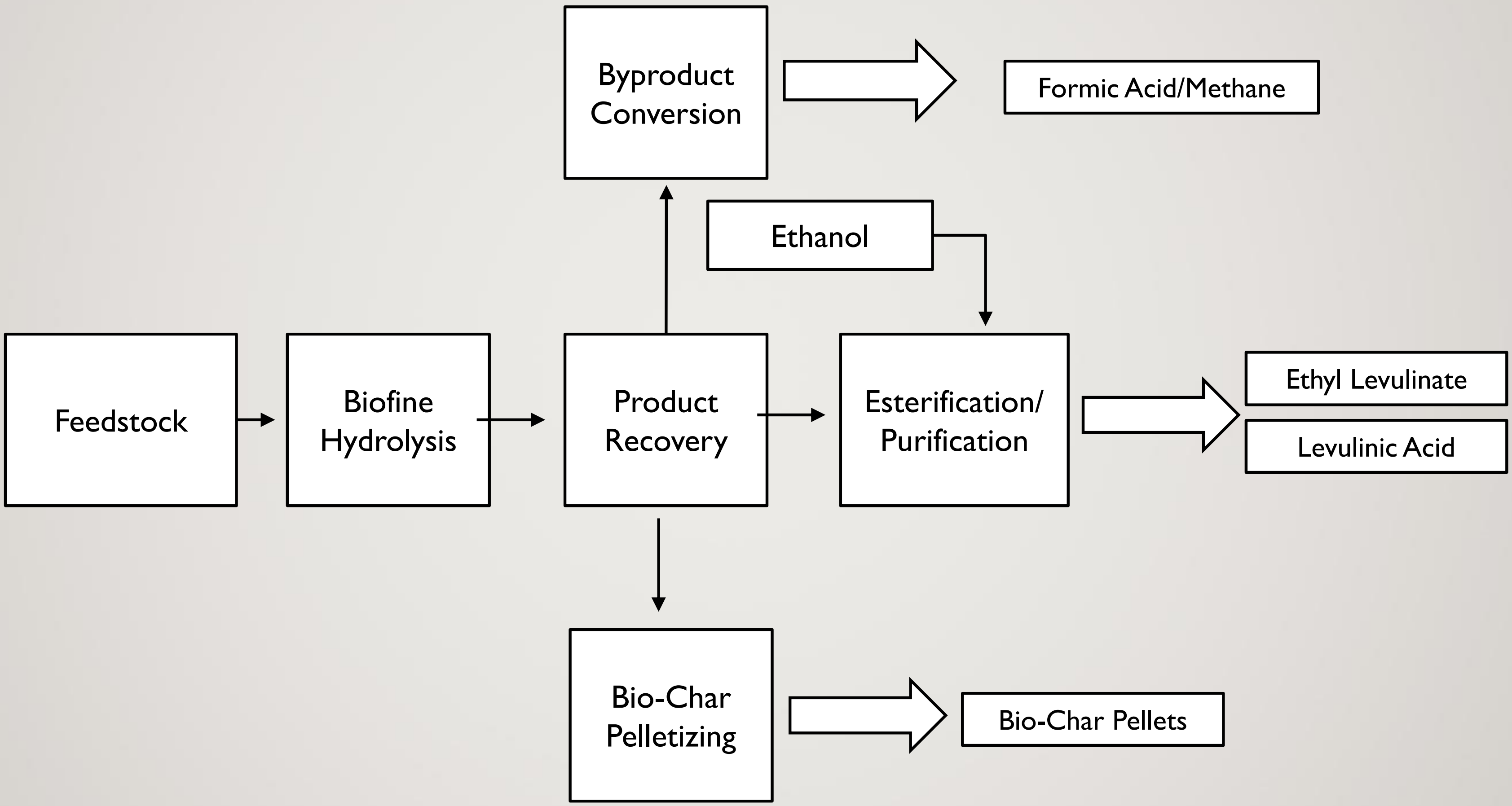
PROCESS FLOW: BIOFINE PLANT



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THE VALUE CHAIN

Cellulosic Feedstock

Wood

Wood pulp

Cellulosic Sludge

Waste Paper/OCC

Crops

MSW

Biofine Process

Levulinic Acid

Formic Acid

Ligneous Char

Downstream Conversion

3-HPA

Acrylic Acid

Succinic Acid

Ethyl Levulinate

TDO Hydrocarbons (UMO)

DALA

Diphenolic Acid

Drop-In Product Demand

Heating Fuels

Jet Fuels

Plastics/Plasticizers

Agriculture

Cosmetics

Flavor & Fragrance

Resins & Coatings

Carbon Fiber

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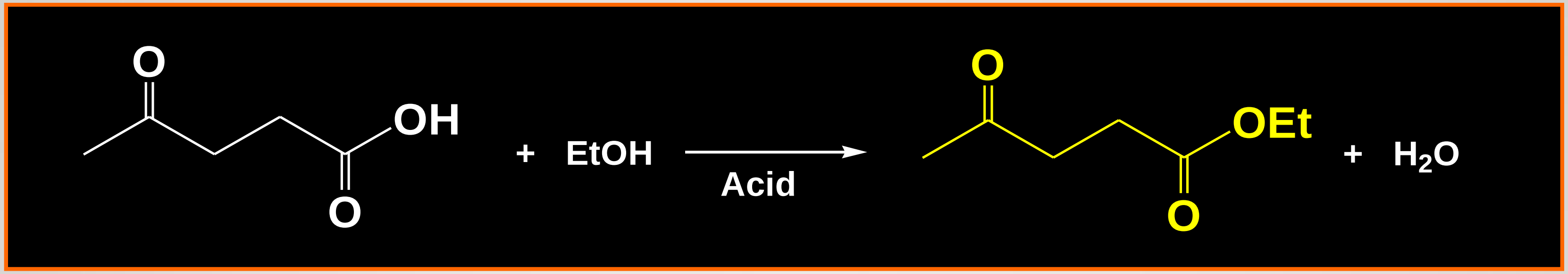
FUEL DEVELOPMENT



- Compatible with both light and heavy fuels
- High flash point
- Very high octane numbers (gasoline)
- Route for ethanol into heavy fuels
- High lubricity (hydro-treated low sulfur fuel)
- Oxygen content 33%
- Reduces diesel smoke (soot) significantly
- Excellent cold flow properties
- Suitable as a blendstock for FAME esters
- Projected production cost - $0.50/lit. ($17/GJ)

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TECHNICAL BENEFITS AS A HEATING FUEL

- NEGATIVE CARBON DIOXIDE LIFE CYCLE ASSESSMENT AS A FUEL (DUE TO BYPRODUCTS)
- INCREASES COMBUSTION EFFICIENCY OF FUEL BLENDS: EL = 33% OXYGEN
- REDUCES COMBUSTION PARTICULATE (SOOT) AND CARBON OXIDES
- REDUCTION IN BLEND SULFUR EMISSIONS (zero sulfur in EL)
- GIVES HEATING OIL A LOWER GHG FOOTPRINT THAN NATURAL GAS @ 10% BLEND
- BIGGER REDUCTION IN GHG FOOTPRINT THAN SOY BIO-DIESEL
- ALLOWS ZERO *OR NEGATIVE* CARBON EMMISSIONS FOR HOME AND COMMERC'L FUELS
- IMPROVES LOW TEMPERATURE HANDLING (GELL PT. CLOUD PT., CFPP)
- INCREASES LUBRICITY AND LOWERS VISCOSITY OF FUEL OIL BLENDS
- EASILY BLENDS WITH BASE FUELS AND BIODIESELS
- GREATLY INCREASES OXIDATIVE STABILITY OF BIODIESEL (RANCIMAT DATA)

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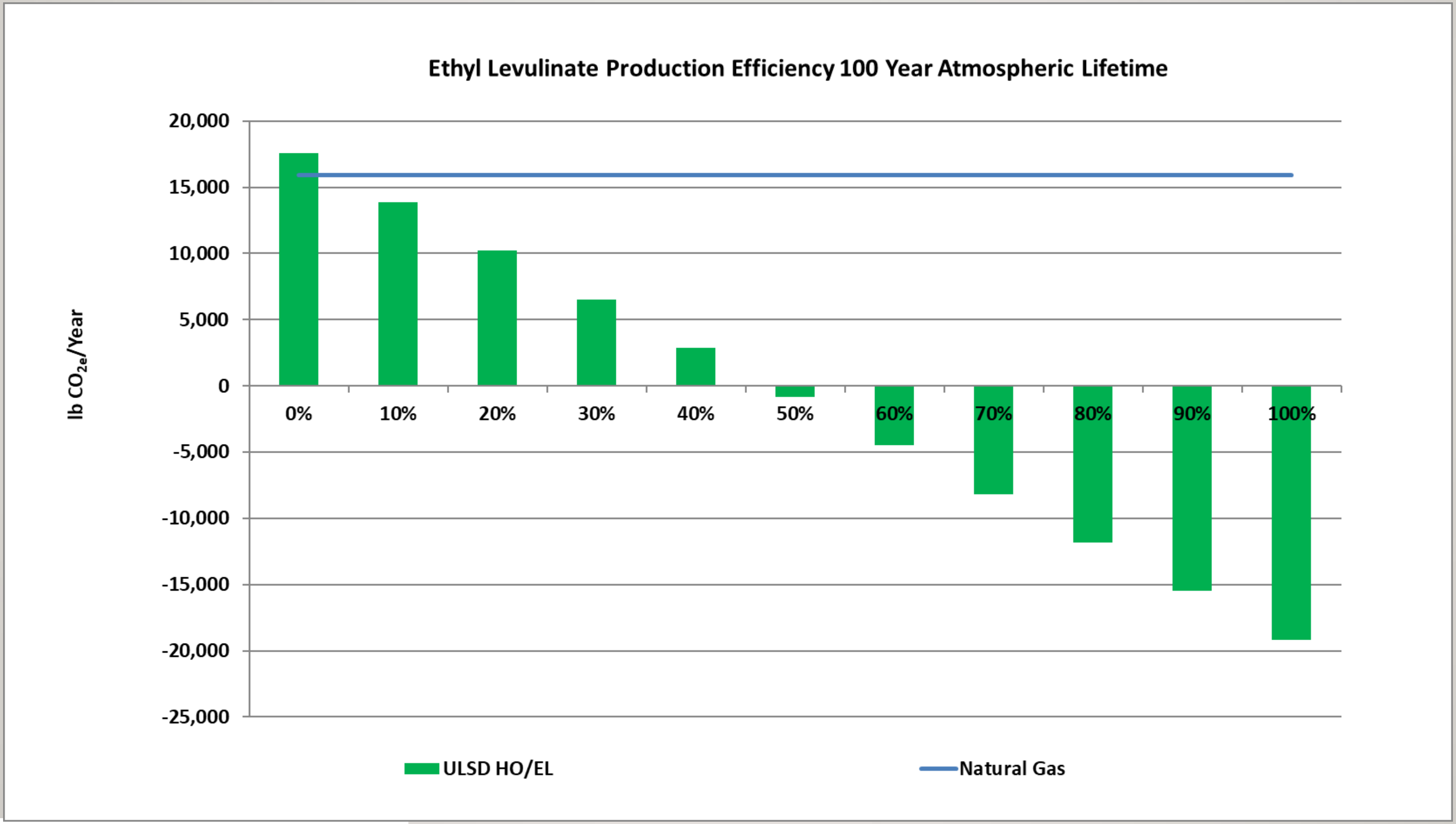
POTENTIAL CARBON DIOXIDE EMISSION REDUCTION USING EL IN HEATING FUEL (LB/HOUSE/YEAR)



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TIMELINE
TEST MARKET - COMMERCIALIZATION

2017 - 2018 Residential Field Test of EL blends = 10 - 20 homes for full season

- Location: Maine
- Partners: Oil Company, NORA – Production, Operations, Logistics, Monitoring, Evaluation

2018 Commercial Field Test of EL 100% = 2-3 month test

- Location: Maine
- Partners: Oil Company, NORA – Production, Operations, Logistics, Monitoring, Evaluation

2018 – 2020 Expected Commencement of Full Scale Plant Design and Construction in Maine

2021 First Plant Operational - Manufacturing EL from waste biomass

- 3 Million gallons/year EL + limited specialty chemicals
- Fuel priced at par with #2 heating fuel
- EL is potentially eligible for D7 cellulosic RINS
- Feedstocks – MSW-derived and waste forest biomass

2021 – 2023 Construction of Larger Plant in Maine

- Approximately 10 Million gallons per year EL for heating fuel
- Larger scale eliminates dependency on RINS
- Potential Blending with UMO TDO-derived hydrocarbons

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ACKNOWLEDGEMENTS

National Oil-heat Research Alliance (NORA)

The Dead River Company (DRC)

The University of Maine (Orono)

U.S. Department of Defense

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