

Reinventing Ethanol

Moving to a Biorefinery Paradigm

What is Biorefining?

- Anyone want to provide their definition?

What is Biorefining?

- Wikipedia says:
 - **Biorefining** is the process of "refining" multiple products from biomass as a feedstock or raw material much like a petroleum refinery that is currently in use
 - A **biorefinery** is a facility like a petroleum refinery that comprises the various process steps or unit operations and related equipment to produce various bioproducts including fuels, power, materials and chemicals from biomass

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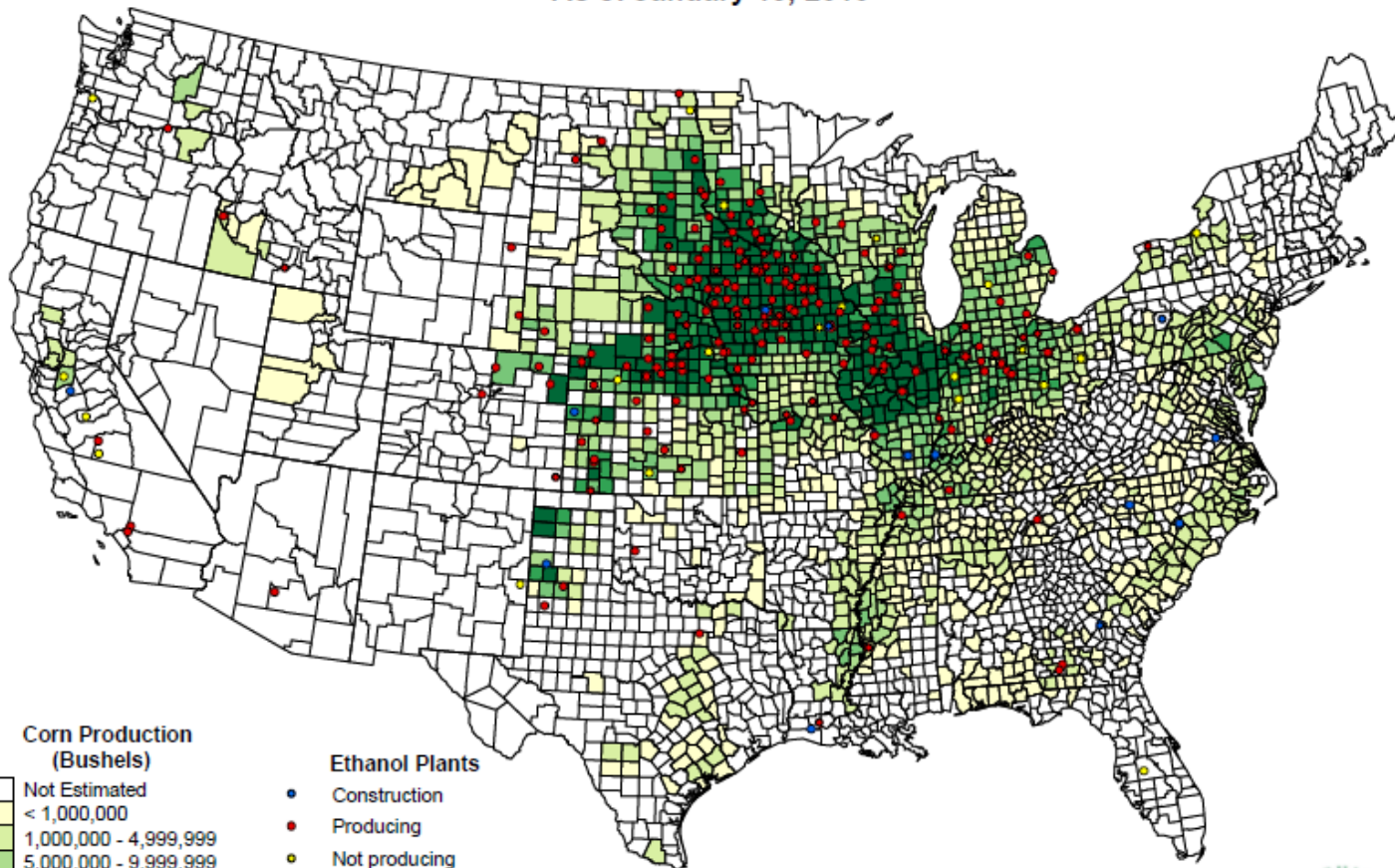
- Substantial corn oil consumer
- Process Improvement
- Technology Neutral
- Strong ties to animal feed, biofuels, bio-based chemicals

ICM Ethanol Plant



Why Use Existing?

Corn for Grain 2009
Production by County and Location of Ethanol Plants
As of January 19, 2010



Corn Production (Bushels)

Ethanol Plants

- Not Estimated
- < 1,000,000
- 1,000,000 - 4,999,999
- 5,000,000 - 9,999,999
- 10,000,000 - 14,999,999
- 15,000,000 - 19,999,999
- 20,000,000 +

- Construction
- Producing
- Not producing



Why Use Existing?

- Tanks
- Pumps
- Scales
- Control Room/Control System
- Rail Infrastructure
- Utilities (Steam, Air, Electricity)
- Water treatment
- Excess distillation capacity (8-12%)

Why Use Existing?

- Front Office (Accounting, Marketing, Etc.)
- Existing markets for co-products
- Existing Air Permit
- Existing Zoning
- Mitigate NIMBY

Opportunity

- Whole Stillage (pre centrifuge)
 - 20% solids
- Thin Stillage (post centrifuge)
 - 8% solids
 - 1.5% sugar
 - 1.5% glycerol
 - .14% acetic acid
 - .1% lactic acid
- Syrup (concentrated Thin Stillage)
 - 32% solids
 - 23% protein (dry basis)

Opportunity

- Liquifaction (milled corn + enzymes and heat)
- Milled corn
- Fractionation
 - Bran
 - Protein
 - Fiber
- Carbon Dioxide (600 Tons/day @ 100MMGY)

Already in Play

- ICM
 - Bran fractionation to cellulosic ethanol
 - 1-3 years from commercial application
- DuPont/Lincolnway Energy
 - Large demonstration cellulosic plant

Already in Play

- Golden Corn Technologies
 - Re-fermentation of whole stillage
 - Developing high value/low fat feed for dairy
- MycoMax
 - Fungus grown in thin stillage

Already in Play

- Organic alcohol
 - Other industrial specialty alcohols
- Other specialty chemicals
 - Organic acids
 - Proteins
 - Fiber

Why Partner?

- Ethanol plants don't have significant capital
 - Innovative partnerships will be welcomed
- Existing plant = Limited NIMBY effect
- Possibility to shortcut the air permit process
- Working together builds a much stronger industry

How?

- Depends...
 - There is no single technology answer
 - Cost savings can be had by designing for the largest number of opportunities
 - Technologies need each other
 - Think of ourselves as ONE industry with many different opportunities

Thanks!

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