

# 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

# FEC Solutions

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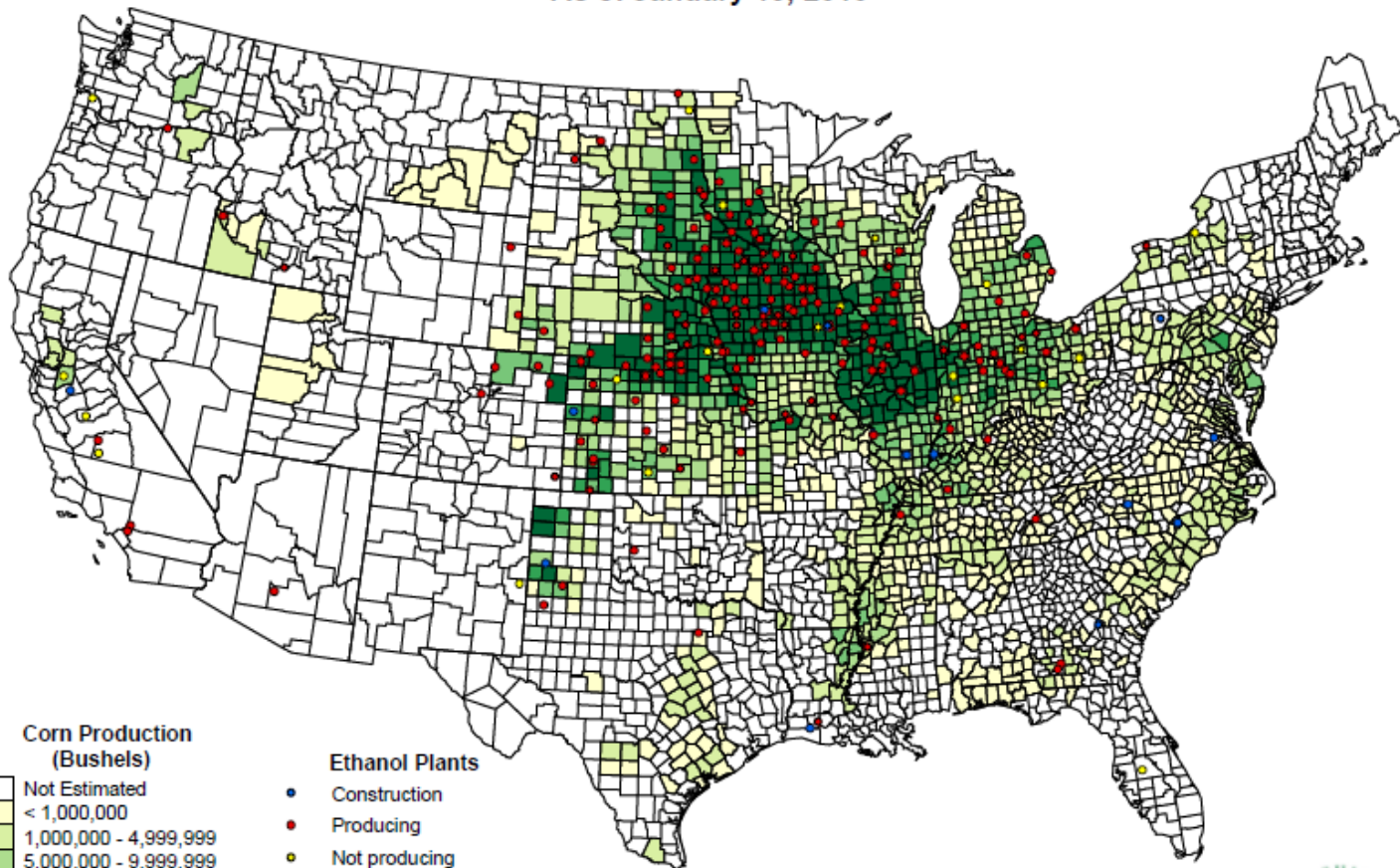
- Substantial corn oil consumer
- Process Improvement
- Technology Neutral
- Strong ties to animal feed, biofuels, bio-based chemicals

# 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)**

- 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 +

**Ethanol Plants**

- 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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