Governors’ Ethanol Coalition

The Next Generation of Fuel Ethanol Technology
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Presentation Overview

- Current Technology Overview
- Line of Sight
  - Food and Fuel (Total Kernel Optimization)
  - Gaining Energy Independence
  - Vision for the Future
- Summary
  - Steps Forward
ICM History & Capabilities

- Founded in 1995; history dating to the 1970’s
- Based in Colwich, KS with 500 employees
- Design, Construction, Manufacturing, and Support of Ethanol Plants
- R&D, Engineering, Energy, Controls, and Environmental
U.S. Ethanol Industry Production:
168 biorefineries - 9.9 BGY capacity

- North America’s Leading Technology Provider (Several facilities in Canada exist. Green dots on U.S. map denote ICM plants).
- ICM is responsible for 80 operating plants (4.7 BGY) -- 20 plants under construction (1.8 BGY)

RFS-Mandated Corn Ethanol and Advanced Biofuels Volumes

- Corn Ethanol
- Advanced Biofuels

in Billion Gallons

Based on Energy Independence and Security Act of 2007
Ethanol helps offset rising food & gas costs

- USDA -- “Given that less than a third of retail food contains corn as a major ingredient, these rising prices for corn-related products would raise overall U.S. retail food prices less than 1 percentage point per year above the normal rate of inflation.” Amber Waves, February 2008.

- The Federal Reserve Bank of Kansas City says, “…a 10 percent gain in energy prices could contribute 5.2 percent to retail food prices.”

- Aug. 8, 2008: OPIS National Retail Average of $3.81/gallon
  DOE Usage Approximation of 140B gallons gasoline
  Merrill Lynch estimates Biofuels reduce gas prices 15%
  Iowa State estimates Biofuels reduce gas prices ~10%

  15 % = US citizens save $75.6B because of Biofuels
  10 % = US citizens save $50.4B because of Biofuels
It’s often about perspective…

WEEKLY COSTS FOR FOOD, GAS


Ethanol Today – August, 2008
Grain Based Ethanol Fermentation

- Maize based (corn kernel)
  - ~95% of US industry ferments corn kernels
  - Other potentials
    - Grain sorghum (milo)
    - Small grains (wheat, barley, rye, triticale)
- “Typical” new dry grind plant today
  - Ethanol: 2.8 gal/bushel corn
    - 96 gallons per dry ton
  - DDGS: 18 lbs/bushel corn
  - CO2 capture where economics allow
  - > 98%+ up time
  - Emissions below 100 tpy
    - (NOx, VOC, PM, CO, SOx)
  - Higher focus on DDG quality
- Fuel ethanol produced exclusively by fermentation
  - Plant consumption per gallon ethanol
    - 30,000 BTU
    - 0.75 kW electrical input
    - 3 to 4 gallons water
      - Majority of water needed for cooling
US Corn Feed Use

Growth rate = 85MM bu/year

*Data Courtesy FCStone Group, Inc.*
Ethanol Reduces Cost of Protein
Line of Sight =

What We’ve Learned

+ What We See

+ What We’re Delivering
Industry Leader – R&D
What Food Comes With Your Fuel?

- Food Grade Protein
- Food Grade Snack Grits & Flour
- High-Protein Distillers’ Grains
- Single-Cell Protein for Feed
- Bran for Dietary Fiber
Gaining Energy Independence

- 80%+ Reduction of Natural Gas
- 10,000 btu Natural Gas/Gallon Ethanol
- Ability to Use Wood Chips, Stover, Bran, Municipal Waste, Landfill Gas
- Methane Production with Single Cell Process
- Turbines for Electricity Generation
- Reduce Carbon Footprint – CO₂ Trading
- Eliminate the “Energy Balance” Debate
Total Kernel Optimization™: Sustainability as Primary Objective

Five Practical Solutions for New Renewables

- Dry Fractionation w/ Solid Fuel Combustion
- Germ-Oil Extraction
- Food-Grade Protein from Germ
- High-Value Feed Protein (Single-Cell)
- Cellulosic Ethanol from Corn Fiber

These products are created through a chronological process.
Vertical tubes carry material from one floor to the next via free fall gravity. The cyclones drop solids out of airflow; solid bran falls out the bottom.
(L-R) This photo shows the endosperm, bran, and germ separations after dry fractionation.
Food-Grade Oil Extraction

- Global Corn Oil Demand Increasing
- Preferred Over Soybean Oil (less trans fat)
- Oil/Fat Consumption Increases w/ Wealth (China & India)

- First Mover Gets Access to Present Market Value of Corn Oil
  - $0.88/lb for Refined Food Grade Today
  - Anticipated Minimum Near $0.50/lb

- 2006 US Corn Oil Supply Equal to Extraction of Thirty 130MMGY Ethanol Plants
Food-Grade Germ Protein

- Significant Fraction of Composition is Isolate Comparable to Egg Albumen
- Food-Grade Protein Concentrate (65%)
- Initial Estimate of Protein Concentrate Value = $3.00 per Pound
- Conservative Estimated Value of $1.50/lb
Single-Cell Feed Protein Synthesis

- **Increases** Protein Available to Feed Industry
- Tyson Removed all Antibiotics from Feed
  - SCP Can be ‘Live’ as Opposed to ‘Spent Yeast’
  - Research Suggests Some Antibiotic Benefits can be Replaced by SCP Feed
- Comparable to Brewer’s Yeast ($0.55/lb)
- Min. Value is Soybean Meal ($0.17/lb)
- Conservative Estimate of $0.25/lb
Cellulosic Ethanol from Fiber & Bran

- Cellulosic Ethanol Expected to Have Higher Market Value (Additional RINs)
- First Phase Capitalizes on C6 Sugars
- Increases Value of Fiber & Bran from BTU Equivalence to that of Liquid Fuel
Ethanol Bridging to the Future

- Food and Fuel
- Plant Energy Independence
- New High Value Products and Markets
- Risk Management Through Diversification
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Helpful websites:
ICM – icminc.com
EPIC – epicinfo.org
Ethanol – drivingethanol.org

Thank You!