

Tribal Opportunities: Ethanol Production

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BBI International

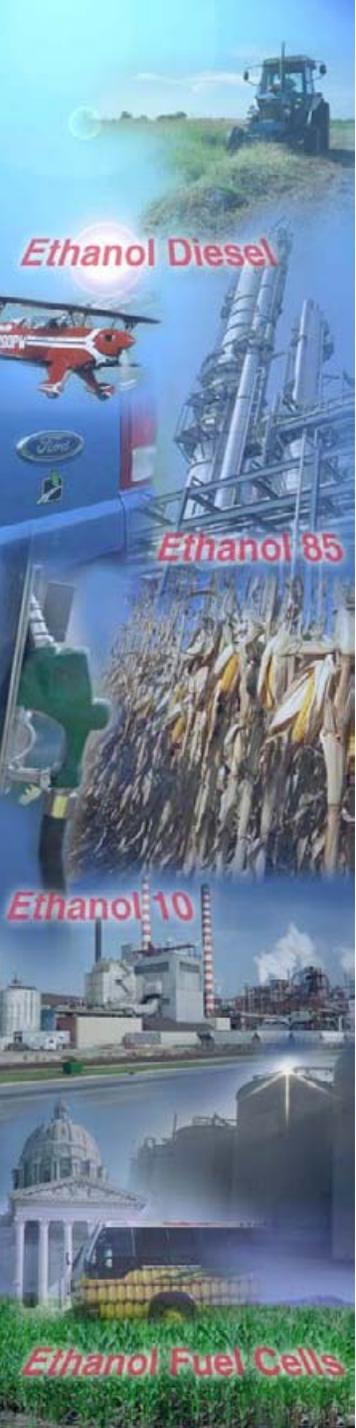
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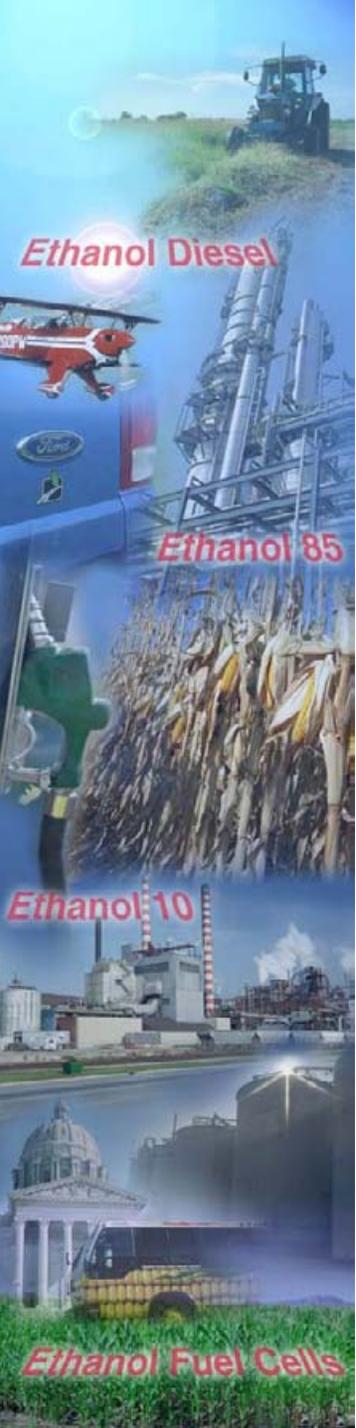
Presentation Outline

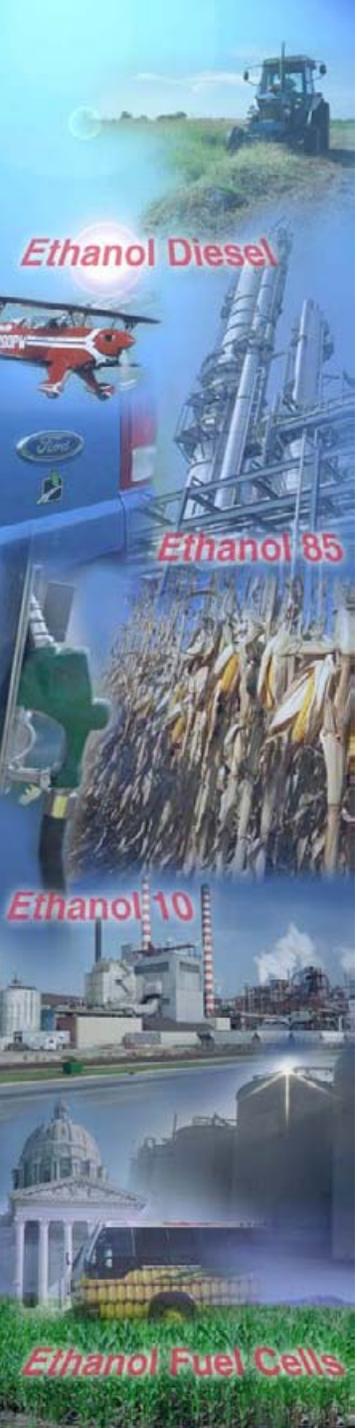
- BBI International
- Ethanol Overview
- Cellulosic Opportunities
- Project Development and Business Startup Issues



BBI International

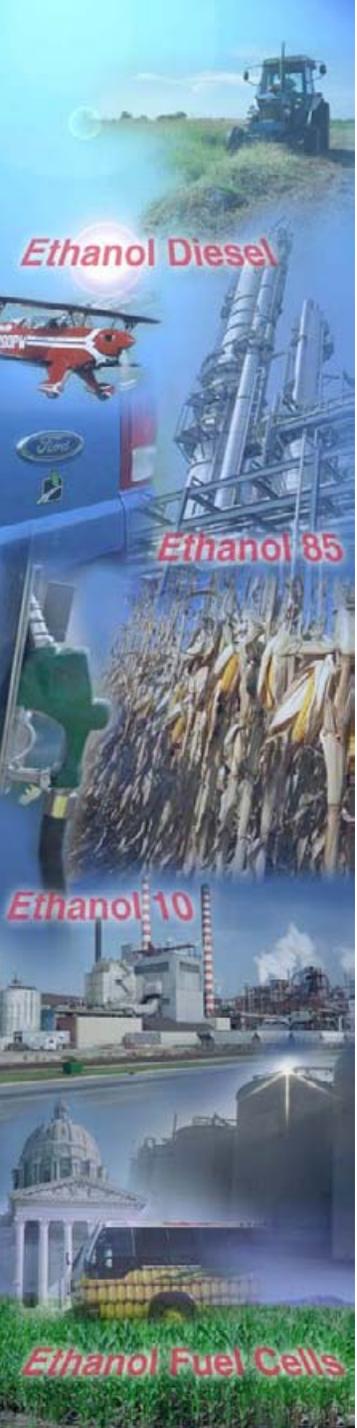
- Bryan & Bryan, Inc. founded in 1995 by Mike and Kathy Bryan (dba BBI International)
- 45 full-time employees
- 100+ years combined ethanol and biofuels experience
- Services:
 - Ethanol and Bioenergy Project Development
 - International Conferences and Workshops
 - Ethanol Producer and Biodiesel Magazines
- An independent source of information and data for owners, lenders and policy makers





BBI Consulting Division

- Leading ethanol consulting company in the US with more than 150 technical studies and business plans in the last five years
- Expertise in ethanol production from corn, milo, wheat, sugar cane, potatoes, etc.
- Expertise in emerging technologies for the production of ethanol and chemicals from lignocellulosic feedstocks
- Expertise in anaerobic digestion, biomass gasification, and biodiesel project evaluation



BBI's Role in the Ethanol Industry

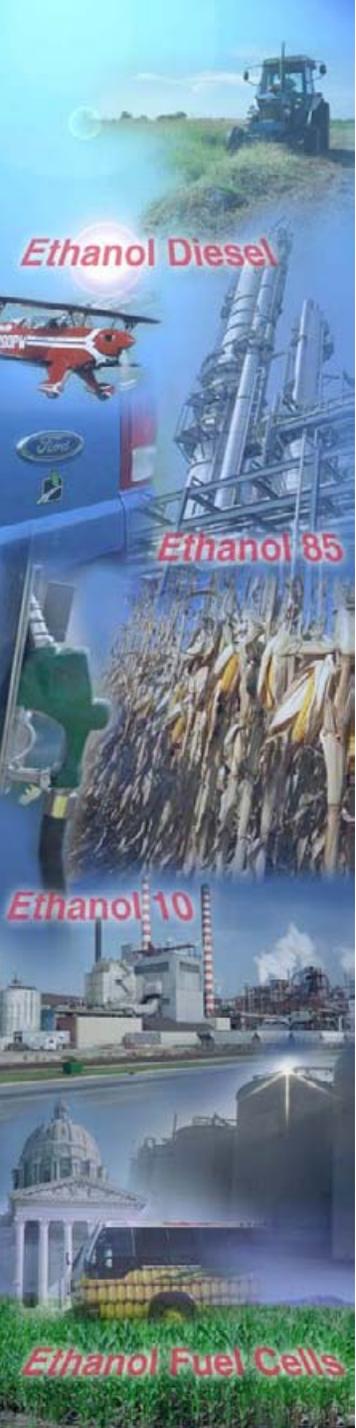
- BBI-affiliated projects total >600 mmgy
- “Affiliated” means BBI provided:
 - Feasibility Study
 - Business Plan
 - Project Development
 - Bank Inspections/Independent Engineers
- BBI has been involved in over 14% of the current standing production capacity in the United States
- Currently developing a 40 mmgy ethanol plant for Chippewa-Cree in Montana

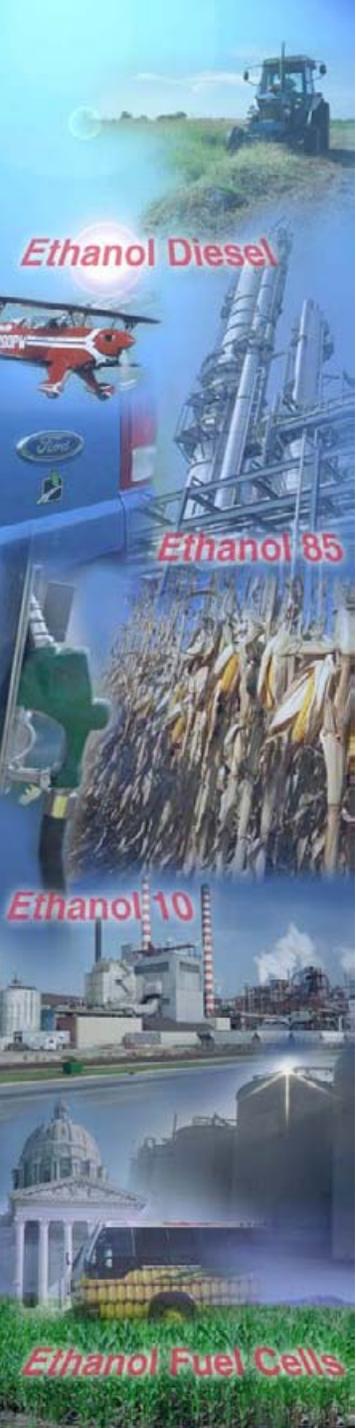
The Ethanol Industry



Overview

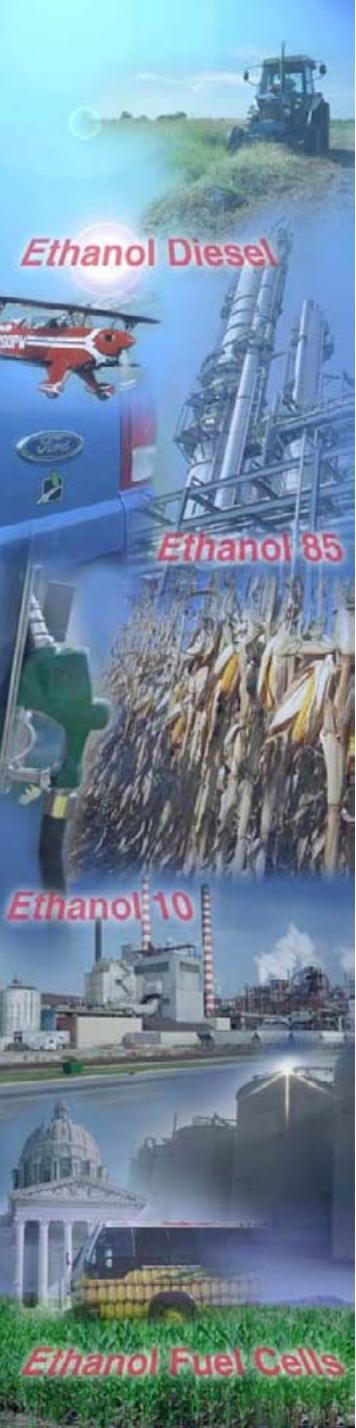
- Ethanol has been known to man for thousands of years
- Distillation was invented in the middle ages
- Henry Ford used ethanol in early cars
- Fuel ethanol has been growing steadily since the early 1970's





Current Ethanol Production

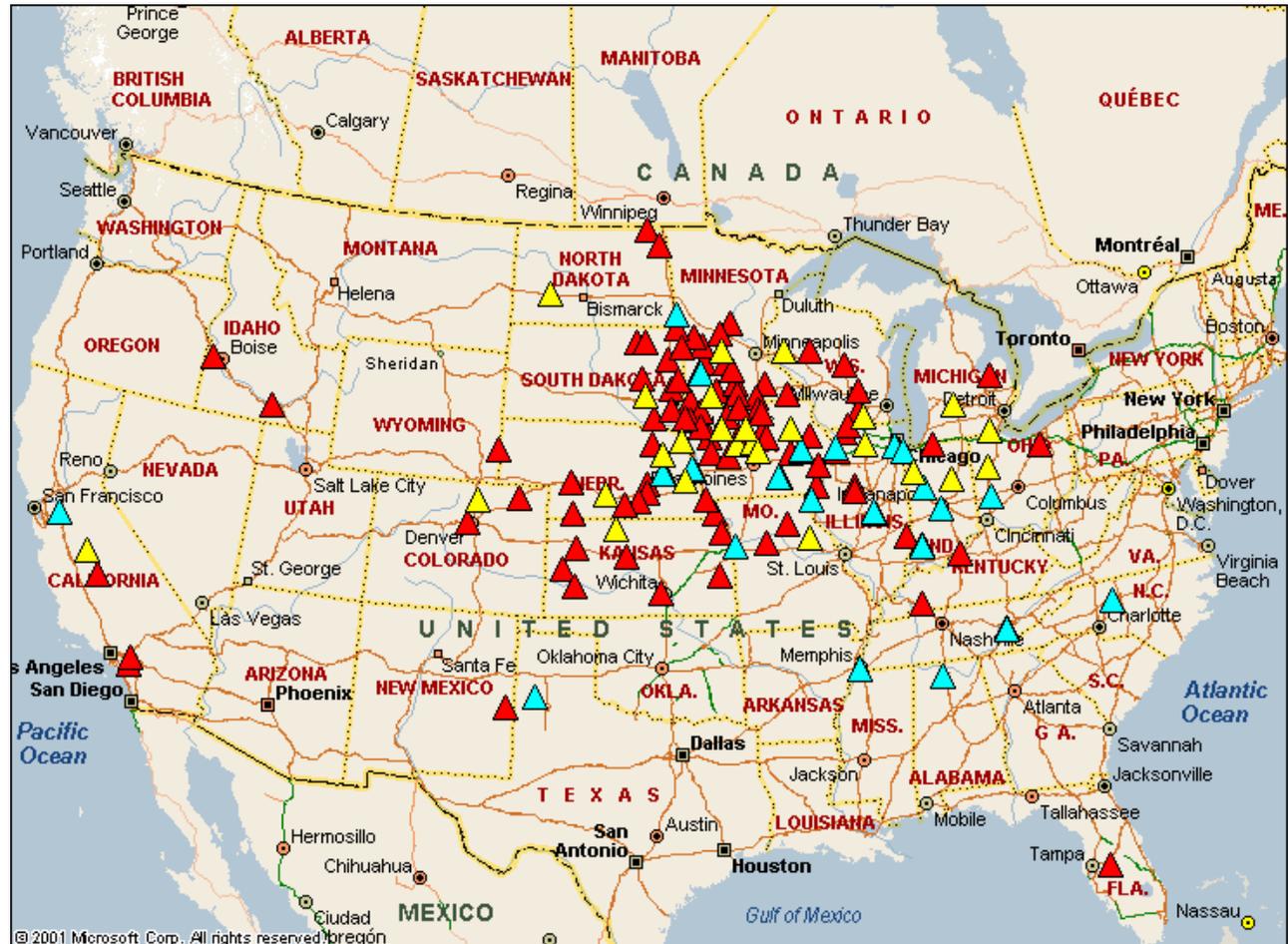
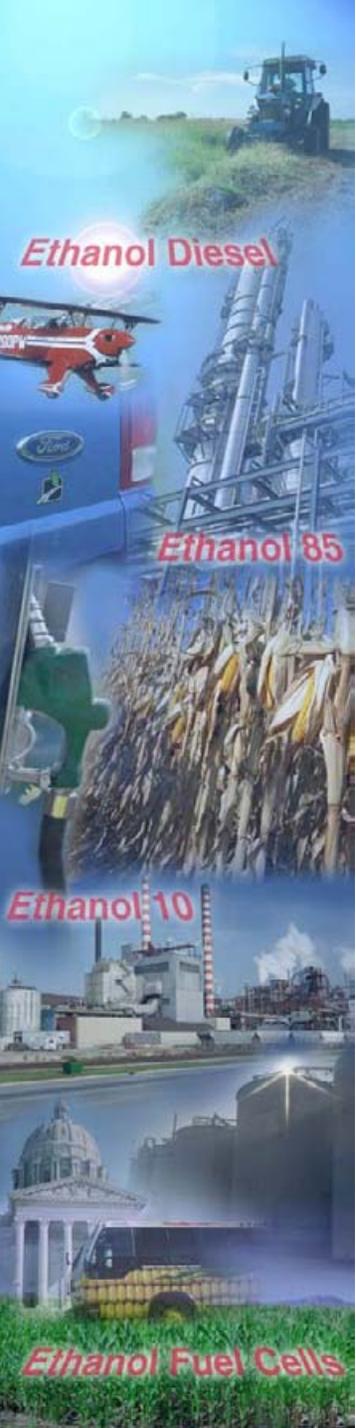
- 103 operating ethanol plants in the U.S. with a production capacity of 4.4 billion gallons
- 31 plants under construction with 1.6 billion gallons of additional production capacity
- 6 billion gallon of production capacity
- Most built in the last 3 years



Current Ethanol Production

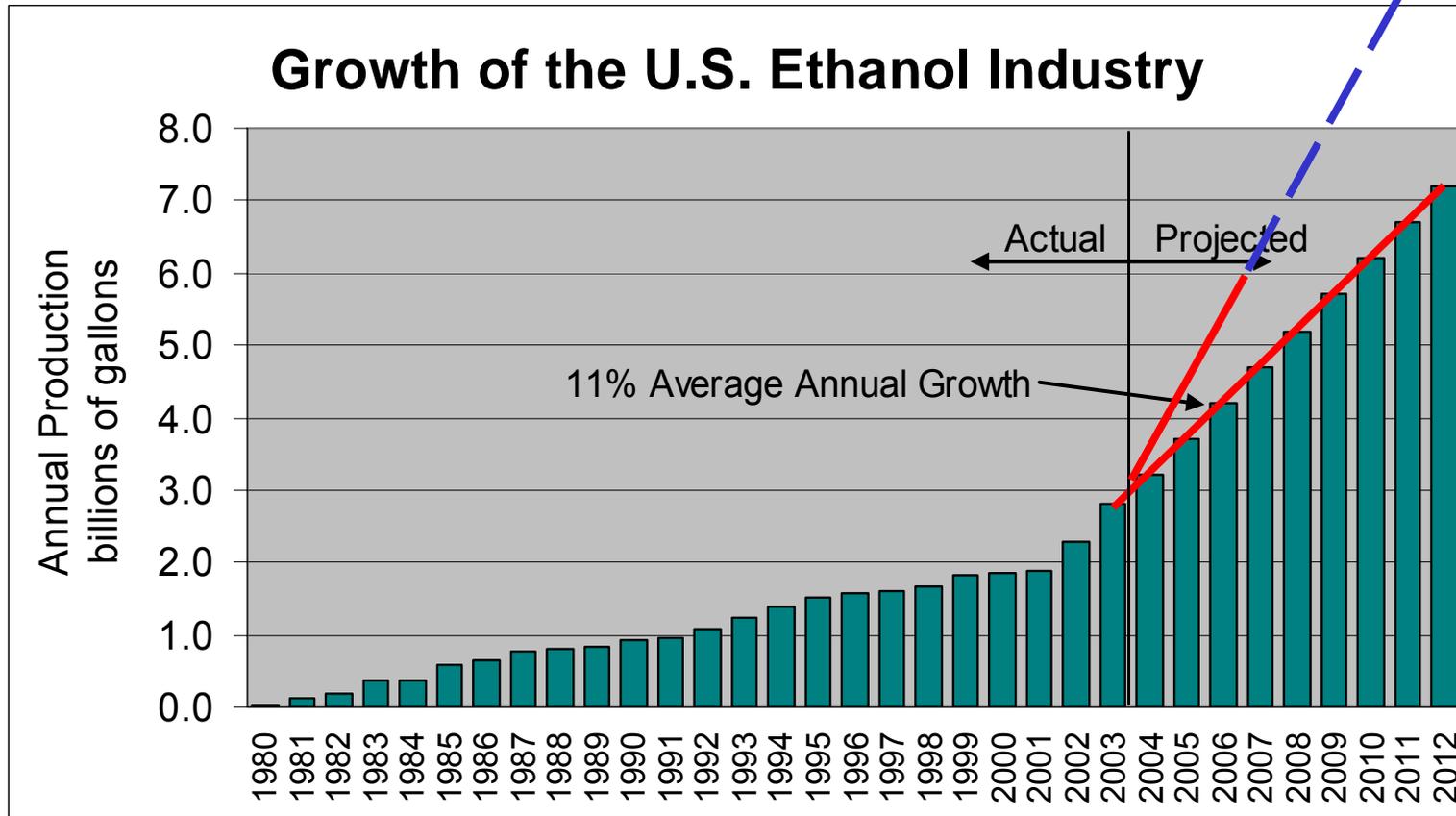
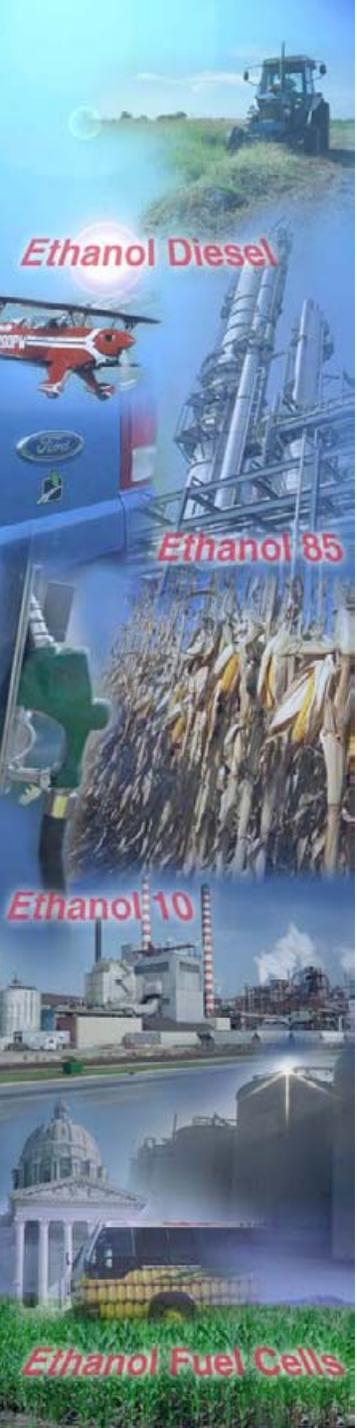
- Earlier plants used to be <20 mmgy
- Plants under construction now range from 40 – 100 mmgy, most > 50 mmgy: ADM: 275 mmgy
- Approximately 45% is wet milling and 55% from dry milling and growing
- Most built in the last 3 years
- 95% of the current production is from corn
- Handful of other feedstocks
- Spent beverage plants are <10 mmgy

Ethanol Producers – Where are they?



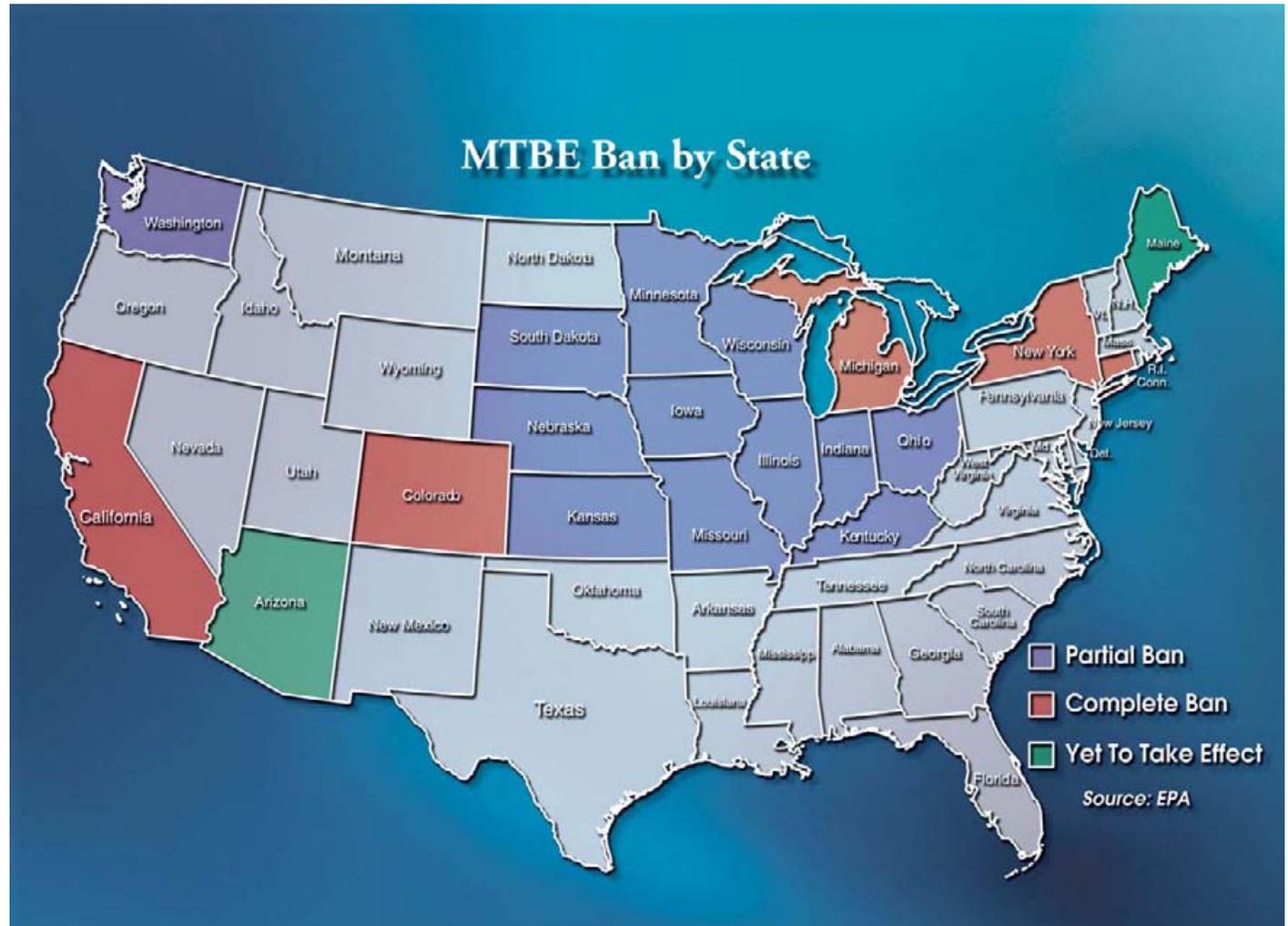
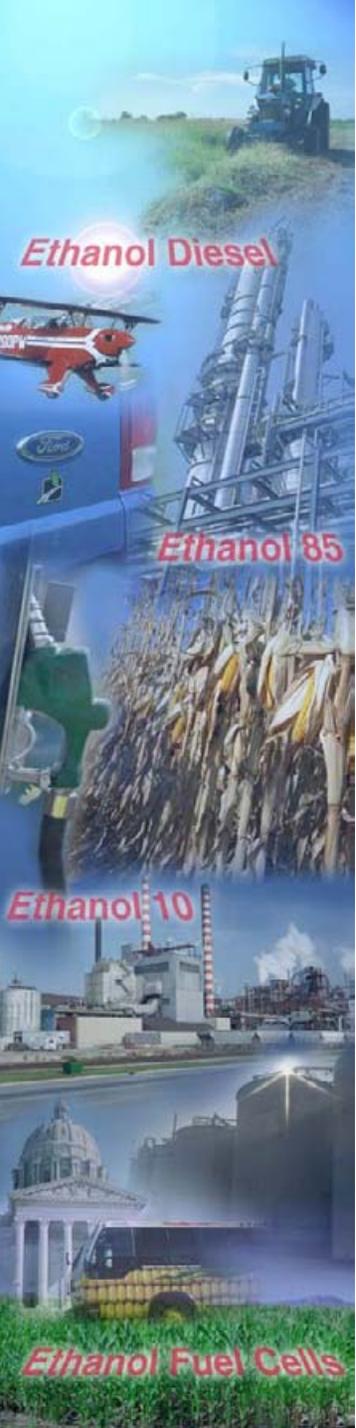
▲ Existing ▲ Wet Mills ▲ Under Construction

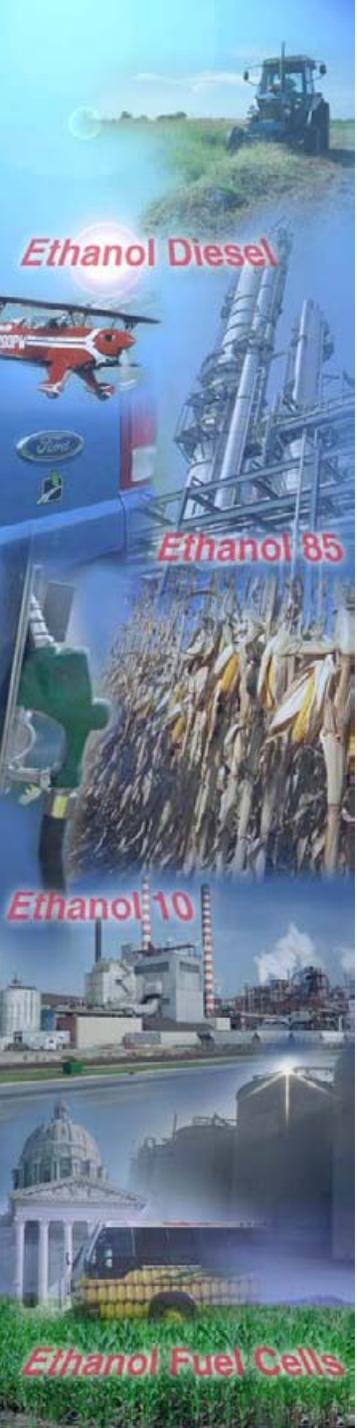
Industry Drivers: Legislated Ethanol Market Growth: RFS: 7.5 billion gallons by 2012



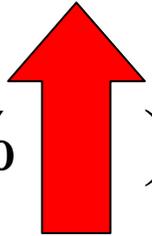
Source: BBI International

Industry Drivers: MTBE Phase Out



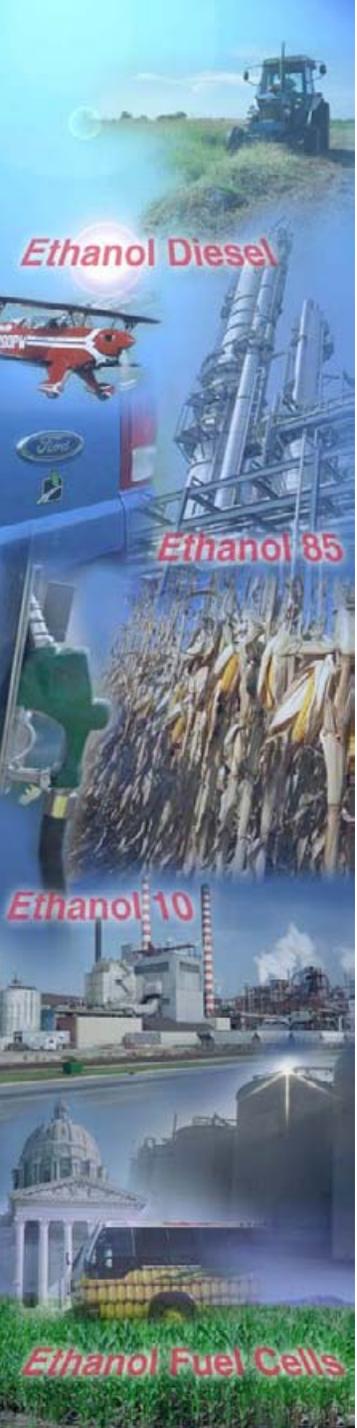
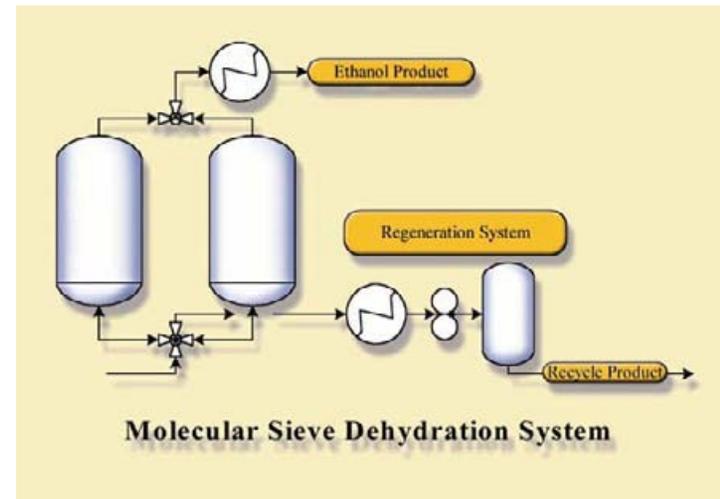


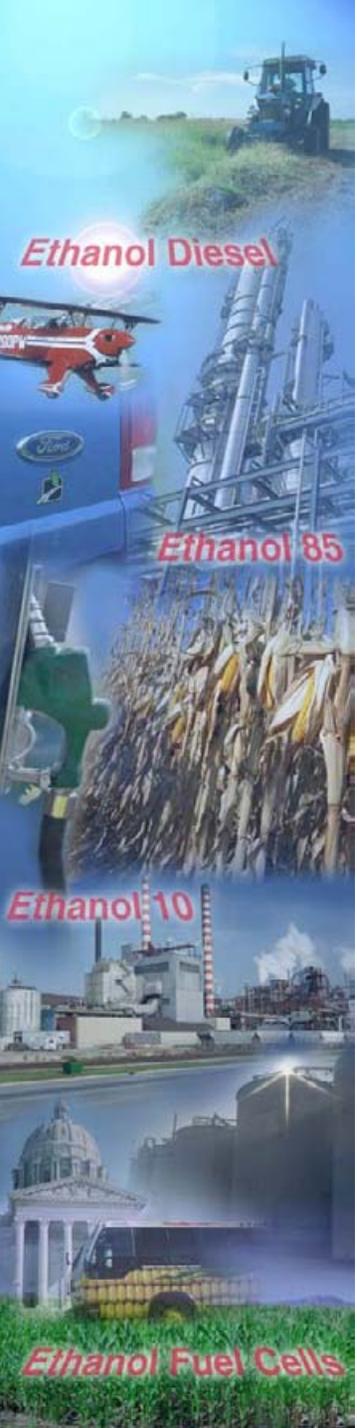
Other Industry Drivers

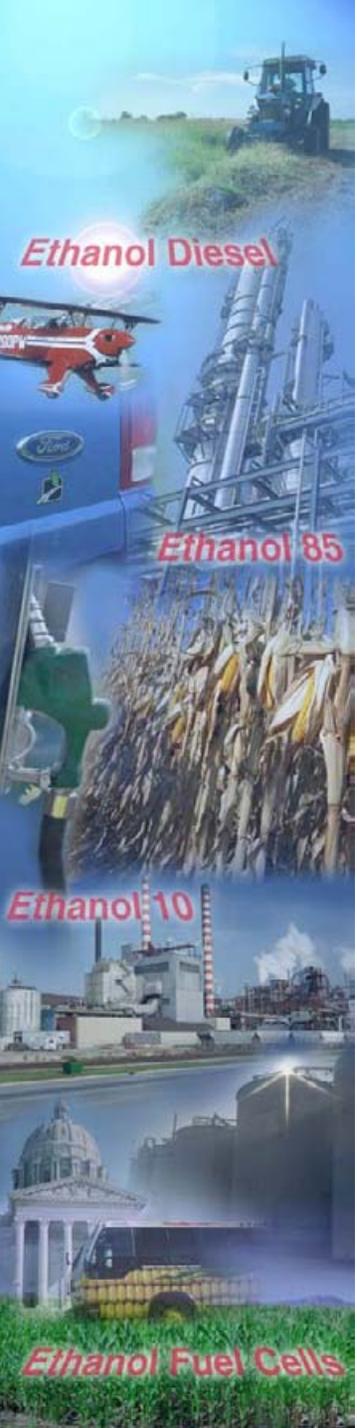
- Oxygenated Fuel
- International Trade Deficit
- Dependence on Foreign Oil (>65% )
- Energy Security
- War
- Value-Added Agriculture
- Special incentives to develop commercial production from cellulosic feedstocks

Ethanol Process Design Companies

- Fagen and ICM
- Broin and Associates
- Delta T
- Katzen International
- Lurgi/PSI
- Vogelbusch USA
- MECS

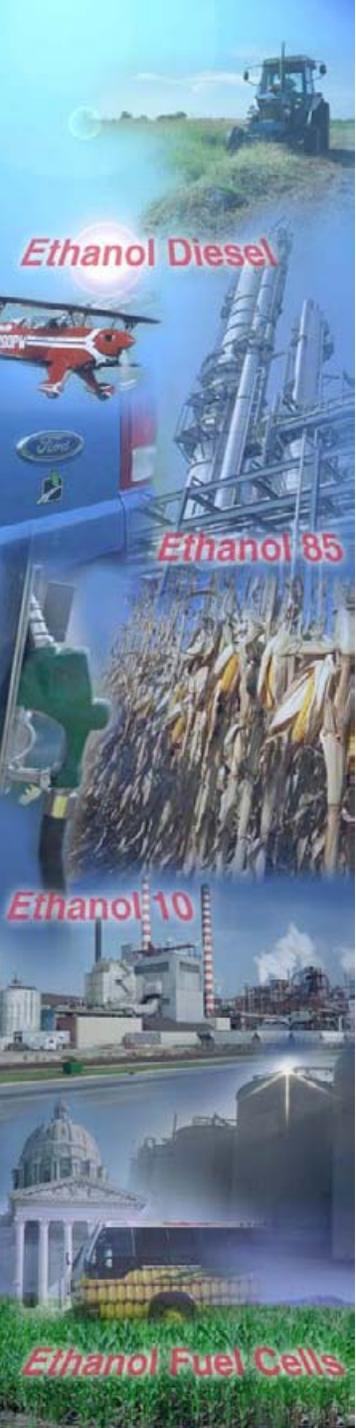






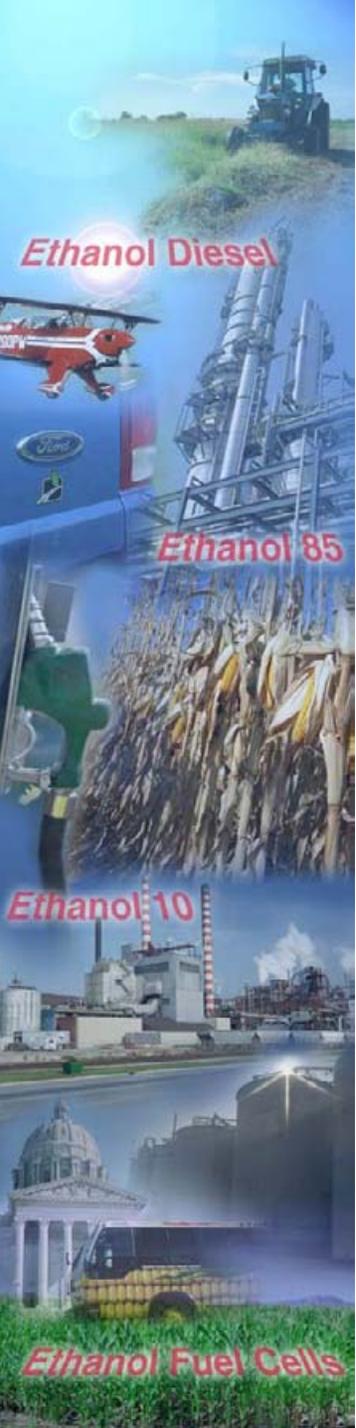
Raw Material - Corn

- Low cost source of starch
- Easily grown, harvested, stored, transported
- Existing infrastructure
- Price well-known
- High value co-products
- Standard grade available



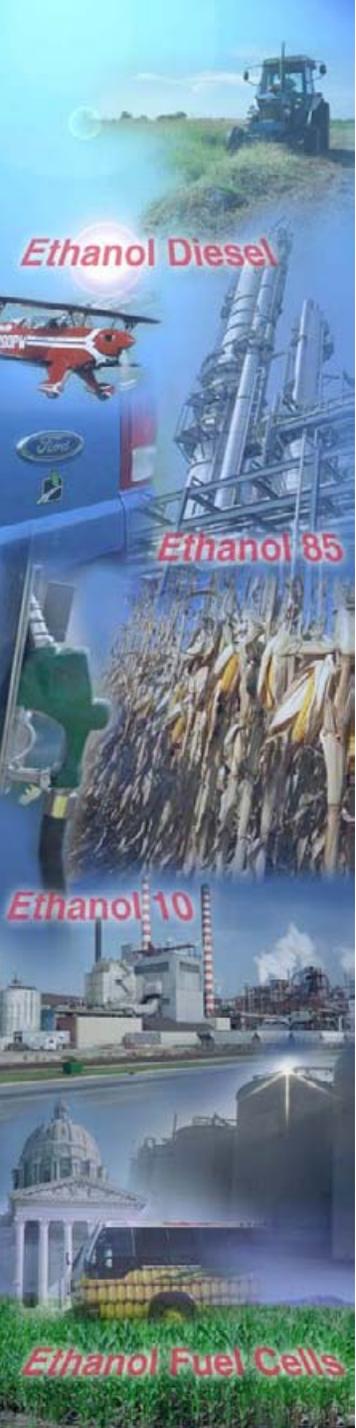
Raw Materials Corn

- Components of corn
 - Moisture 14 – 16 %
 - Starch 65 – 72 %
 - Protein 8.5 %
 - Fibre 9.5 %
 - Fat 4.3 %

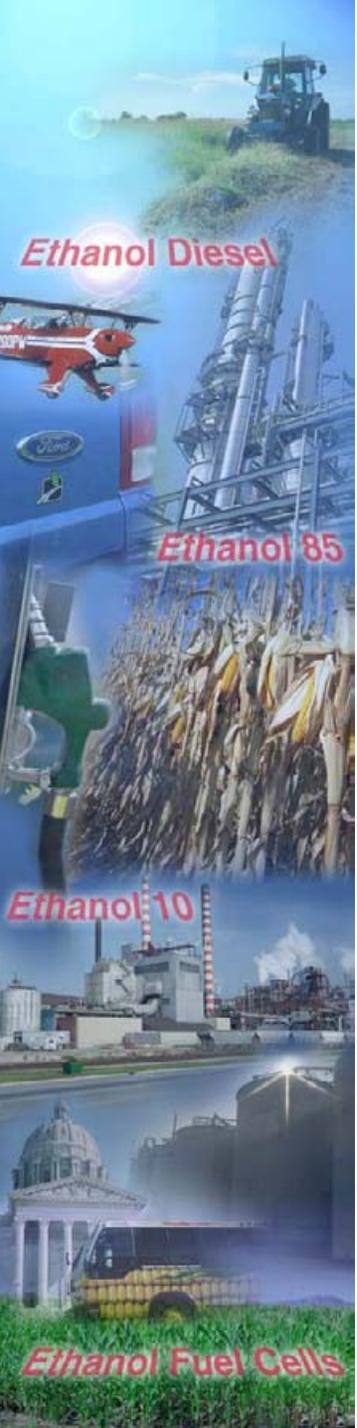
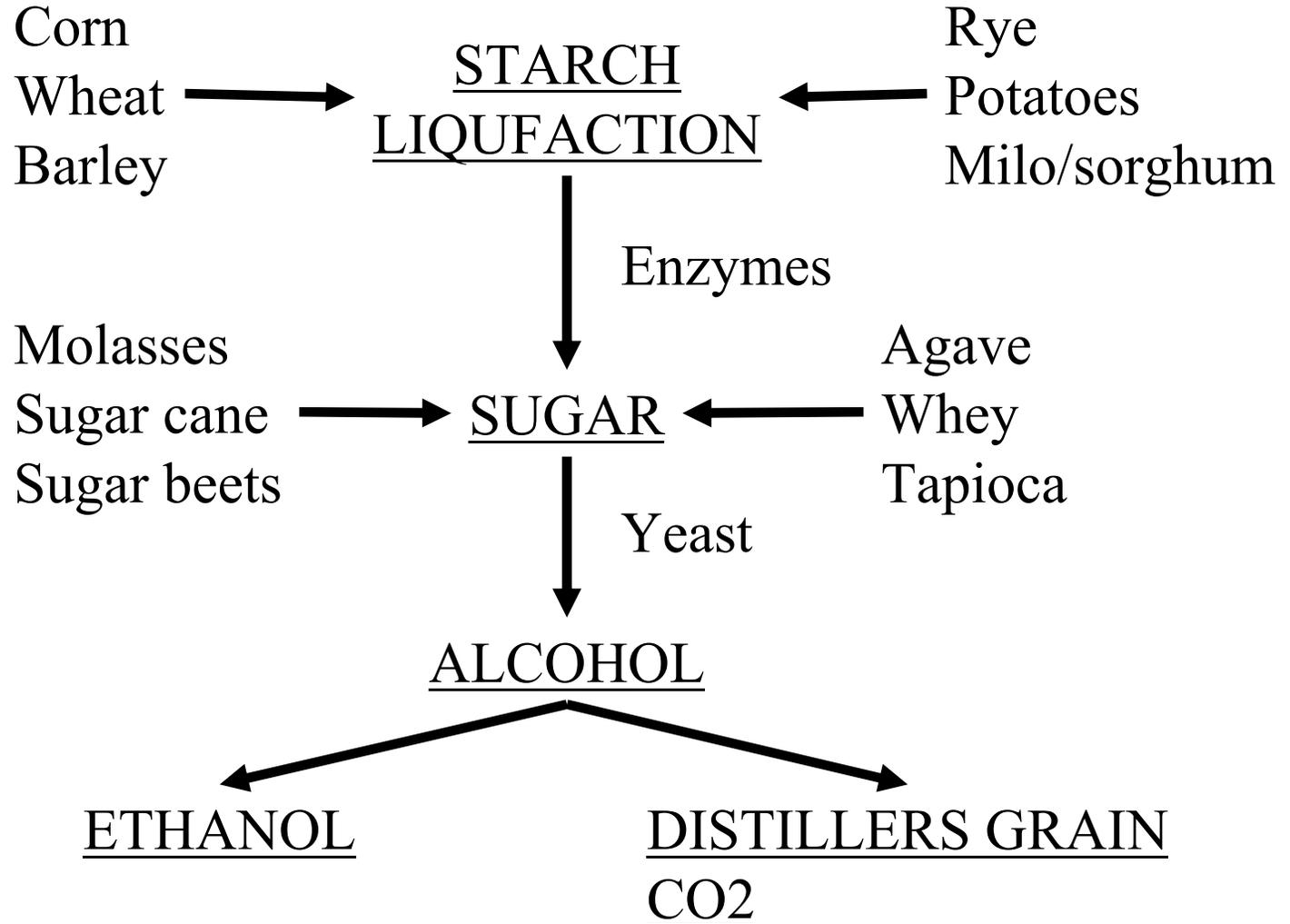


Other Feedstocks for Alcohol Production

- Cereal Grains
 - Corn
 - Milo (sorghum)
 - Wheat
 - Barley
 - Rye
- Sugar Based
 - Molasses
 - Sugar cane
 - Sugar beets
 - Agave
 - Tapioca
- Potatoes
- Cellulosic Biomass

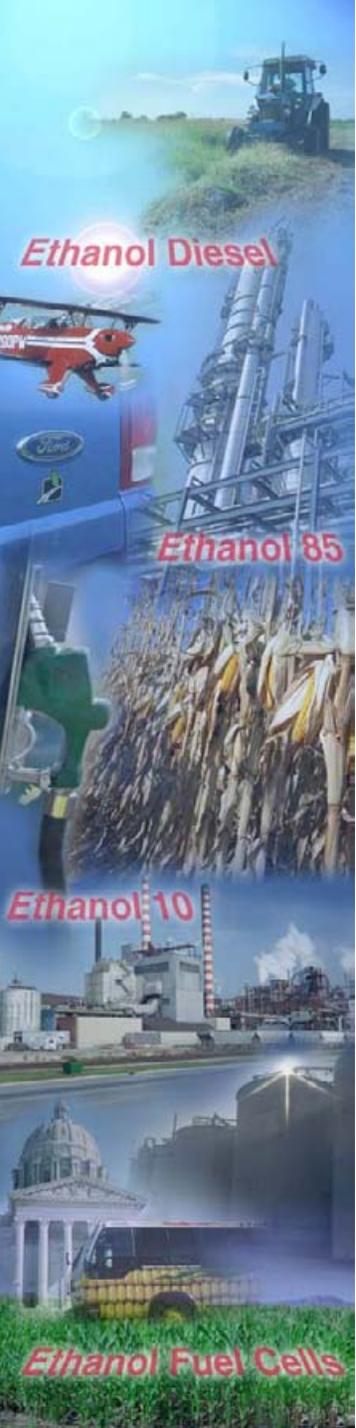


Alcohol Production

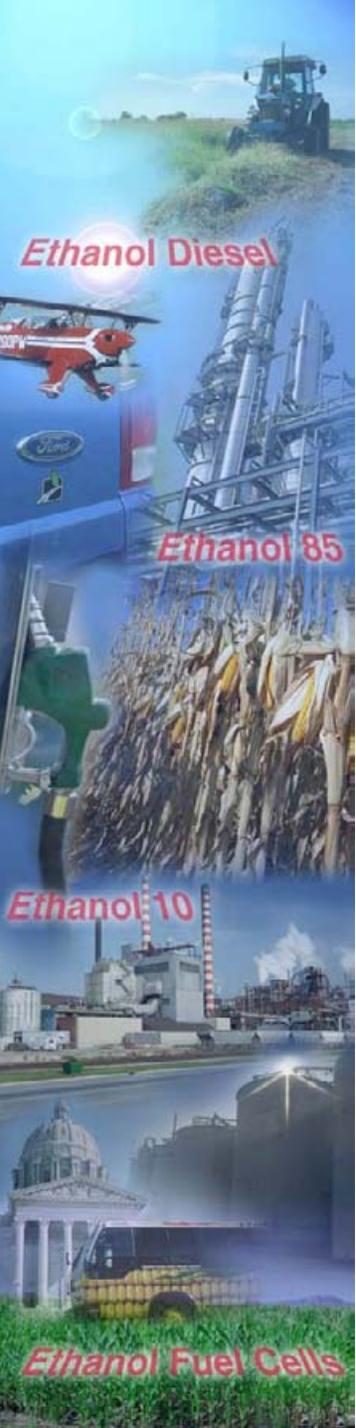
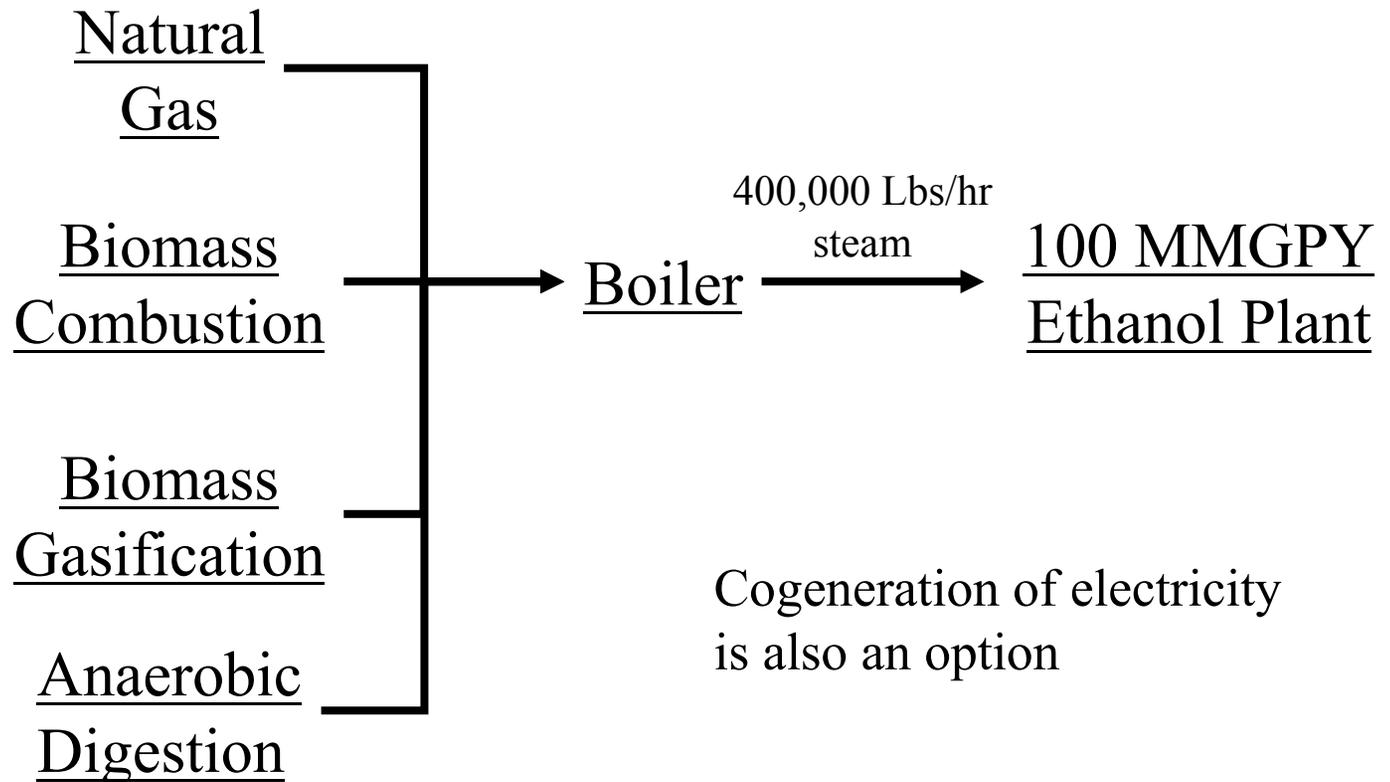


Production Requirements

- 2.68 gal/bu anhydrous; 2.8 gal/bu denatured
- 17,500,000 bu/yr for 50 mmgy of EtOH
- Utilities required include natural gas, electricity, water and wastewater disposal
- Steam: 32,000 BTU/gal ethanol
- Electricity: 0.7 kWh/gal ethanol
- Water: 4-12 gal/bushel corn
- Wastewater: can vary considerable with plant design, but about 25% of makeup water



Fuel Options



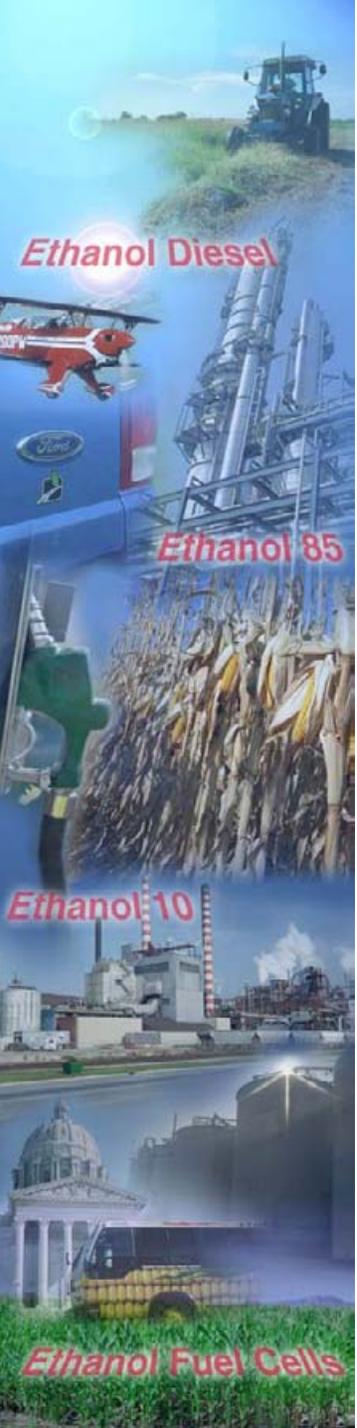
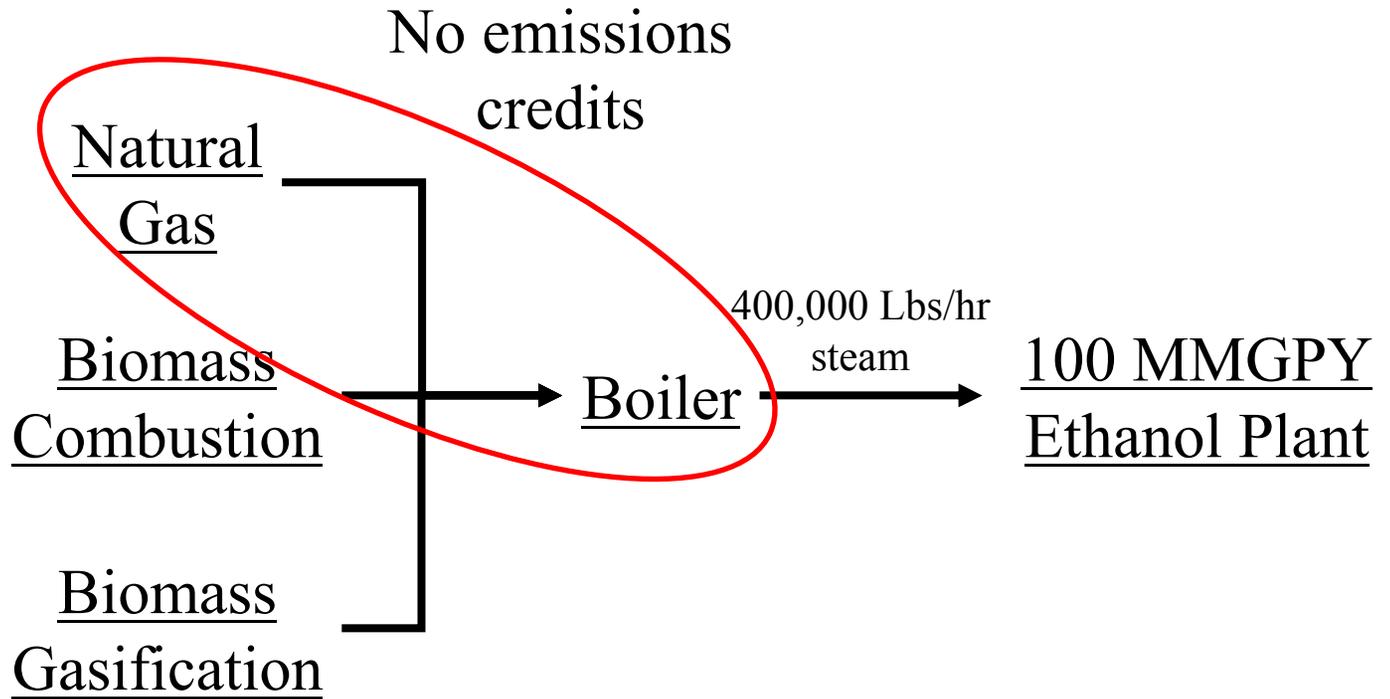
Ethanol Diesel

Ethanol 85

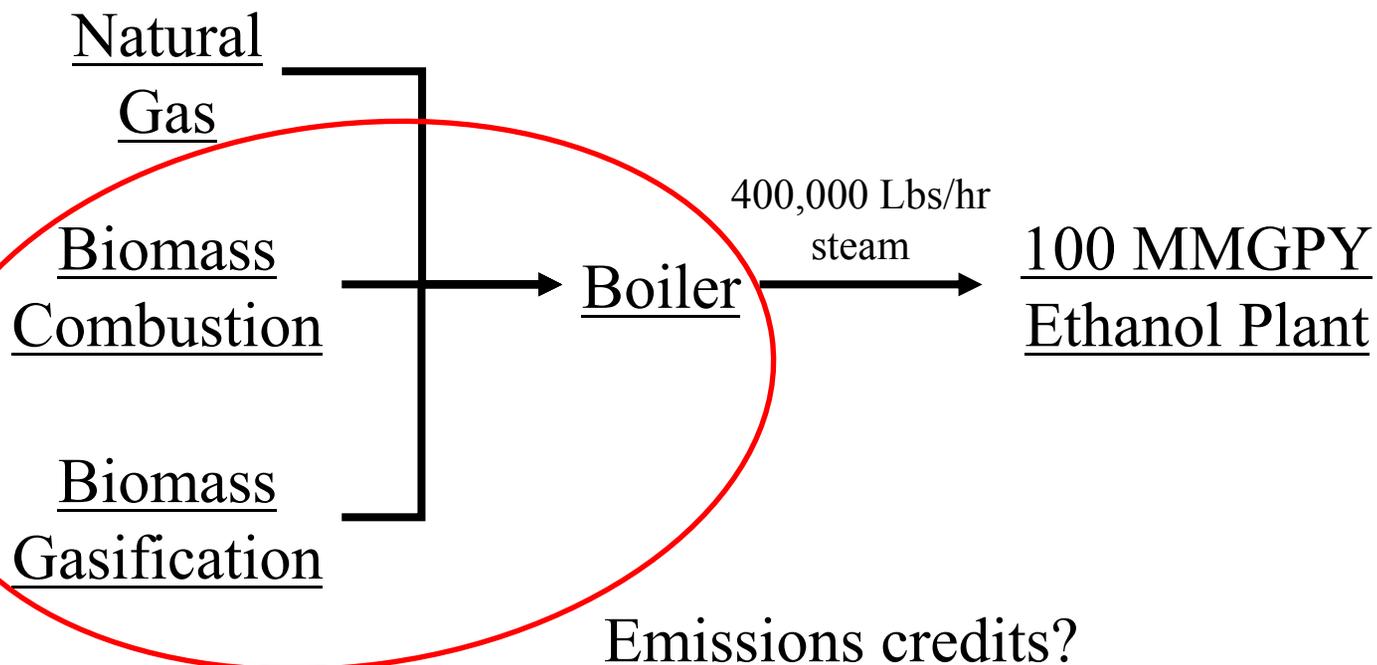
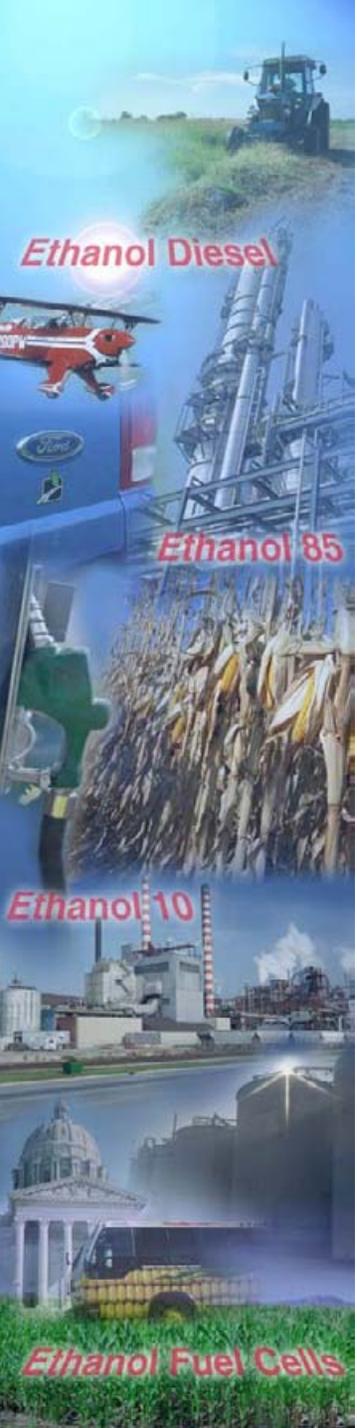
Ethanol 10

Ethanol Fuel Cells

Natural Gas Fuel Option



Biomass Fuel Option



Products From Corn



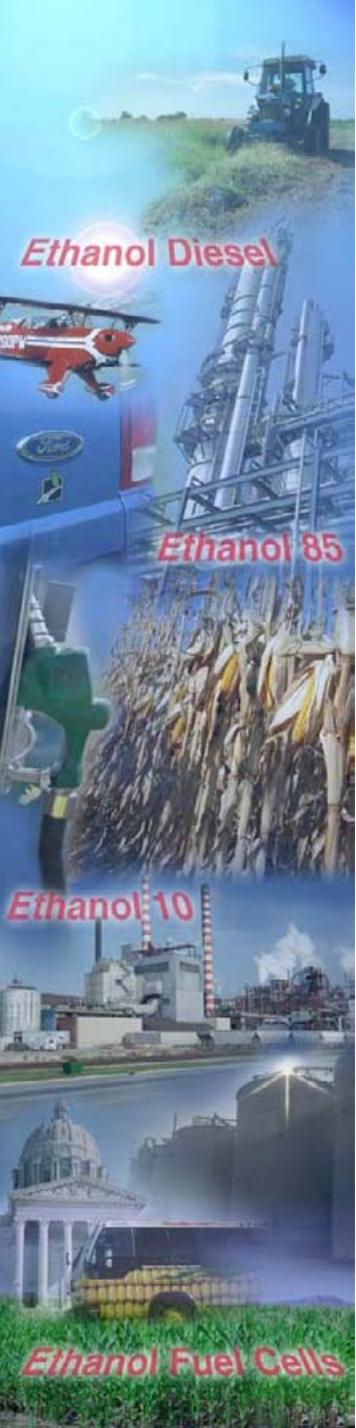
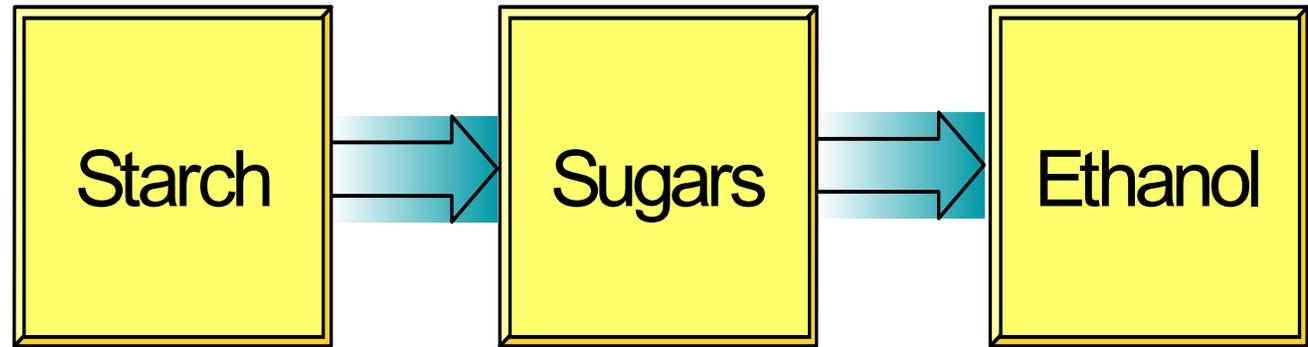
Corn

Ethanol
1/3

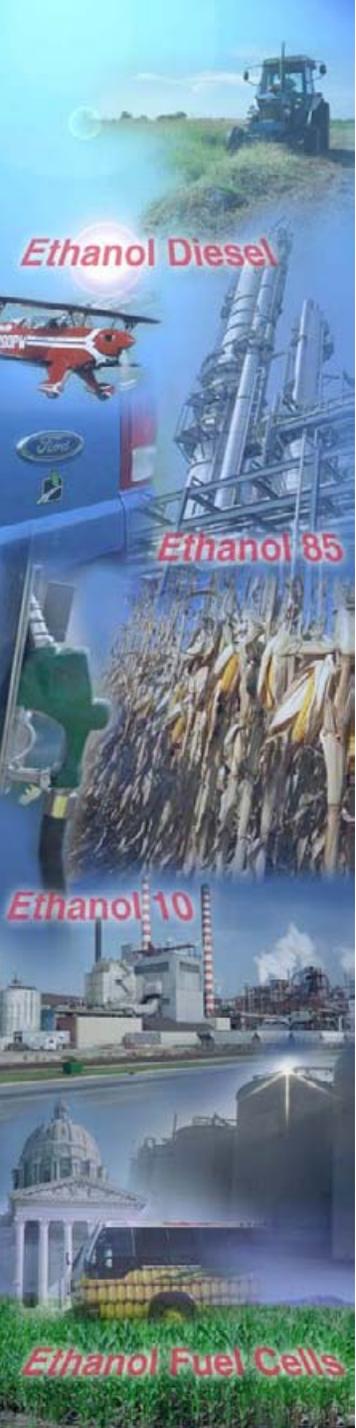
Dried Distillers Grains
DDG
1/3

Carbon Dioxide
CO₂
1/3

Ethanol Production

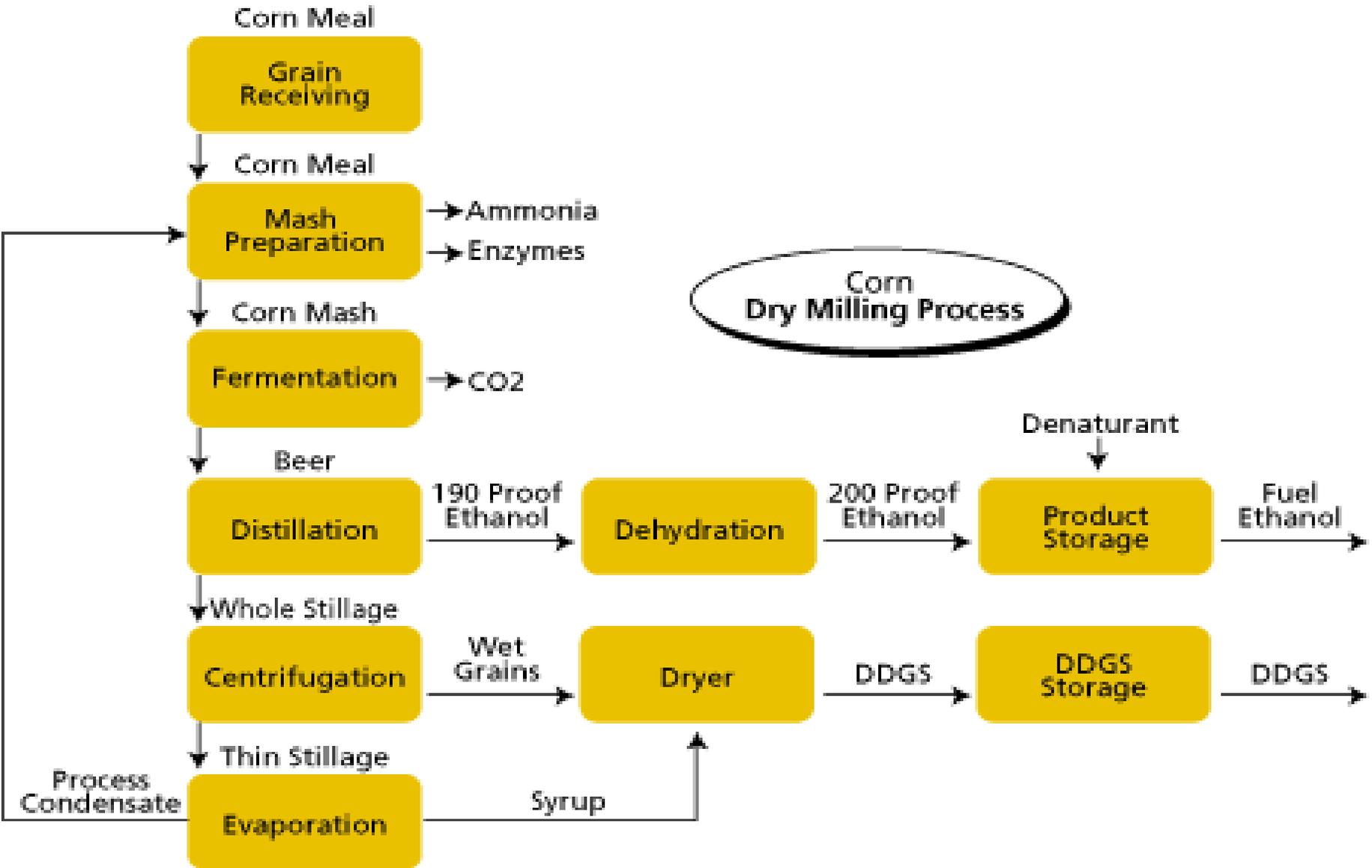


Corn Receiving and Storage



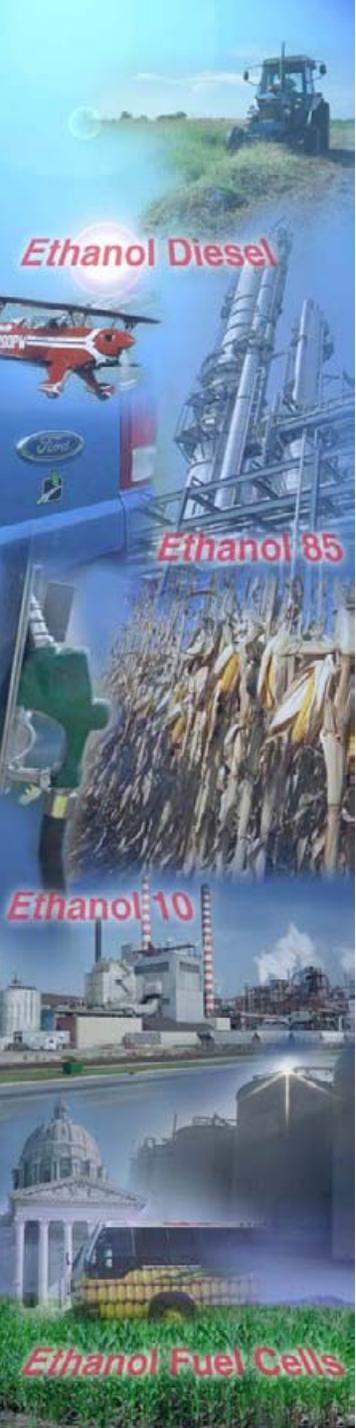
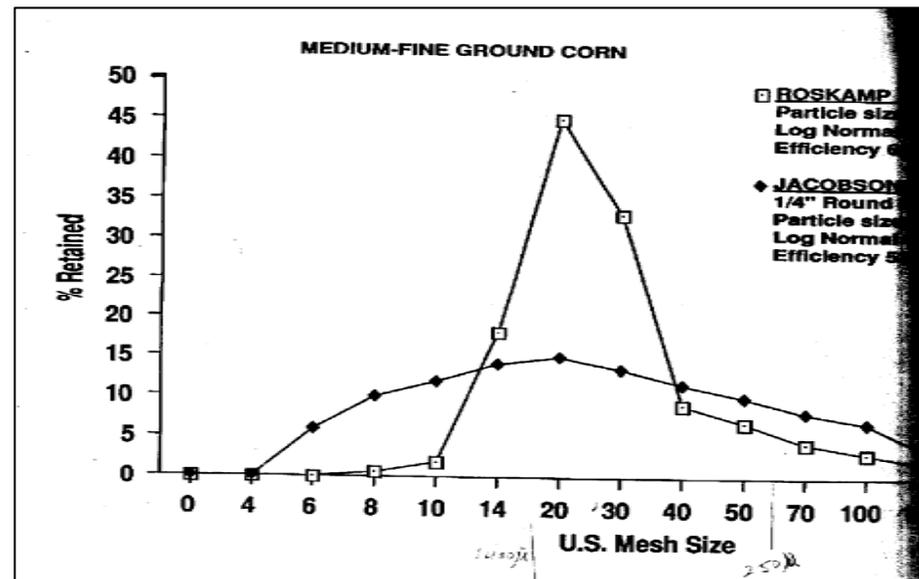
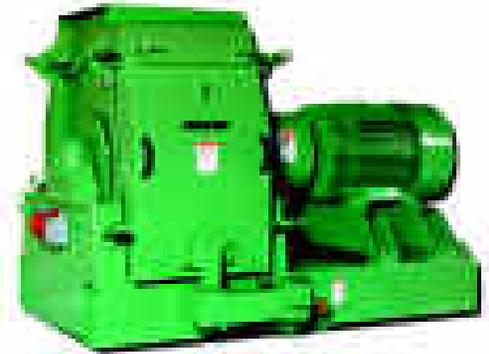


Dry Milling Process



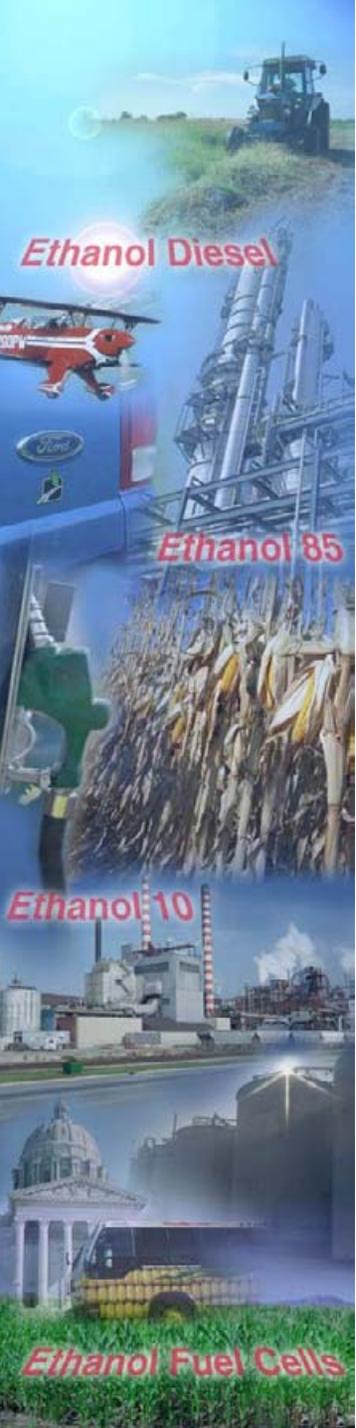
Grinding

- Hammermills
- Meal analysis
 - Avg. particle size 1.5 mm
 - 60% on sieve # 18 to 60
 - less than 10% fine and coarse



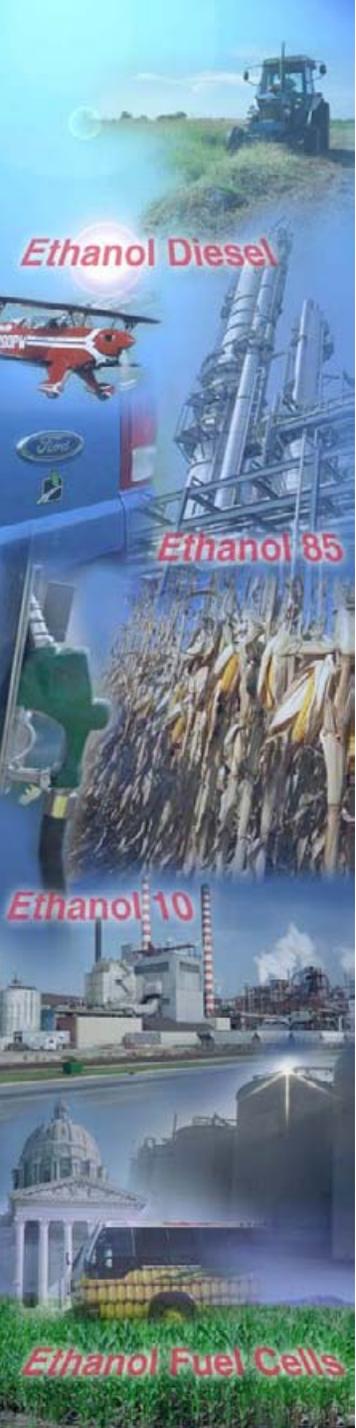
Mashing

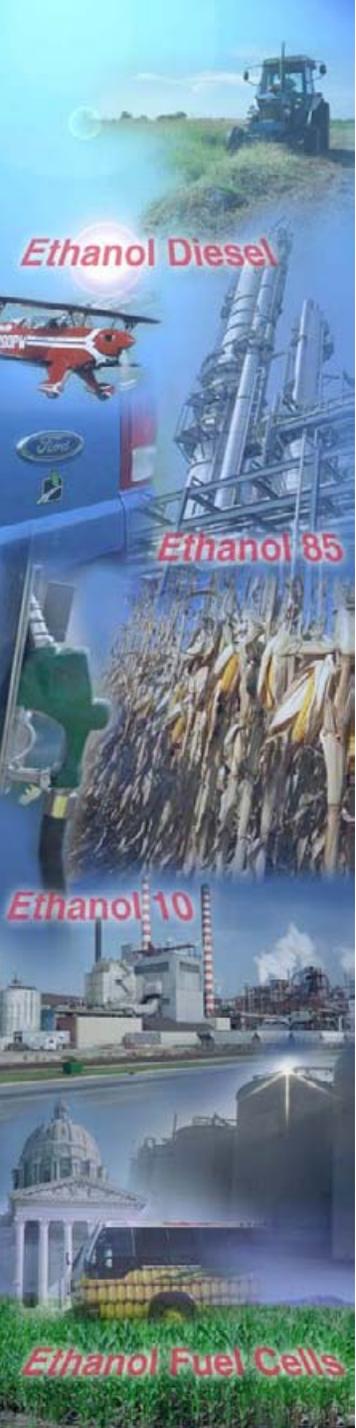
- Slurry
- Cooking
- Conversion
- Saccharification
- Enzymes
- Time / temperature



Fermentation

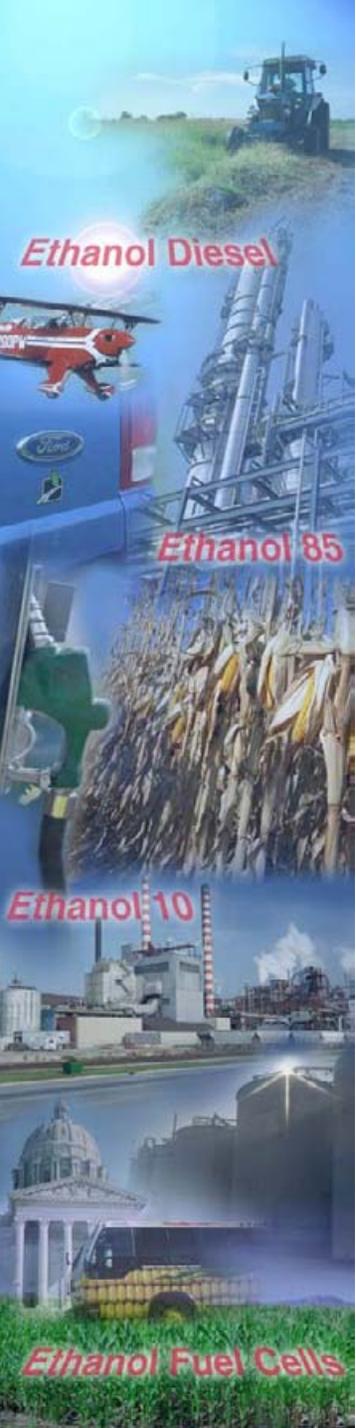
- Batch vs. Continuous
- Yeast
- Time / Temperature
- Infections





Downstream Operations

- Distillation
- Dehydration
- Centrifugation
- Syrup Evaporation
- Distillers Grains Drying
- Process Water Recycling: AD & UF/RO
- Product Denaturation and Loadout



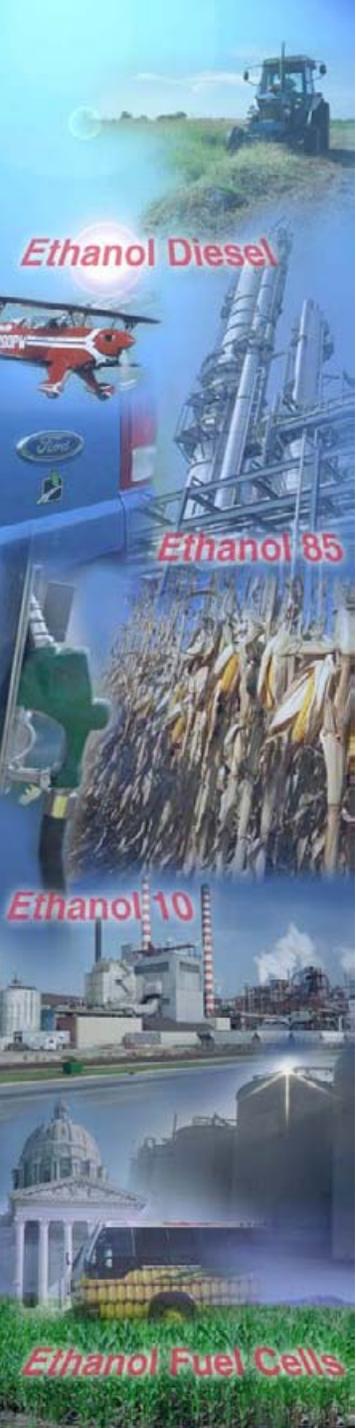
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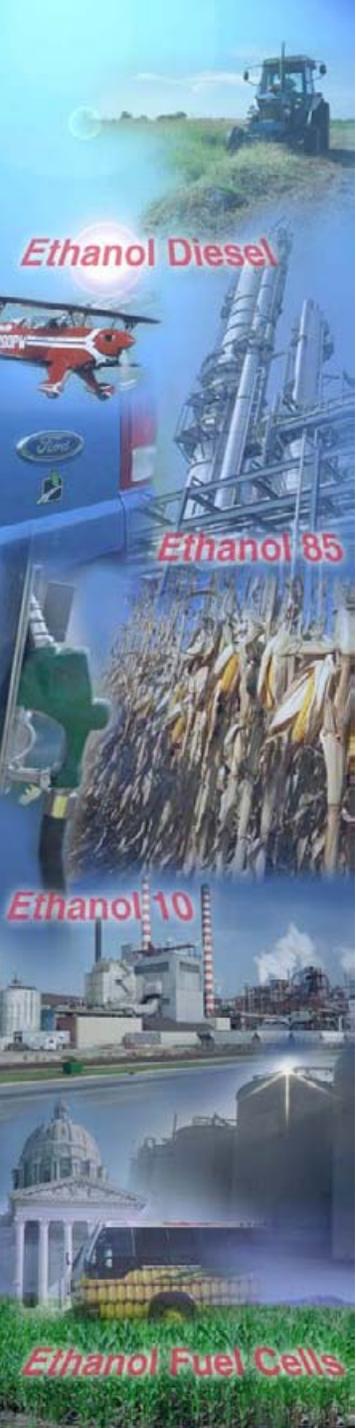
Ethanol Fuel Cells

Cellulosic Ethanol -- Commercialization Issues and Strategies



Biomass Feedstocks

- Ethanol production potential from corn stover in the U.S. is greater than 10 billion annual gallons
- Add all other agricultural residues, forest residues, urban green waste, MSW, and energy crops in the U.S. and the potential is as high as 50 billion gallons
- Feedstocks will not limit the size of the cellulosic ethanol market

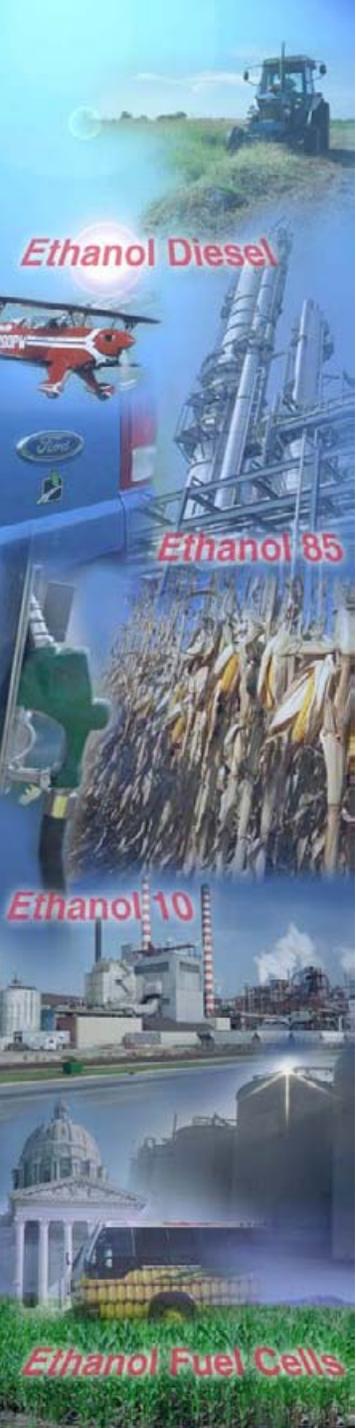


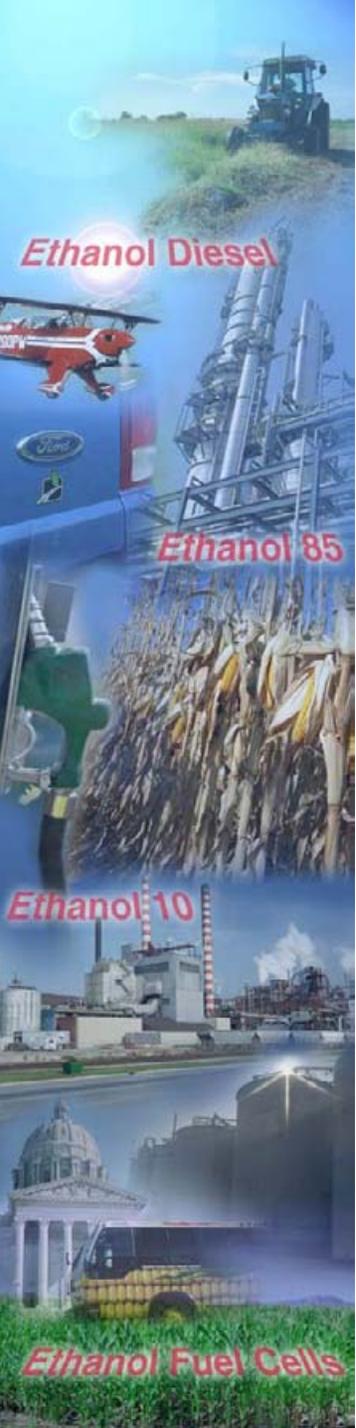
Status of Technology

- Enzymatic hydrolysis to produce sugars has the lowest cost potential
- The cost of cellulase enzymes has prevented commercialization of the enzymatic process
- other processes – two stage dilute acid, concentrated acid, gasification – have not made the jump to commercial deployment

Projects

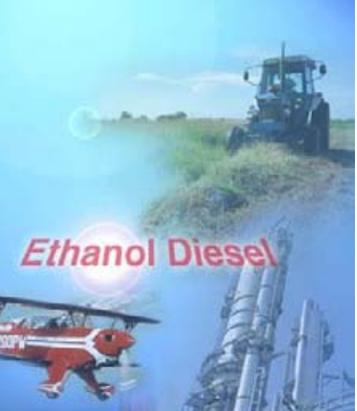
- BCI – Jennings still not financed...
- BCI – Gridley and Collins Pine cancelled
- Masada – long delay for air permit (now issued), Middletown, NY project may be financed soon? (2 years and waiting)
- Arkenol – project in Japan?
- Iogen – making perpetual progress
- Gasification – (catalytic conversion of syngas to ethanol) lots of interest, little published data





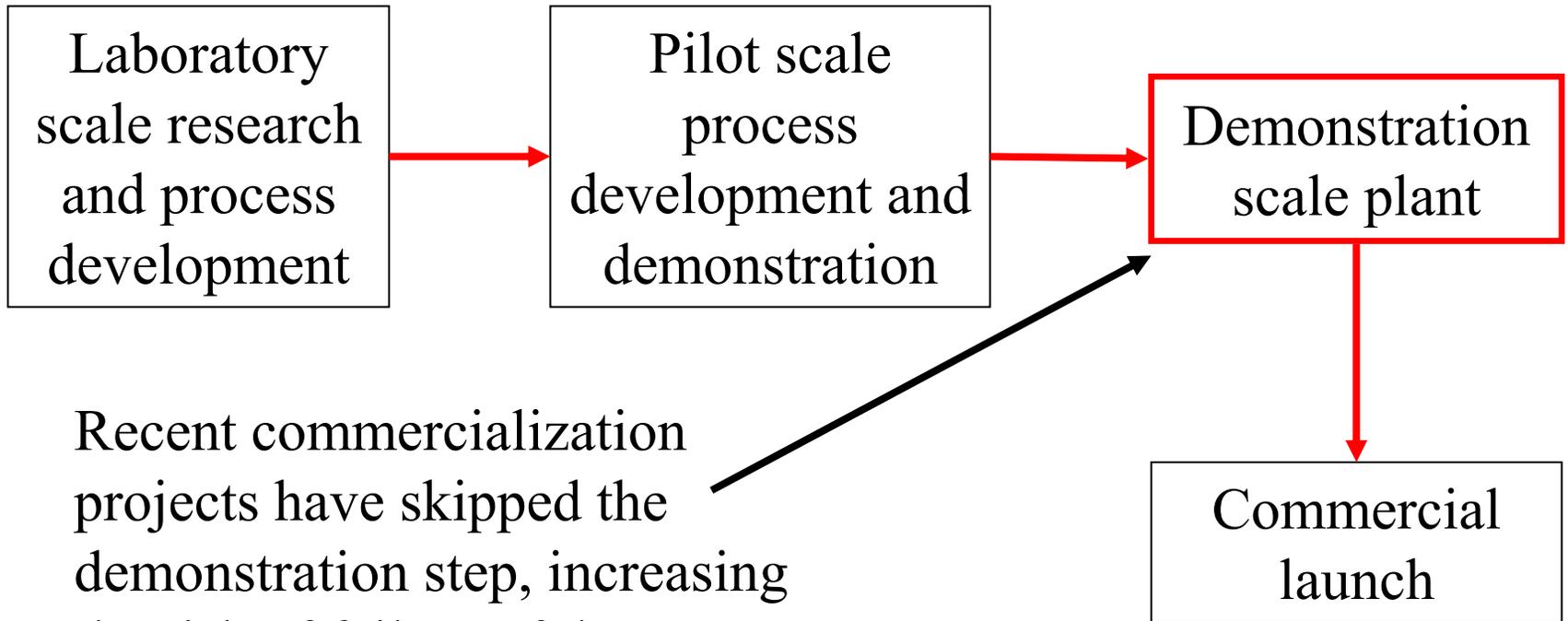
Projects

- Cargill-Dow – PLA plant in Blair, NE using wet mill sugars; working on biomass as sugar source
- Williams/Purdue – Conversion of fiber in DDG to ethanol
- Abengoa – has just built a 5 million liter/year cellulosic plant in Europe with a 200 million liter/year wheat/barley ethanol plant

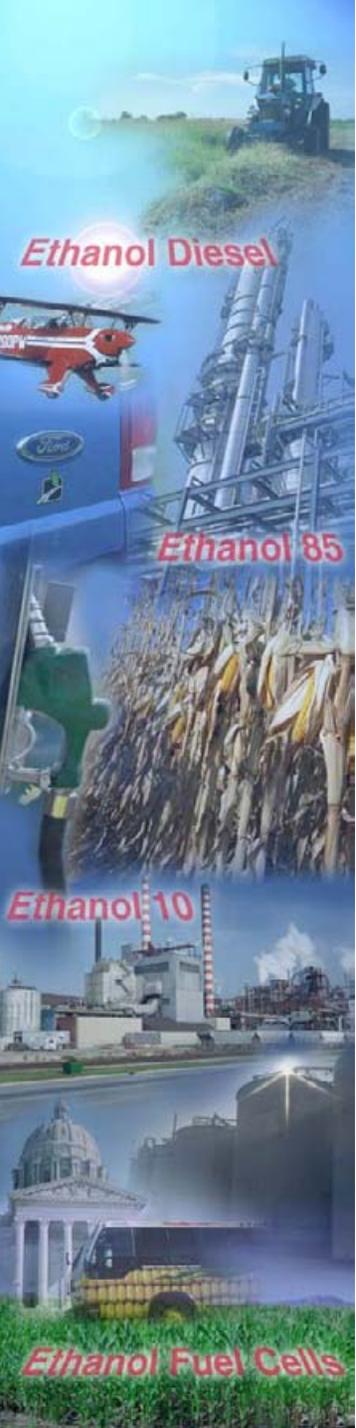


New Technology Path

Increasing equipment size and development costs

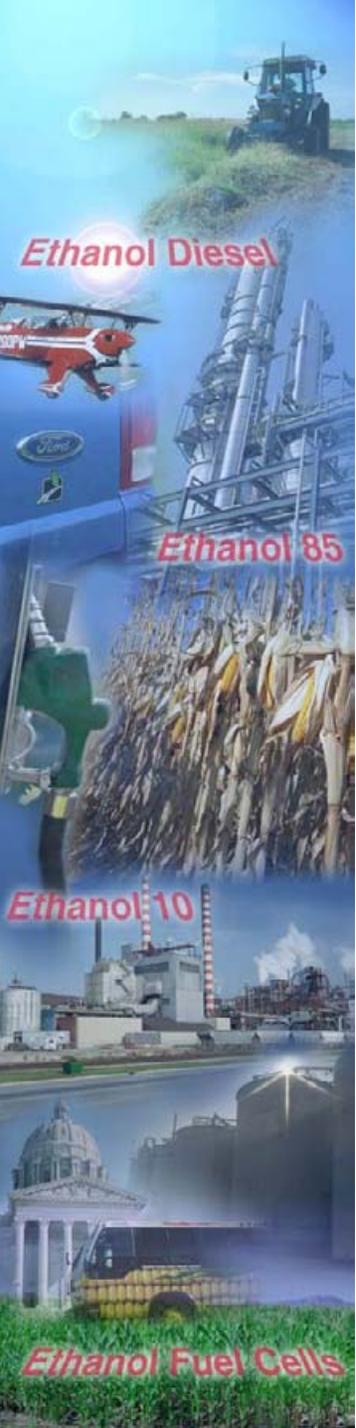


Recent commercialization projects have skipped the demonstration step, increasing the risk of failure of the commercial launch



Technology Issues

- Pretreatment
- Enzymatic hydrolysis
- Pentose fermentation
- Secondary issues:
 - Lignin utilization
 - Ethanol concentration
 - GMOs

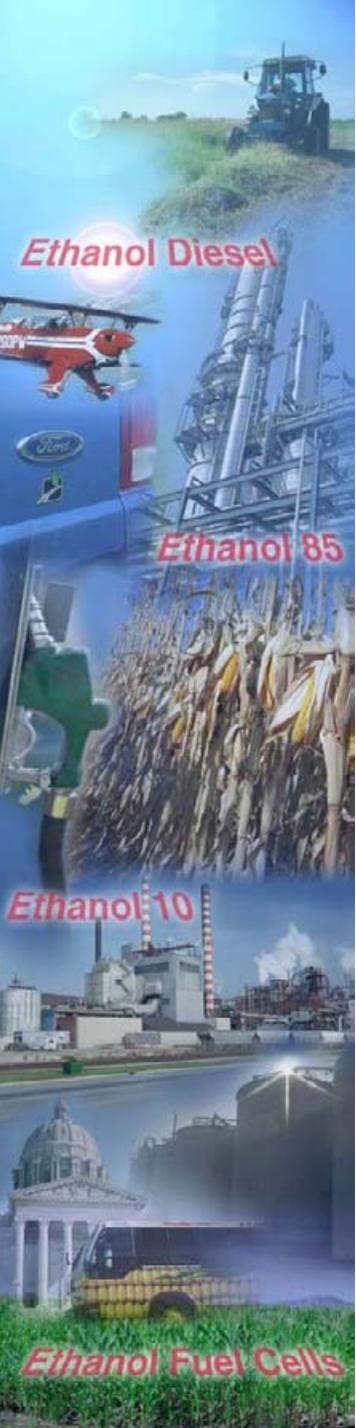


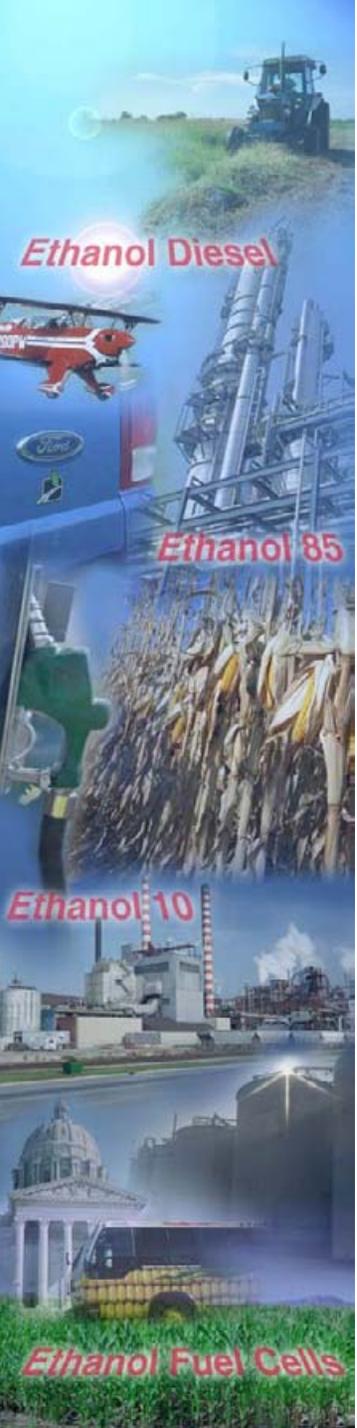
Financial Issues

- Technology risk
 - Small technology companies cannot guarantee their process
 - Risk mitigation drives up the project cost to the point of insufficient returns
- Cellulosic ethanol must compete with ethanol from corn

Commercialization Strategy

- Follow corn ethanol “model”
 - Site with adequate feedstock supply, utilities, transportation and markets
 - Utilize successful design/build firms
 - Hire experienced ethanol marketing firm
 - Assemble first rate management team
 - Need 40% equity, 50% better
 - Projected Return on Equity should be 30% or higher



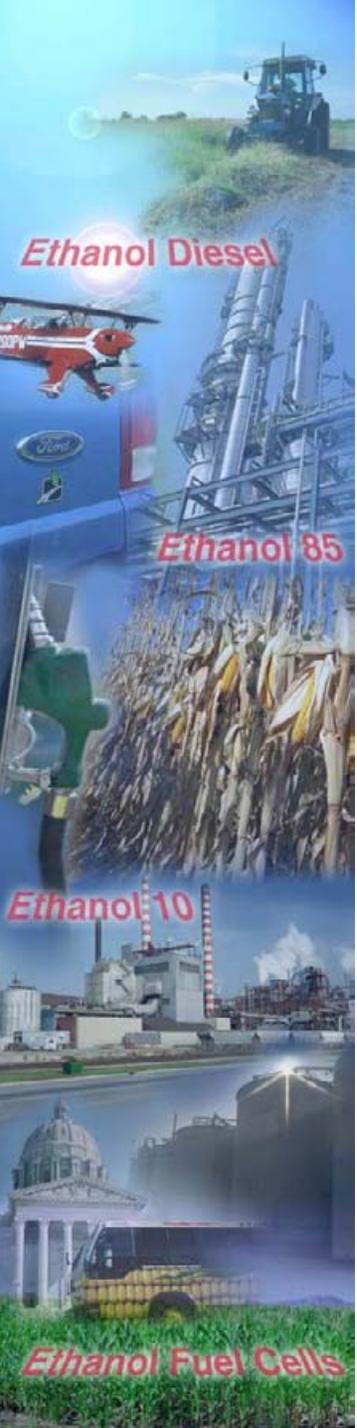


Commercialization Strategy

- Lower capitalization for the first project – \$20 million, not \$100+
- Examples:
 - Pulp mill sludge does not require pretreatment; may have a negative cost
 - DDGS or brewers grains
 - Rice hulls/feedstocks collected by others
 - Existing infrastructure i.e. Coors brewery
- Projects in Europe – tax breaks

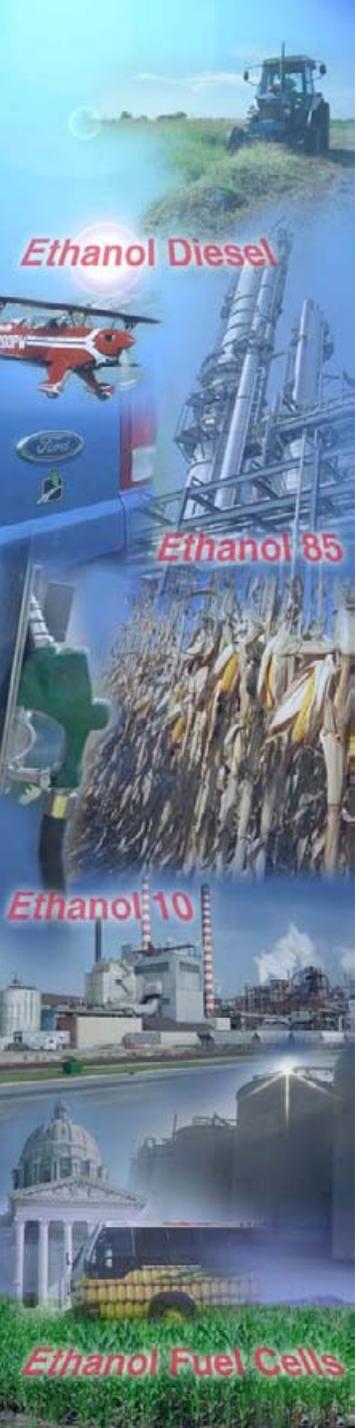
Conclusions Regarding Cellulosic Ethanol

- Availability of low cost cellulase enzyme is the key issue
- Start with small, but profitable niche opportunities
- Tribes has access to cellulosic feedstock resources
- Native American organizations have the opportunity to be involved in the groundfloor of a new industry



Project Development



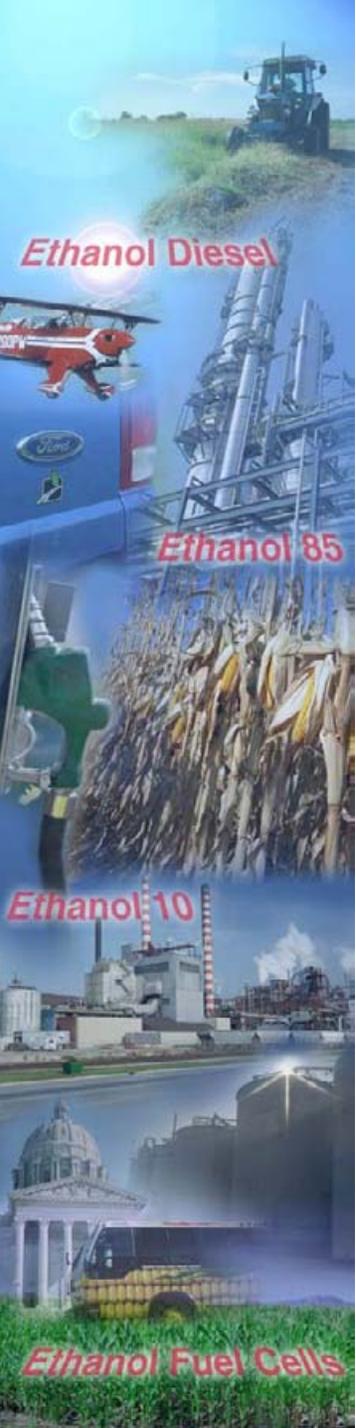


Project Development Path

- Organize business and secure seed money
- **Conduct a Feasibility Study**
- Write a Business Plan
- Develop a Prospectus
- Conduct a Membership Drive
- Obtain Financing
- Hire a Project Manager
- Begin Construction and Startup

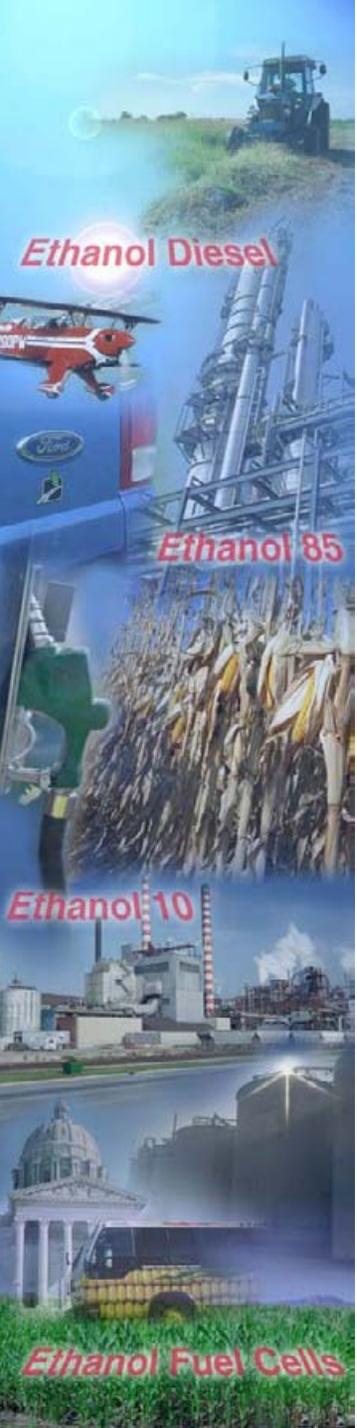
Key Elements of the Ethanol Feasibility Study

- Site selection
- Feedstock analysis
- Market analysis
 - Ethanol
 - DDGS or animal feed
 - CO₂
- Financial analysis
 - Construction costs
 - Owner's costs
 - Operating costs
 - Projected profitability and sensitivity studies



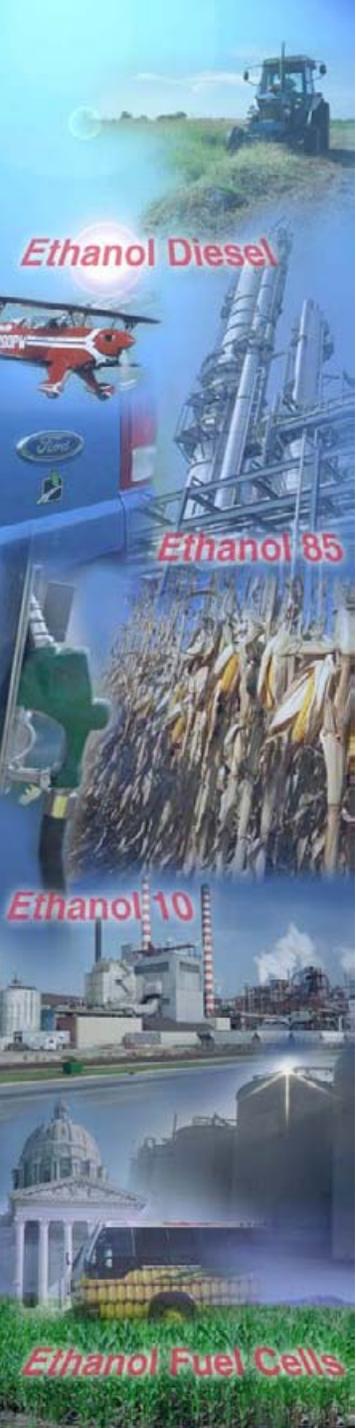
Site Selection

- Typically 30 to 40 acres in a rural area with:
 - Low cost feedstock (typically corn)
 - Good rail access
 - Good road access
 - Adequate utilities at reasonable cost
 - Close proximity to co-product markets
 - Access to ethanol markets
 - Access to labor



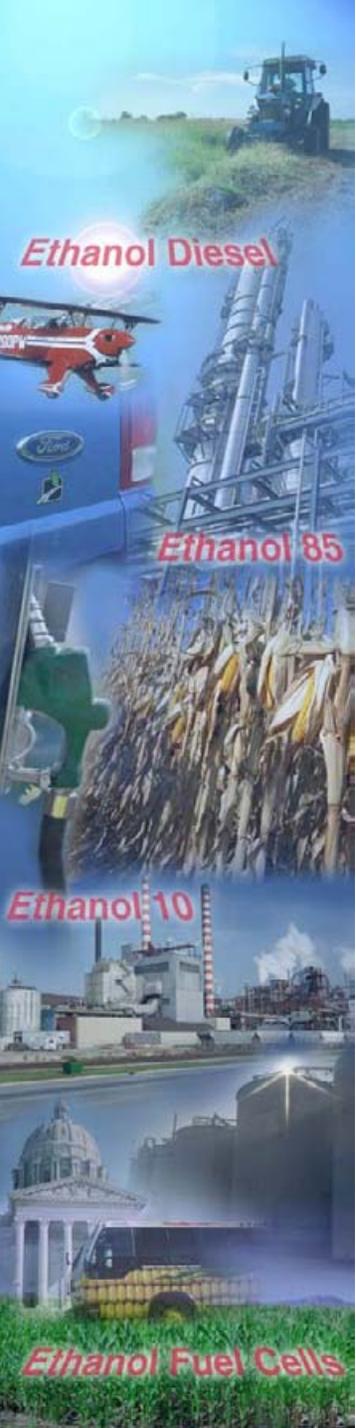
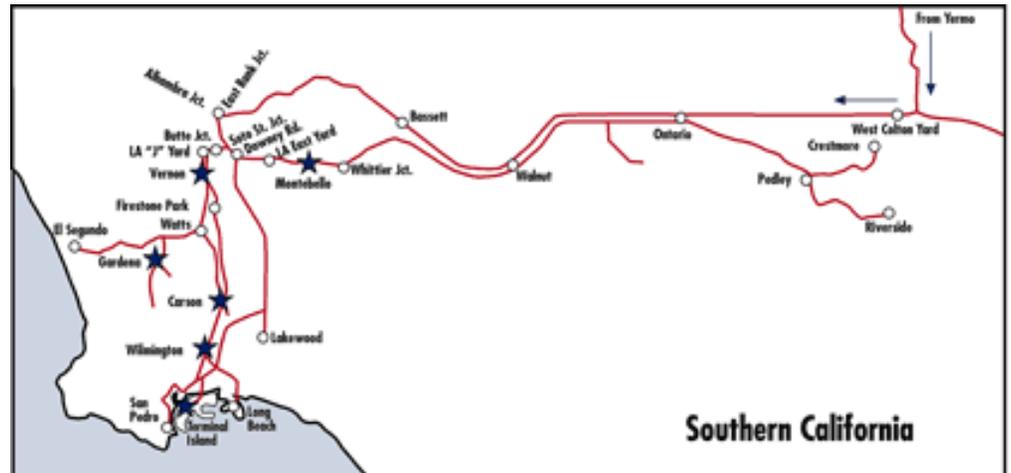
Feedstock Analysis

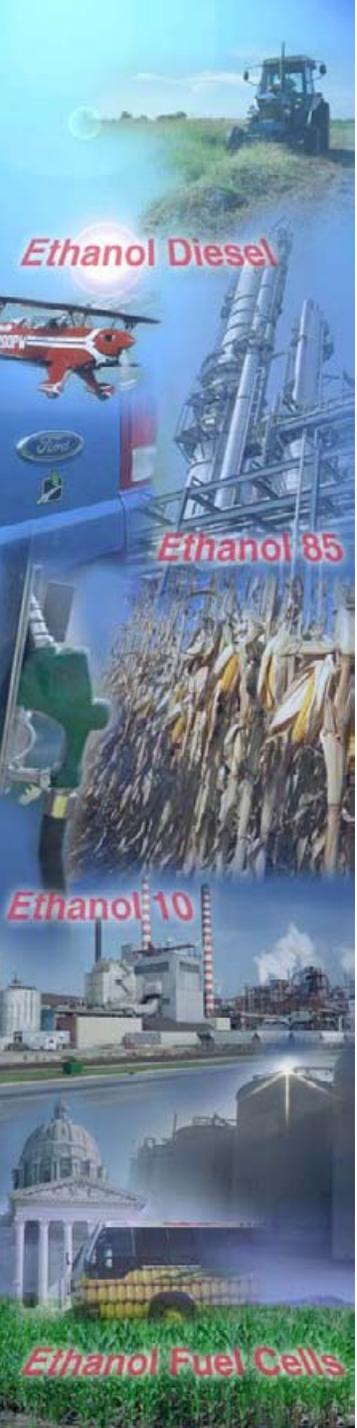
- Local or imported feedstock?
- Availability and price (10-yr history)
- Ethanol yield
- Co-product yield
- Competition for feedstock



Ethanol Market Analysis

- Define local, regional and national markets for the project's ethanol
- Document historical ethanol use and price in the markets
- Estimate transportation costs to markets



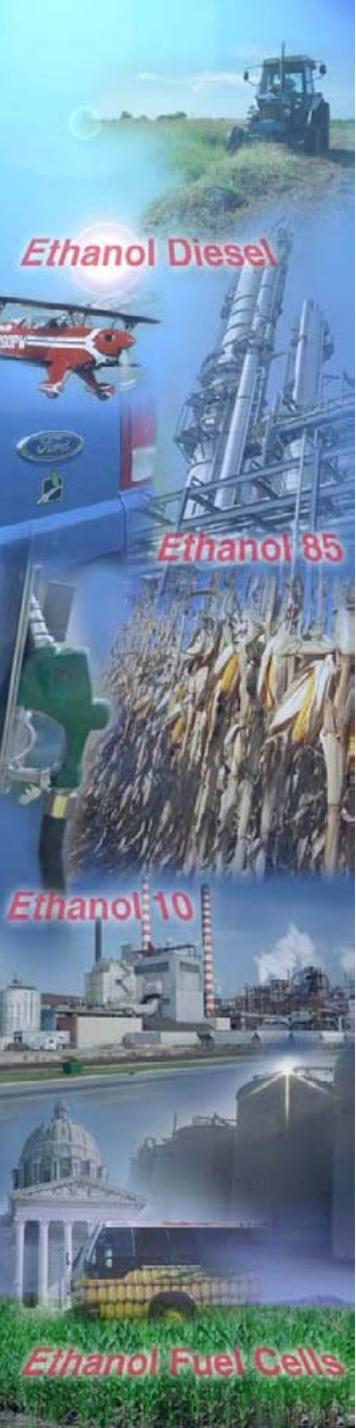


Co-Product Market Analysis

- Distillers Grains – traditionally marketed wet or dry to cattle feedlots and dairies; dry to poultry and swine
- Depending on feedstock, need to establish value and potential market for alternate co-products
- Carbon Dioxide – markets in major cities; less demand in areas with existing CO₂ production (refineries, ethanol plants, etc.)
- Are there nearby markets for the coproducts?

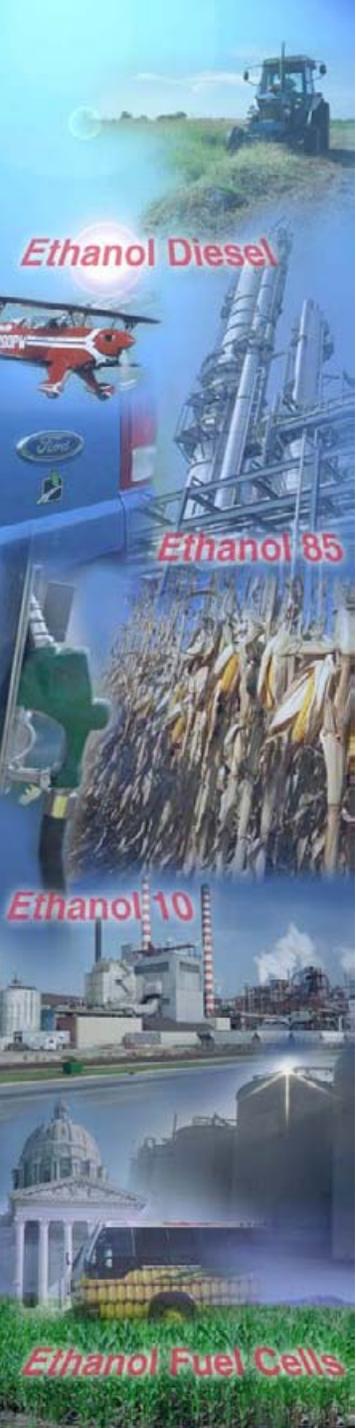
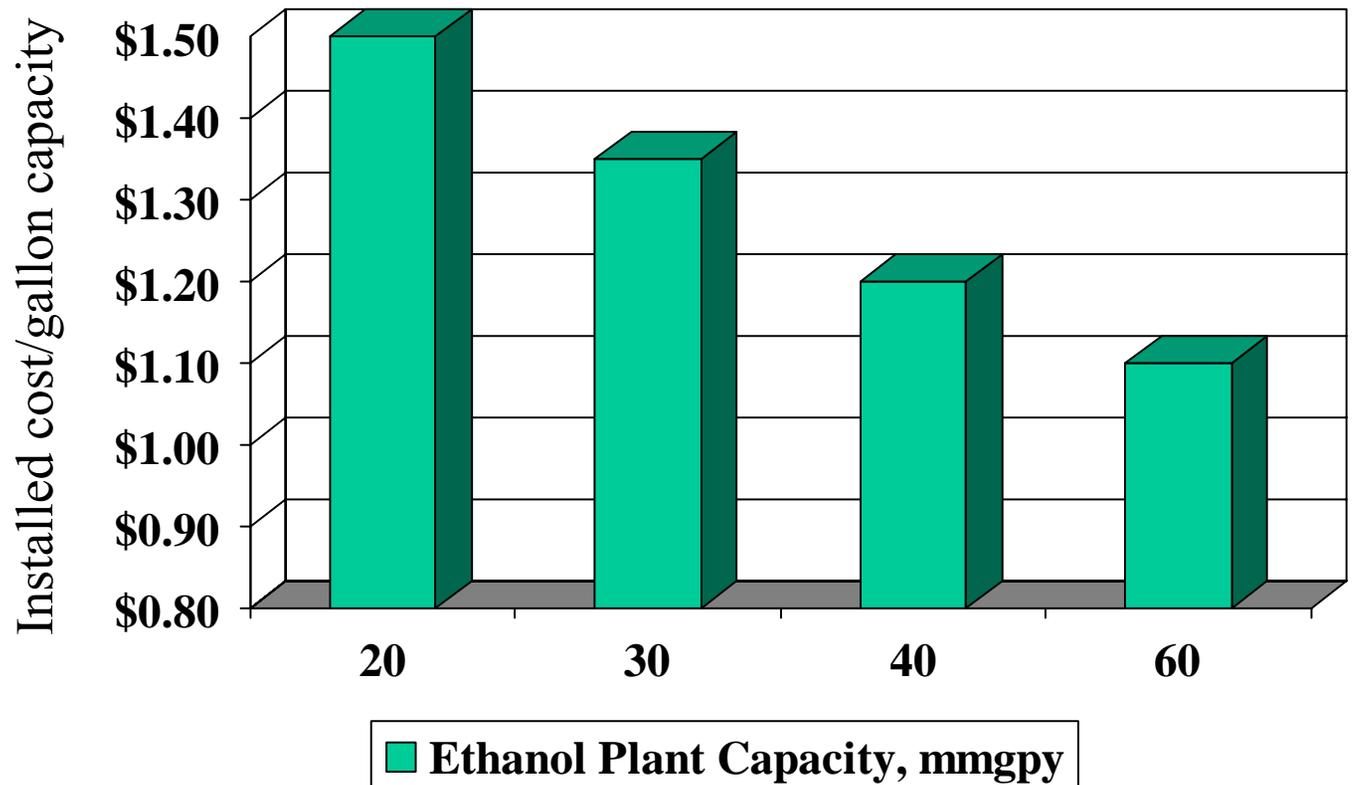
Financial Analysis

- Use conservative assumptions
- Use ROI or IRR for profitability
- 25% minimum ROI, 30% for better projects
- Returns are most sensitive to feedstock and ethanol pricing



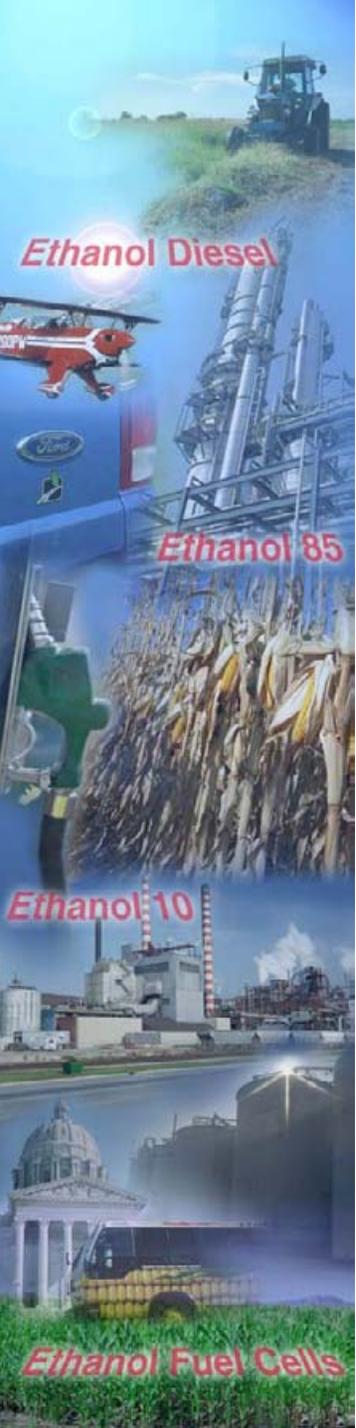
Construction Costs

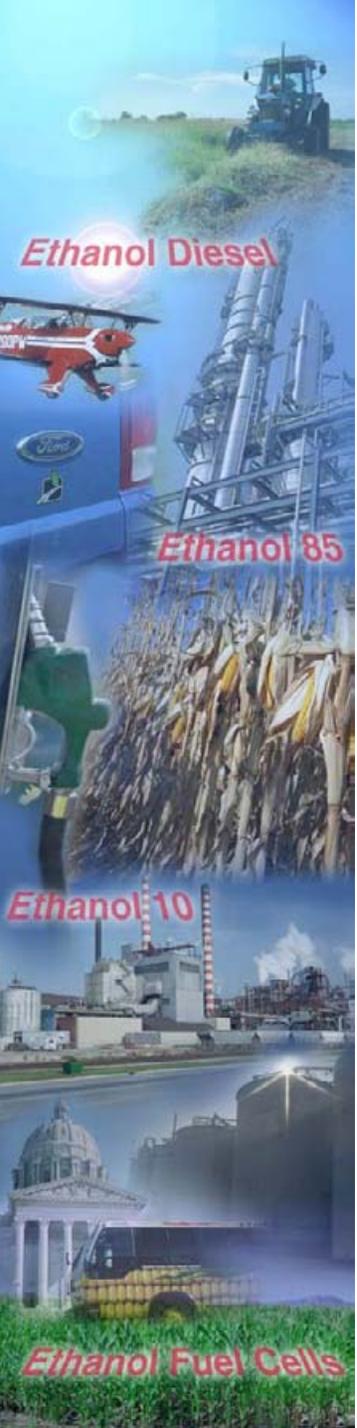
Typical Corn Dry Mill Ethanol Plant



Owner's Costs

- Land, roads, rail & site development
- Administration building/furnishings
- Utilities, water treatment, fire water
- Permits
- Startup costs and training
- Construction interest and loan fees
- Inventory costs
- Owner's Costs add 20-30¢ per gallon to the overall project cost



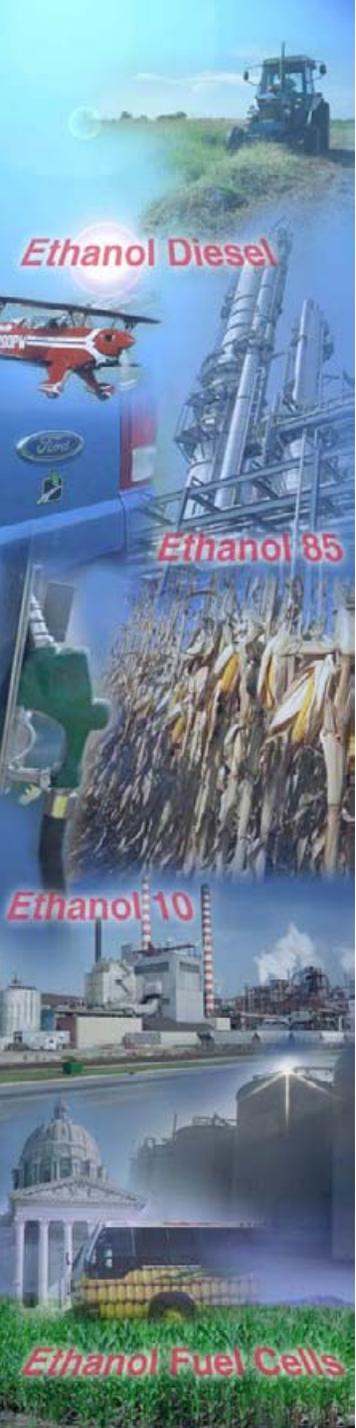


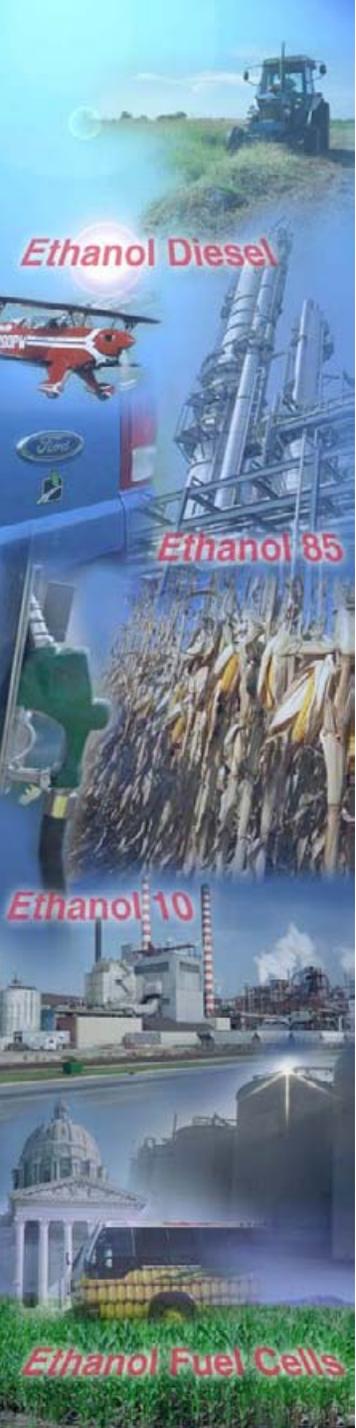
Typical Operating Costs & Revenue

- Production costs \$1.20/gal
 - Feedstock (Corn)
 - Energy
 - Chemicals, enzymes, yeast, denaturant
 - Labor
 - Water
- Administrative costs \$0.07/gal
- Debt service \$0.13/gal
- Revenue \$1.55/gal
 - Ethanol
 - Distillers grain and possibly CO₂
- Pre-tax income \$0.15/gal

Gaining an Advantage

- Strong local/regional ethanol market
- Low feedstock price
- Low energy costs (alternative fuels)
- Sell wet distillers grain
- Developed site/co-location
- Risk management
- State incentives

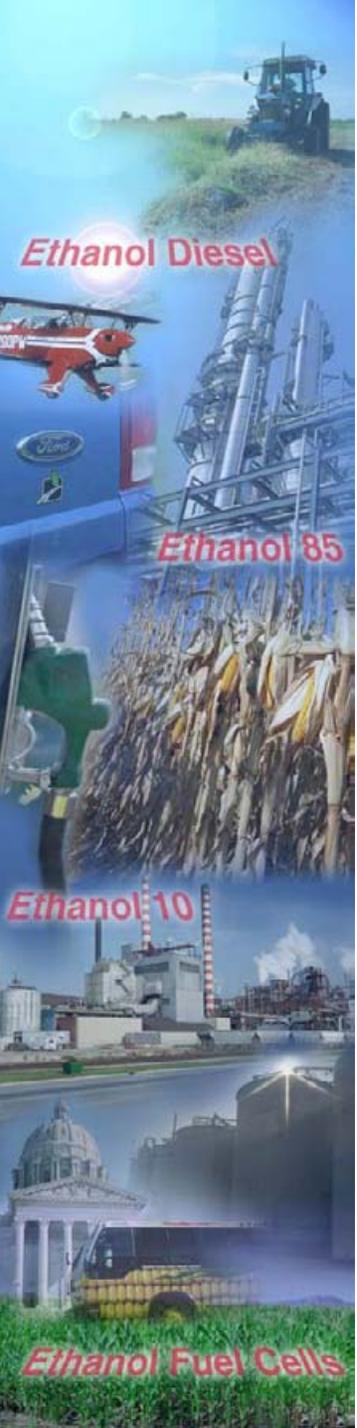
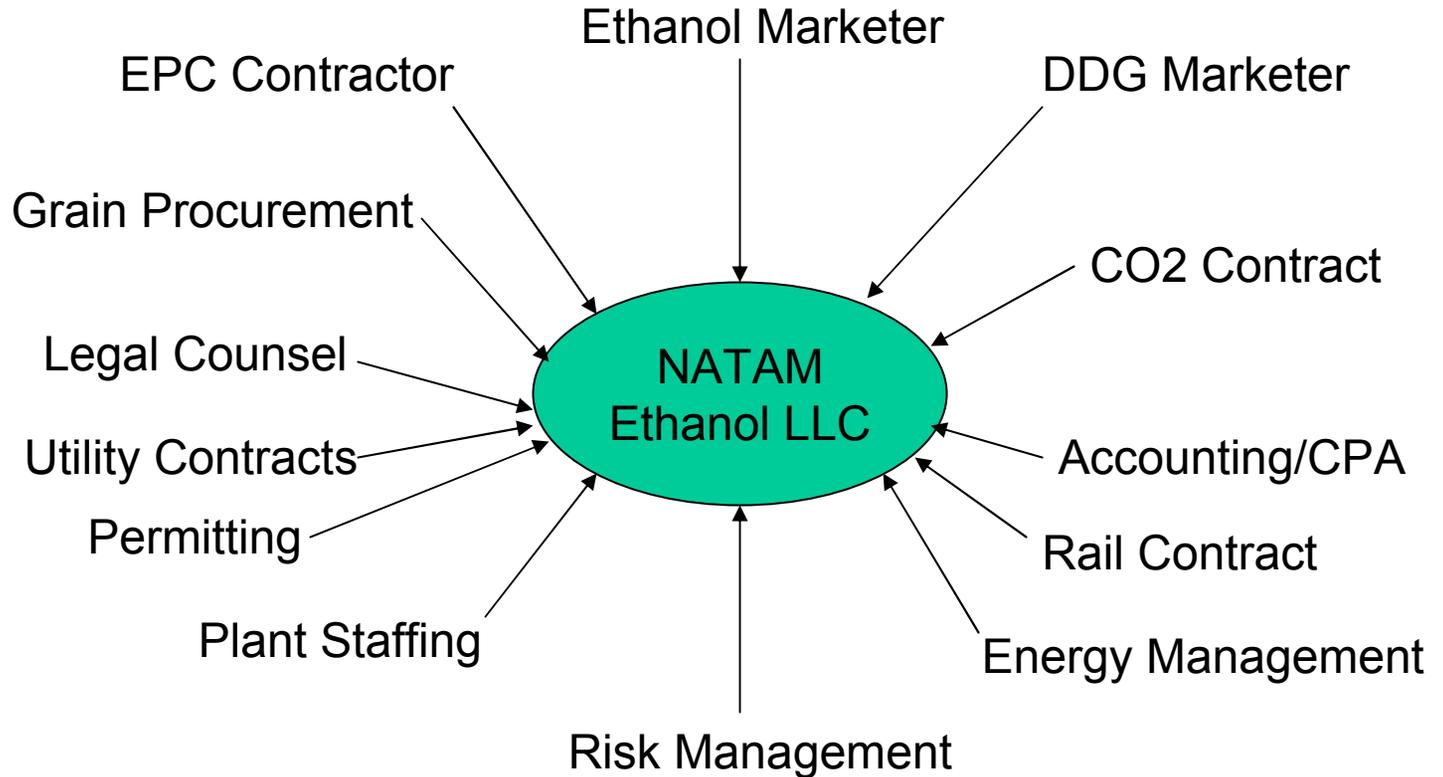




After the Feasibility Study

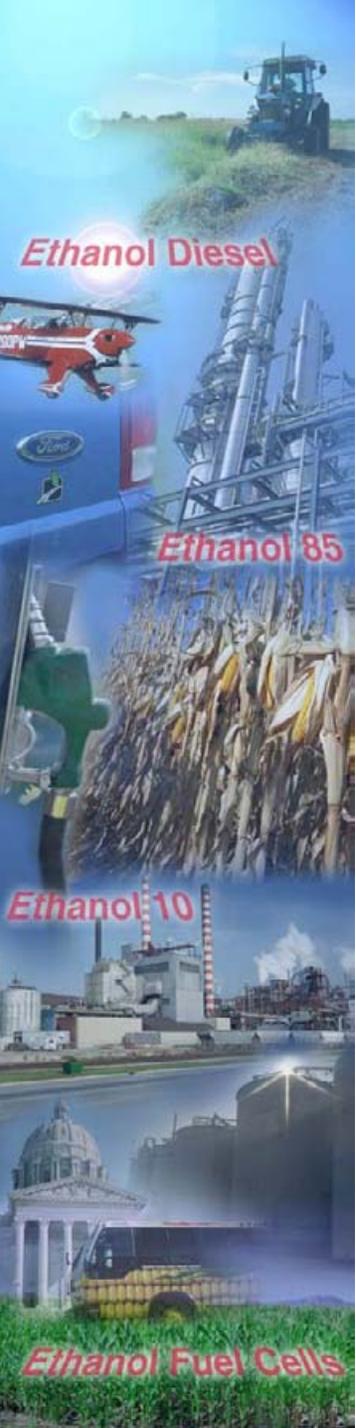
- Project Leadership
- Legal Organization and Tax Status
- Equity Capitalization
- Site Selection
- Feedstock Procurement
- Design-Build Team
- Senior Lender
- Ethanol Sales
- Co-Product Sales
- Risk Management Strategy

Project Structure



Your Ultimate Goal – Debt Financing

- The three M's of lending:
 - Markets
 - Who, what and how much
 - Management
 - Board/local leadership
 - Operational leadership
 - Money
 - Capital and cash flow



Thank You!



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