

Ethanol 2008

Ethanol: Producing Food, Feed and Fuel

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Historical Perspective



Marketing Advanced Biofuels: Lincoln, NE- 1933;
Governor fills 'er up with corn alcohol gasoline (E-10)

Putting Biofuels in Context

- For 100 years the Biofuels debate has been about market share.
 - For 10 decades the debate has been about public policy.
 - “Food vs Fuel” is contrived.
 - Public Policy is clear: Biofuels will constitute a portion of world transportation fuels.
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Introduction

- A popular **myth** is that “*Ethanol production requires a choice between food and fuel.*”

This is demonstrably false.

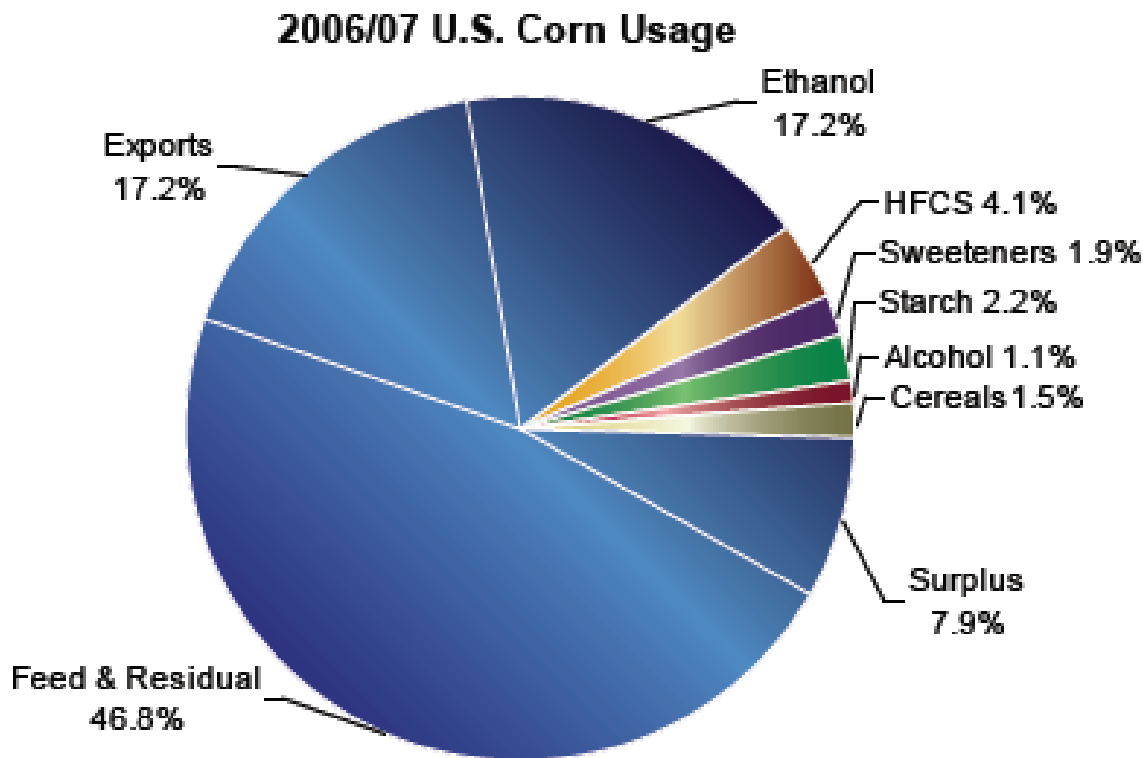
- Crop genetics, agronomic practices and technology provide agriculture the means to produce more food and biofuel. Sugar crops and refined products yield ethanol.
 - Grain ethanol production technology continues to yield greater output of food, feed and fuel each year.
 - **The steep rise in petroleum price is the primary reason for increased food crop prices. 500% price increase in past decade.**
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Corn in the Crosshairs

- KEY FACTORS in supply & demand:
 - Acres
 - Yield (weather, genetics, etc)
 - Exports
 - Feed use
 - Inventory
 - Sufficient supply; speculation = price
 - Impact on food price minor compared to:
 - Energy costs up 60%
 - Food prices within historical 2-4% (5.5%)?
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U.S. Corn Utilization

- Ethanol is only a fraction of corn usage



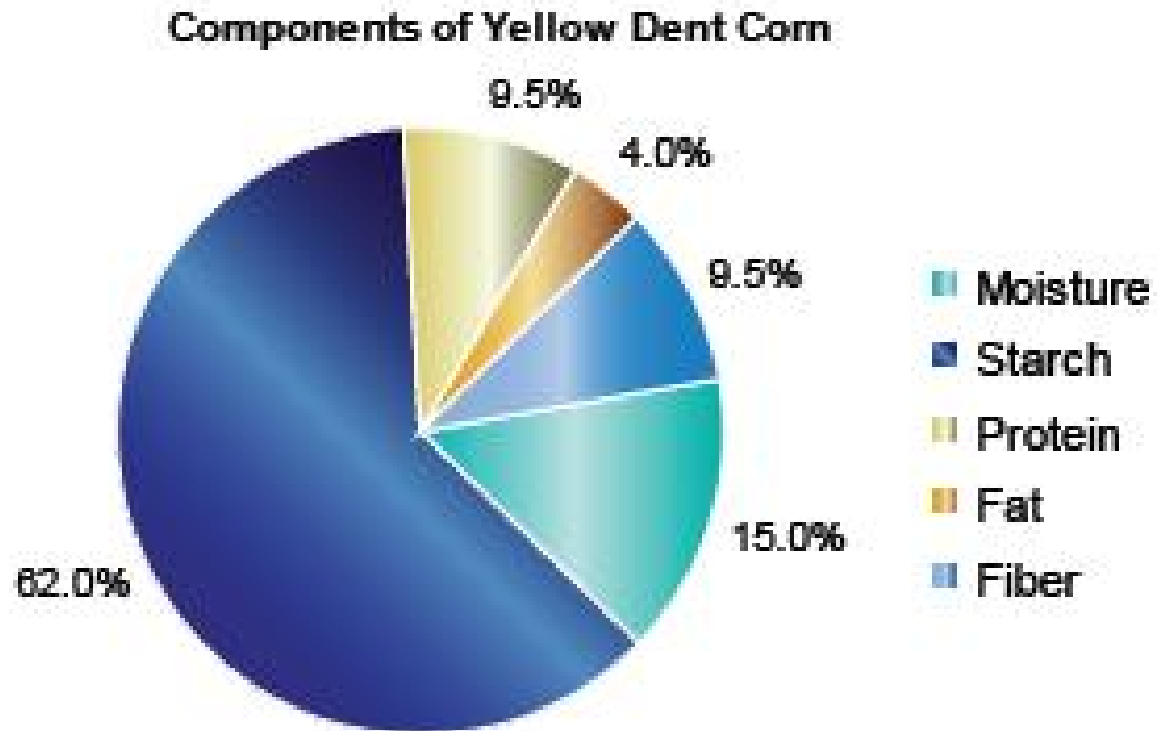
— Source: USDA, ERS; Feed Outlook, June 13, 2007

Note: Percentages based on Total Supply

Converting Corn to Food and Fuel: Ethanol Production Processes

- Ethanol Production: the Dry Mill Process
 - Ethanol Production: the Wet Mill Process
 - Approximately 18% of U.S. corn production used for ethanol in 2007 (equal to exports).
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Allocation of Corn Kernel



Source: Corn Chemistry and Technology, 1999

Note: Wet Weight

Corn



Whole Corn Products

Fractionated Products

Cob and Kernel

Food
baby corn
pickled baby corn
boiled sweet corn
canned corn
frozen packaged



Industrial
decorative items
(pop, indian corn)

Cob or Stover

Industrial
polishing media
barfana
(chemical feedstock)
liquid spill recovery media
dust absorbent
construction board
cosmetic powders

Whole Kernel Products

Food
popcorn
snack food
cacao
posole
canned corn
soup mixes
canned hominy
frozen packaged



Food
livestock feed
wild animal feed

Alkali Cooked

Food
tortilla flours
hominy
corn chips
tortilla chips
taco shells
apazalita
atole
pozole
mesquero
teosaron

Dry-milled Corn

Grits / Cones

Food
breakfast cereals
fortified foods
pinole
snack foods
nutrize porridges
alkali cooked products
bevasa, bakery products
fermented beverages
non-fermented beverages
pet foods
corn bread



Industrial
wallpaper paste
floor wax
hand soap
dusting agents

Flour

Food
bakery products
masa flour
snack foods
baby foods
baking mixes
batters
desserts
pie fillings
grooves and sauces
solid dressings
frozen foods
meat extenders
moosemeat extenders
thickening agents

Hominy Feed

Industrial
fermentation media
explosives
cypriates
wallboard
paper products
briggaiting
foundry binders
ore refining
drilling fluids
label adhesives
edge paste
pharmaceuticals

Germ

Oil
vitamin carriers
lecithin
cooking oil
margarine
mayonnaise
potato chips
solid dressings
sauces
shortening
soaps



Meal
livestock feed
amino acids
fur cleaner

Wet-milled Corn

Steepwater

Industrial / food
steepwater (feed)
antifoulants
chemicals
pharmaceuticals
yeast culture

Gluten Feed

Food
cattle feed

Gluten Meal

Food
poultry feed
zein production



Germ
(Same uses as dry-milled germ)

Modified Starch

Food
baby foods
bakery products
chewing gum
retortable thickeners
puddings, custards
prepared desserts
solid dressings
baking mixes
pie, pastry fillings
gum candies
snack foods
sauces and gravies
condiments
icings and glazes
dehydrated foods
instant tea
natural breakfast foods
low-cal sweeteners
margarin
pan coatings

Industrial
adhesives
book-binding agents
pastes, glues
candles
curing (resin) binders
dyes
printing inks
azobenzene
insulation, fibreglass
labels
leather products
secondary compounds
fireworks
are separation compounds
potter paints
paper products
plastic molding
plywood, wallboard
sandpaper
textiles
wallpaper, shade cloth

Starch Products

Native Starch

Food
baby foods
bakery products
baking powder
brewed beverages
chewing gums
chocolate drinks
puddings, custards
prepared desserts
stock foods
solid dressings
meat products
baking mixes
prepared mustard
prepared condiments
pie, pastry fillings
processed, frozen meals
prepared soups
powdered sugar
canned vegetables
candies

Industrial
abrasive papers
adhesives
dry-cell batteries
composite binders
paperboard products
binder compounds
bookbinding
briquettes
clay (ceramic) binders
chemical precursors
fermentation foodstock
detergents, cleaners
coatings
paper color carriers
paper products
textile color carriers
cord sizing, polishing
cork products
crayon, chalk binders
dispersion agents
dye component

Industrial
fiberglass sizing
fireworks
insulating materials
lubricating agents
oilcloth
well drilling mud
ore refining
paints
fillers and caulk
curing compounds
molded plastics
printing inks
colloid emulsions
textile finishing
celling inks
rubber tires
wallboard
wallpaper
water treatment



Pharmaceutical / Cosmetic
antibiotic production
aspirin
powdered cosmetics
liquid thickener
dietary formulations
soaps
detergents
surgical dressings



Sweeteners

Glucose

Food / Pharmaceutical
baby foods
adhesives
chemicals
medical syrups
powdered products, mixes
beverages
breakfast foods
sauces
prepared cereals
cheese spreads
chewing gum
coffee whiteners
cordials and liqueurs
desserts
prepared egg products
extracts and flavors
frostings and icings
fruit jams, butters
fruit juices, drinks
prepared soups, sauces
solid dressings
pickled products
frozen seafood
peanut butter
leppings

Fructose

Industrial
adhesives
chemicals
dyes and inks
explosives
leather tanning
metal plating
paper products
plasticizers
shoe polish
rayon
textiles
theatrical makeup
tobacco products

Food / Food

bakery products
canned fruits
canned juices
condiments
confections
frozen desserts
fruit jams, preserves
wine products
yeast production



Industrial / Fuel

alcoholic beverages
acidulants
flavor enhancers
soft drinks
amino acids (feed)
industrial alcohols
engine fuel
fuel octane enhancers
oxygenate in engine fuels
plastics
solvents
carpeting
textiles
food packaging



IOWA STATE UNIVERSITY
Center for Crops Utilization Research

Food AND Feed

- Distillers feed products contain the protein fraction of the grain.
 - Distillers feeds replace corn in livestock diets.
 - Distillers feed products can be adjusted to meet any livestock feed ration.
 - Distillers feed products can incorporate readily available, poor quality roughage the perform well in livestock rations, in wet or dry form.
 - Distillers feeds yield better gain at lower cost than conventional corn diets.
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Corn and Oil Price Trends

- **The real price of oil has increased dramatically, especially relative to corn.**
 - If corn prices increased by the same level as oil prices in the past 20 years, corn would now cost **\$13.50 per bushel**
 - **Inflation adjusted price of Dec '73 corn futures would be \$16.16/bu in 2008 dollars**
 - Higher gas and oil prices leaves less disposable income for consumers.
 - Energy cost increases in the past year far outpaces historical inflation.
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Higher Energy Prices = Higher Food Costs

- Average corn price for 2007 = \$3.40/bu. An 18 oz. box of corn flakes includes about **5 cents** of milled corn.
 - At retail, the box of corn flakes costs \$2.49. Transportation and energy costs associated with processing constitute the majority of price to the consumer.
 - It is a short distance to the farm gate; it's a long road to the grocery shelf.
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The Cheap Corn Policy

- U.S. agricultural policy historically promotes cheap corn. Livestock feeders and food processors have profited.
- Cheap corn is expensive to taxpayers. To ensure sufficient corn supplies, corn producers and exporters are subsidized.
- In 2007 the corn market became demand driven; export demand, biofuels, feed, food...
- Market demand reduces the cost of government farm programs.

Intended Consequences

- A primary goal of state and national ethanol policy has been to stimulate the price of corn and other commodities via “new uses” and “value-added” programs. LB 776- 1971
 - “...study examines what would happen if we were to discontinue present farm subsidy programs and use this money to subsidize energy production.” APIUC brochure- 1972
 - President Bush about Ag Secretary Johanns: “a strong proponent of alternative energy sources, such as ethanol...we’ll continue policies that are pro-growth, pro-jobs and pro-farmer.” 2004
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The Cost of Energy: Oil Prices

- **“These higher (oil) prices will flow throughout the economy ... increased shipping costs will almost certainly be passed on to consumers.”**
 - Tim Evans, Energy Analyst, Citigroup
 - **Products made from petroleum itself ... are likely to be more expensive, and that in turn could push up the cost of food.**
 - Associated Press
 - **A \$1 increase in the gallon price of gas has 2 to 3 times the impact on food prices as a \$1 increase in the bushel price of corn.**
 - National Corn Growers Association
 - **“...everything by truck...at \$3.79 diesel.”**
 - Seward grain truck driver
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The Cost of Energy: Ethanol Reduces Gasoline Prices

- There is no chance of lower energy prices “absent a severe recession or depression.” Oil prices could top \$200 a barrel in the next decade.” Philip Verleger, Energy Economist
 - “During the past seven years the rack price for ethanol blends at Nebraska terminals has been below the price of 87UNL for all but five months.” S. Sorum, Analyst
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Increased Ethanol Production= Lower Prices

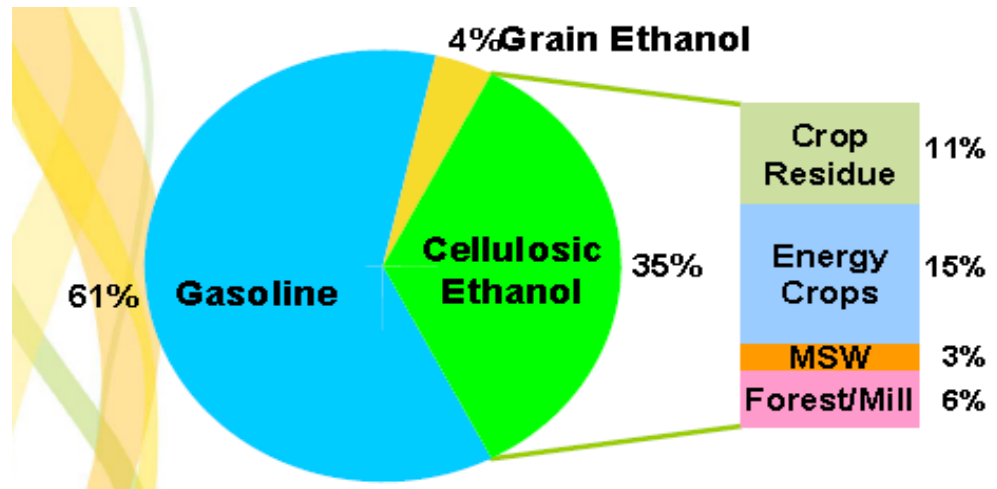
- U.S. Gasoline Demand Trend:
 - 1.3 % annual increase from 1971-2007
 - 0.6 % annual increase in 2007
 - 0.4% annualized increase in early 2008
 - ***“Ethanol boom may stifle U.S. gasoline demand.”***
Reuters, 2/14/08
 - ***“Ethanol blending could help ease U.S. refining bottlenecks and that could be ultimately reflected in lower prices at the pump.”*** AG Edwards Analyst E. Wittenauer 2/14/08
 - ***“...oil and gasoline prices would be about 15% higher than they are now if not for biofuels.”***
- Francisco Blanch, Merrill Lynch analyst

Ethanol Acceptance by Consumers

- 50+ % of all gasoline sold in the US contains ethanol.
 - In several states >75% of gasoline contains ethanol
 - Ethanol blend prices are generally 10 cents lower
 - Net Ethanol price at wholesale today is more than \$1.50+/gal lower than gasoline.
 - Higher blends may emerge in the marketplace
 - E-85 sales are increasing; infrastructure needed
 - More than 7 million FFVs on road in US
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Corn Ethanol: Bridge to the Future

- Ethanol from corn
- Ethanol from cellulose
- Higher alcohols (butanol), green gasoline/diesel
- True biorefineries
 - Biobased products
 - Chemicals
 - Petroleum substitutes



Source: GM, University of Toronto

Seven Key Points to Take Home

- High oil prices raise all other prices
 - Average oil prices will continue to increase as oil production has already peaked
 - Ethanol lowers gasoline prices
 - Energy prices affect food prices **more** than grain price
 - Food selling price fluctuation is a function of food supply and demand, **not a function of food input costs.** In the U.S. food prices rose 4.5 % during past year; without ethanol demand price increase would have been 4.25%
 - Market corrections will eventually moderate the price of commodities like corn; corn price down \$2/bu
 - Increased cellulosic ethanol production will help mitigate the “food vs. fuel” myth
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Putting Water Use in Context

- Virtually all types of manufacturing use water at some point in the production process.
 - Current ethanol processing technology uses approximately 3 gallons of water for each gallon of ethanol.
 - Ethanol process improvements indicate water use can be reduced to 1.5 to 1.
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Water Conservation Opportunities

- *Reduce Energy Consumption (less cooling tower evaporation & blowdown)*
 - *Recycle waste and blowdown streams*
 - *Treat makeup water (less blowdown)*
 - *Use air or groundwater to reject heat (less evaporation and blowdown)*
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Water Conservation Opportunities

Gallons Fresh Water/ Gallon Ethanol less than:

- *<3 – Current Best Practice*
 - *1.5 – Achievable with proven technology at extra capital cost*
 - *0 – Possible in future with new technologies*
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Putting Water Use in Context

(or The End?)

- 22 ethanol plants are currently operating in Nebraska; 4 plants are actively under construction; 37 additional plants have been proposed for Nebraska sites. If **ALL** current and proposed plants were operating, they would use about two-tenths of 1 percent of the water pumped in the state.*
- 94% of corn produced in U.S. is rain fed.

**Based on USGS estimates.*

Putting Water Use in Context

- A large (100 mgy) ethanol plant uses the same amount of water annually as it takes for four center-pivot irrigation systems to water a section of land.
 - In water-short area, ethanol plant developers buy land that has irrigation wells and convert the water use from irrigation to ethanol production.
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Putting Water Use in Context

- Ethanol production requires less than one-twelfth of the water needed to refine crude oil into energy products like gasoline.
- A barrel of crude oil yields 19.5 gallons of petroleum, using 1,851 gallons of water in the process. The water needed to produce one gallon of gasoline would produce more than 30 gallons of ethanol.*

* *USGS estimates*