

Biofuels: National and Kansas Updates

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Renewable Fuels Drivers

- High gasoline and diesel fuel oil prices
- Flow of dollars out of the United States
- Instability in oil exporting regions of the world

The United States and Oil

- Uses 20 million barrels per day
- Produces 6 million barrels per day
- Oil usage has increased 2% per year but the economy has been growing at 3.3% per year
- Cost per year to import oil - \$300 to \$375 billion

The Fossil Fuel Inventory

<u>Type</u>	<u>Amount</u>	<u>Location</u>
Oil	1,278 BBOE	78% E. Hemisphere
Heavy Oil (Tar Sands)	608 BBOE	64% W. Hemisphere
Bitumen (Oil Shale)	345 BBOE	88% W. Hemisphere
Nat. Gas	1,239 BBOE	77% E. Hemisphere
Coal	4,786 BBOE	Widely Distributed (60% in U.S., Russia, and China)

Source: en.wikipedia.org/wiki/Fossil_fuel

U.S. Oil Import Suppliers

1. Canada
2. Mexico
3. Saudi Arabia (OPEC)
4. Venezuela (OPEC)
5. Nigeria (OPEC)
6. Iraq
7. Angola
8. Algeria (OPEC)
9. Russia
10. Ecuador

Source: Energy Information Administration

OPEC Cartel Members

1. Saudi Arabia
2. Iran
3. Venezuela
4. Nigeria
5. Iraq
6. Algeria
7. Kuwait
8. Libya
9. Indonesia
10. United Arab Emirates
11. Qatar

Source: Energy Information Administration

What would it take to replace imports?

The U.S. uses 140 billion gallons of gasoline per year and 60 billion gallons of diesel fuel made from oil of which about 60% is imported. (50% from OPEC)

To replace the OPEC gasoline (42 bgpy) with ethanol would require 15.6 billion bushels of corn. Last year's production – 10.5 billion bushels.

To replace the OPEC diesel (18 bgpy) with soy-diesel would require 12.3 billion bushels of soybeans. Last year's production – 3.2 billion bushels.

Land Needed to Replace Imported OPEC Fuels

Corn	100 mil. A. (92.9 mil. A.)
Soybeans	293 mil. A. (64.1 mil. A.)
Total Needed	392 mil. A.

Total Crop Land Available	322 mil. A.
Plus CRP (35.9)	358 mil. A.

Energy: Non-petroleum Sources

- Wind
- Solar
- Geothermal
- Nuclear
- Bio-fuels
- ...and Conservation

Bio-processing

To fractionate agricultural commodities into component parts and use biological or chemical processes to produce useful bio-products or intermediary compounds.

Objective – make the sum of the parts more valuable than the whole.

‘Leave no molecule behind.’

Bio-processing Assumptions

- Petroleum will remain relatively expensive
- A wide range of bio-products can be produced for less than petrol-based
- Bio-mass raw materials can be replenished each year (non-depleting)

Net Energy Balance

<u>Product</u>	<u>Energy Out/Energy In</u>
Gasoline	.81
Ethanol from grain	1.67
Ethanol from cellulose	2.00
Diesel	.83
Bio-diesel	3.2

Source: Congressional Research Service, RL32712, May 18, 2006

ETHANOL

Global Ethanol Production, 2006

	<u>Production</u> (bil. gal.)	<u>Share</u> (%)
World	13.5	100.0
United States	4.855	36.0
Brazil	4.491	33.3
ROW	4.154	30.5

U.S. Industry at a Glance

	<u>2006</u>	<u>2007</u>
■ Number of operating ethanol plants:	97	124
■ Plants under construction and expanding:	35	83
■ Announced plants:	150	300
■ Current production capacity: (BGPY)	4.8	6.5
■ Projected production capacity:	8.1 BGPY end of 2007 12.2 BGPY end of 2008	
■ Feedstock percentage:		
Corn	97	
Sorghum	2	
Other	1	

The Kansas Ethanol Industry

<u>Operating Plants</u>	<u>Under Construction</u>
Campus	Goodland
Colwich	Liberal
Garden City (2)	Lyons
Garnett	Pratt
Leoti	
Phillipsburg	
Russell	

Capacity – 261.5 mgy 240 mgy = 501.5 mgy
Use 185 to 195 mil. Bu. of corn/milo (640 mil.bu. 2007)

Ethanol Plant Economics

- Cost to build a 100 MGPY plant - \$160 million
- Purchase about 37-39 million bushels of corn
(240,000 acres)
- Daily water use: 1.5 million gallons
- Natural gas expense - \$15 to \$25 million
- Payroll expense about \$2 million
- Distiller's Dried Grains income about \$25 million
- CO² income about \$4 million
- At current ethanol price (\$1.99), the B.E. corn price is \$4.49 per bu.
- Goal 30% R.O.I.

Distiller's Grain

- Each bushel of corn dry grind processed for ethanol yields about 17 pounds of distiller's grain.
- Distiller's grain retains one-third of the nutrient value of corn.
- In N. America:
 - 45% dairy
 - 37% beef
 - 13% swine
 - 5% poultry

Distiller's Grain

- WDG – wet distiller's grain
- DDG – dried distiller's grain
- WDGS – wet with solubles
- DDGS – dried with solubles

- DDGS Ave. Nutrients (Percentage):

Dry matter	89.3
Crude protein	30.9
Crude fat	10.7
Crude fiber	7.2
Ash	6.0
Lysine	.9
Phosphorous	.75

Corn Use and Distiller's Grain Production

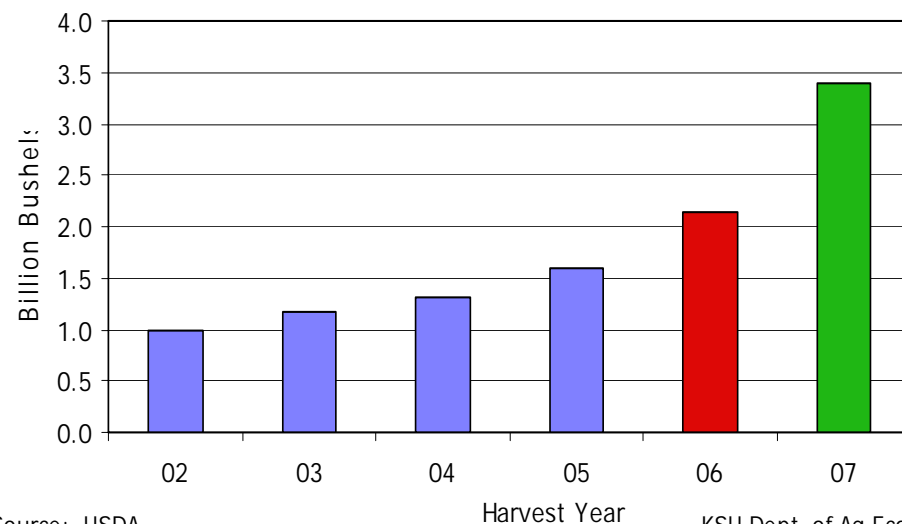
(billion bushels and million tons)

	<u>Corn</u>	<u>DGs Production</u>
2005	1.6	13.6
2006	2.15	18.3
2007	3.4 est.	29.0
2008	4.3 est.	36.7

Dangers Ahead for Ethanol

- Over expansion of capacity – On-line capacity at the end of 2007 is expected to be 8.1 billion gallons
- Food or fuel debate
- Drop in the price of oil

Corn Used for Ethanol



Source: USDA
WASDE Report: 7.12.07

KSU Dept. of Ag Econ
www.agmanager.info

Corn Usage Estimates (Millions of Bushels)

	USDA/WASDE 2006/07	USDA/WASDE 2007/08 est.
Feed and Residual	5,750	5,700 ¹ (-1%)
Food, Seed, and Industrial	1,375	1,390 ² (+1%)
Ethanol for Fuel	2,150	3,400 (+58%)
Net Exports	2,100	2,000 (-5%)
Ending Stocks	<u>1,137</u>	<u>1,502</u>
Total Usage	12,512	13,992 (+12%)

¹ Assumes DDGS retain 30% of the feed value of corn and are included in the feed and residual category by the USDA.

² Industrial, food, and seed less ethanol.

Local Community Impact of an Ethanol Plant (millions of dollars)

	<u>50 mgj</u>	<u>100 mgj</u>
Annual Expenditures	46.7	88.2
Gross Revenue	209.2	406.2
Household Income	29.2	51.2
Employment (total jobs)	836	1,573
Gross State Product	115.0	223.4

Contribution of the Ethanol Industry to the Economy of the United States, John M. Urbanchuk, February 21, 2006. prepared for the Renewable Fuels Association.

BIO-DIESEL

The Bio-diesel Formula

100 gallons of veg. oil or animal fats
+10 gallons of methanol

=

100 gallons of bio-diesel
+10 gallons of glycerol

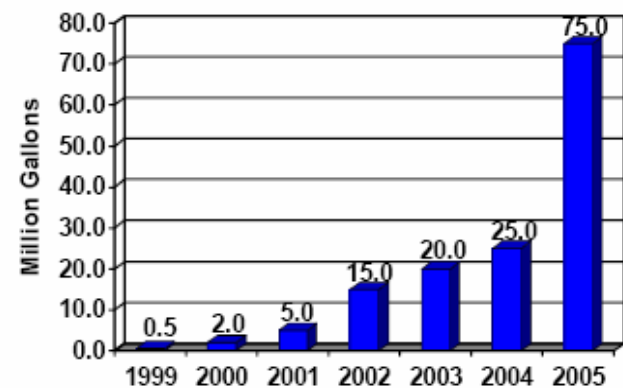
Advantages of Bio-diesel

- No sulfur and less carbon emissions
- Higher cetane rating – better mileage
- Superior lubricity

One disadvantage:

Bio-diesel requires an additive to prevent jelling at low temperatures

Estimated US Biodiesel Production



U.S. Soy-diesel Production

- Currently 65 plants in U.S.
- Total capacity 365 mg – ave. size 7.45 mil.
- Output 2005 – 75 mg of biodiesel Why?
- Plants under 10 mg batch process using waste fats and oils
- Much of output has been going to soap and shampoo rather than biodiesel

U.S. Soy-diesel Production

- 58 plants expanding or under construction projected capacity 713 mil. gal. (Emporia, KS plant under construction)
- Many of the new plants - 30 mil. gal. (Require the oil from 400,000 A. soybeans.)
- Continuous processing using multiple feedstocks of veg oil

World Production of Fats and Oils, 2003/04, MMT

Vegetable		Tropical	
Soy	30.1	Palm	28.7
Rape	14.1	Palm Kernel	3.5
Sun	9.3	Coconut	3.3
Peanut	5.0		
Cotton	3.8		
Olive	2.8		

Value-Added Benefits per Gallon

- **Soybeans to Bio-diesel Conversion:**
- Soybeans per bushel -\$7.92
- Biodiesel 1.5 gallons/bu. +\$3.00
- Byproduct: soymeal +\$4.97
- Cost of methanol = Glycerin credit
- Value of biodiesel & byproducts +\$7.97
- Net Value-added +\$0.05

The industry believes it can compete directly with petrol-diesel when oil price is \$40 or above unless the prices of soybeans and soyoil are high.

Bio-diesel Conclusions

- The industry is building new plants.
- The high prices of vegetable oil will constrain industry production of biodiesel.
- Soybean meal will become the by-product and increased supply will cause price to fall.
- Corn and soybeans will be fierce competitors for available acres of land.

Future Bio-fuel Technology

- Cellulosic Ethanol
- Bio-butanol
- Algae oil