Energy Situation in Ag

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See report to the Kansas Energy council entitled:
"Energy Use in the Kansas Agricultural Sector"
by Kastens, Dhuyvetter, Mintert, Nelson, and Li
www.agmanager.info

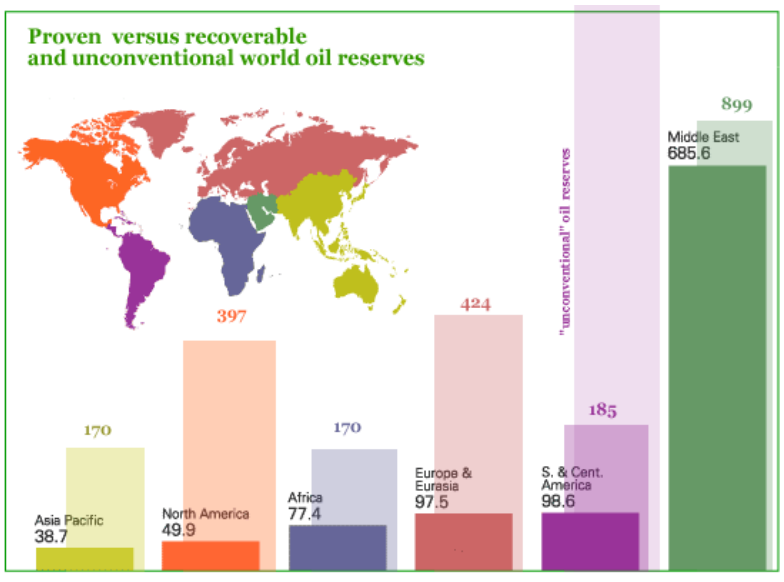
Risk & Profit Conference, Manhattan, Kansas
August 17-18, 2006

Running out of oil and U.S. energy independency

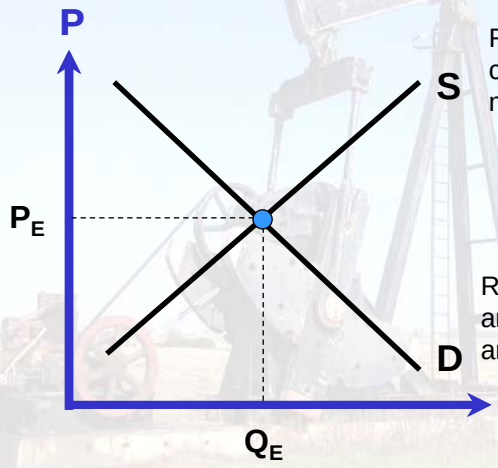
Scarce Energy?

- 1859: Drake discovers oil in Pennsylvania
- 1879: USGS formed to deal with running out of oil
- 1882: 95M bbl remain (Institute of Mining Engineers)
- 1918: 3 million cars on the road
- 1919: auto industry shouldn't ignore that only 20 years left (Scientific American)
- 1926: 4.5B bbl left in U.S. (Federal Oil Conservation Board)
- 1930: 18 million cars
- 1932: 10B bbl left in U.S. (Federal Oil Conservation Board)
- 1944: 20B bbl left in U.S. (Petroleum Administrator for War)
- 1950: 100B bbl left in world (American Pet. Institute)
- 1980: proven oil reserves 648B bbl
- 1993: proven oil reserves 999B bbl
- 2000: proven oil reserves 1016B bbl

Scarcity is an economic issue, not a physical one



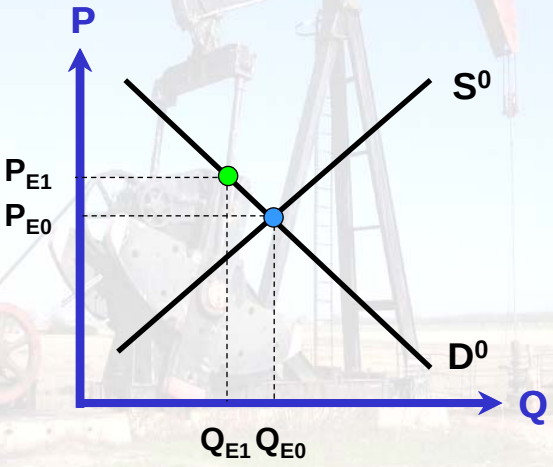
Supply and Demand determine prices …



Represents the marginal cost of supplying to the market.

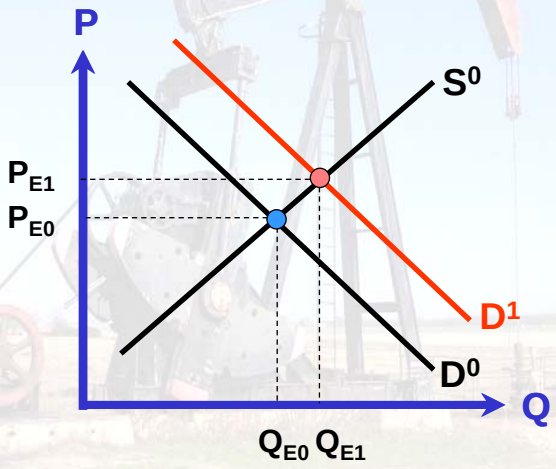
Represents the maximum amount buyers are willing and able to pay.

Supply control results in increasing prices and a reduction in quantity …



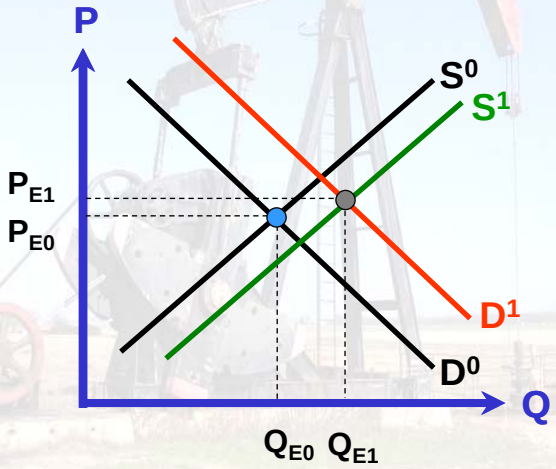
Think of OPEC in the 1970s

Increase in demand, all else constant, results in increasing prices and an increase in quantity …

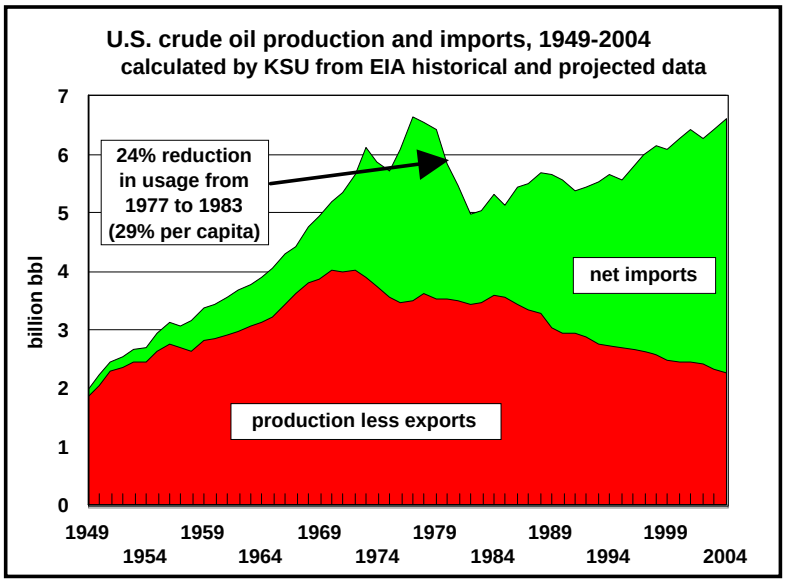


Think of China recently

Increase in demand and increase in supply result in increasing quantity and ??? change in price …



High prices induce technological change



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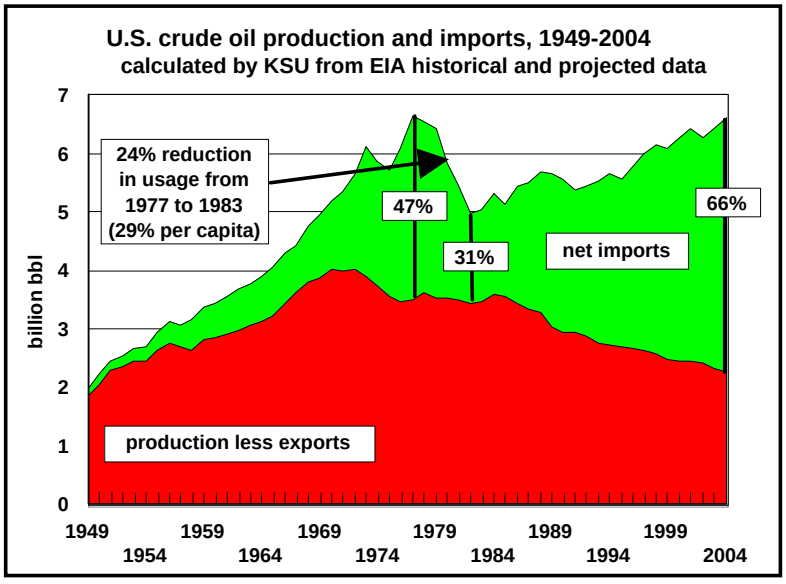

Is crude oil self-sufficiency a reasonable goal? Substitutes for crude? 5B gal ethanol might replace 0.066B bbl crude (1.51% of imports)

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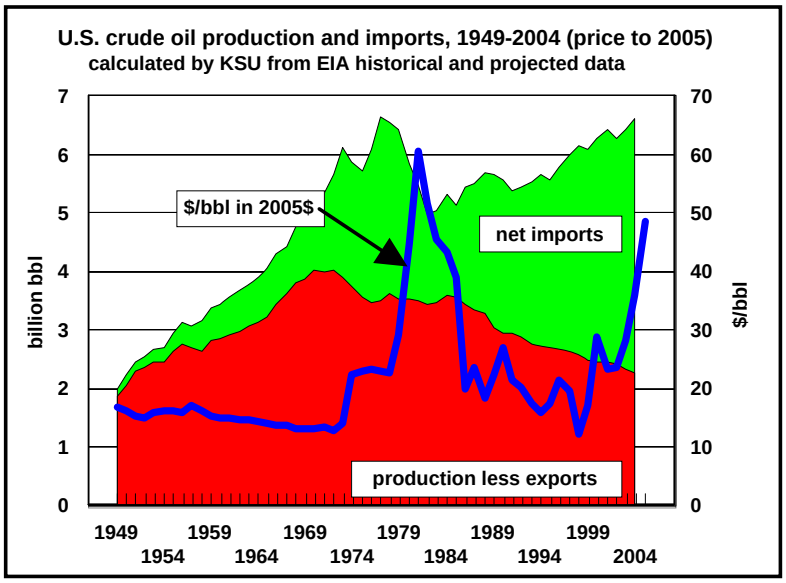
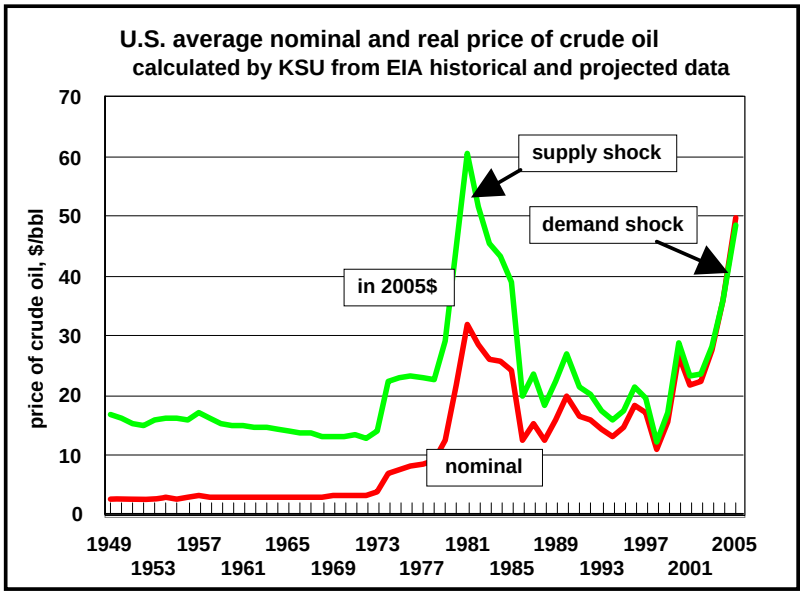
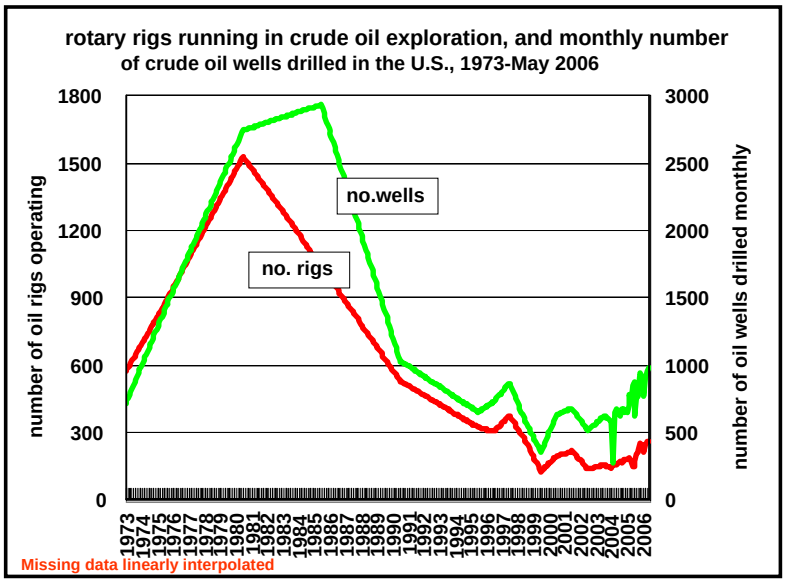
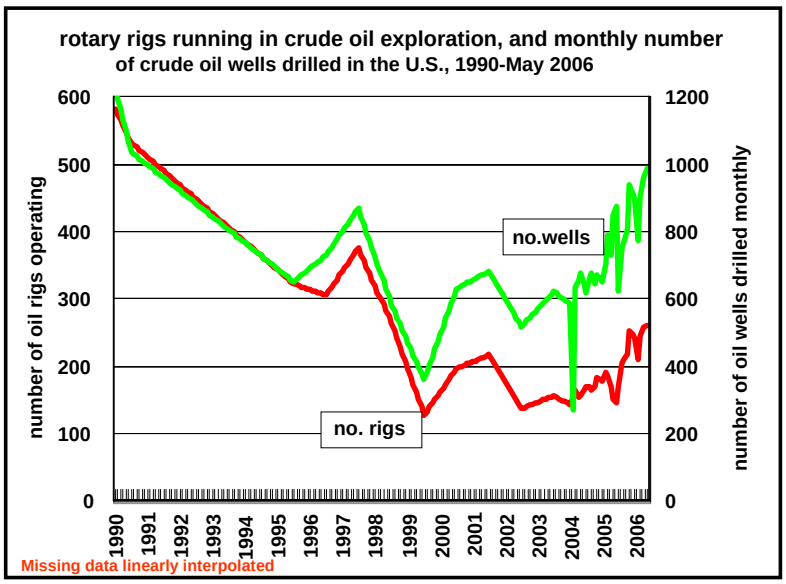




Markets will still work; but will prices fall as fast this time?



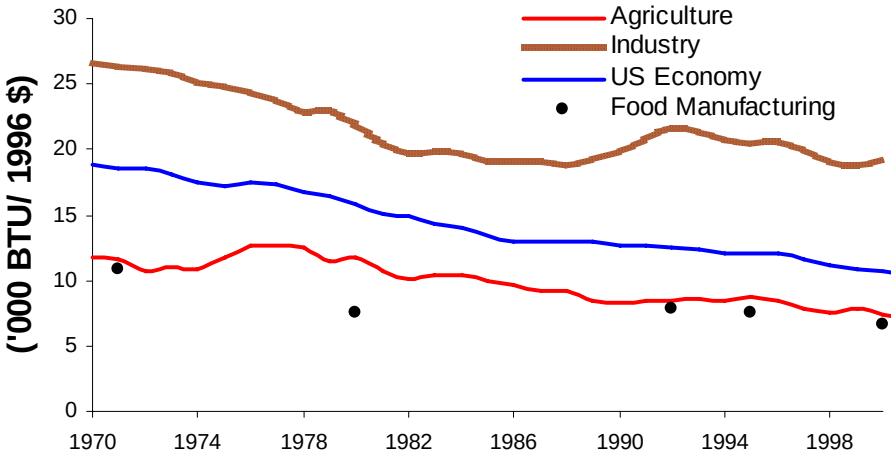
Price decimated the U.S. oil industry in the late 1980s and 1990s



Markets will work again and supply will increase as demand is tempered

Energy use in agriculture

Energy Intensity (BTUs consumed per dollar) in US Agriculture, Food Manufacturing, Industry, and U.S. Economy



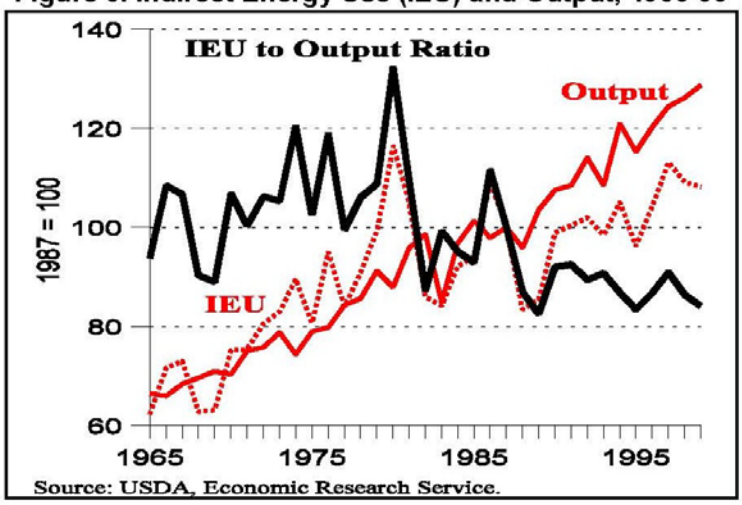
From Miranowski, 2004, "Energy Consumption in U.S. Agriculture," presentation at USDA conference on *Agriculture as a Producer and Consumer of Energy*, June 24, 2004

Congressional Research Service (CRS)
"Energy Use in Agriculture: Background and Issues"

- **Direct energy use**
  - Fuel and electricity to power farm activities
  - 1.1 x 10^{15} Btu (65% of total farm use)
- **Indirect energy use**
  - In fertilizers and chemicals produced off farm
  - 0.6 x 10^{15} Btu (35% of total farm use)
- **Ignores fuel embodied in machinery manufacturing and non-farm transportation**

Agriculture has become about 10% more efficient in terms of indirect energy usage from 1965 to 1999

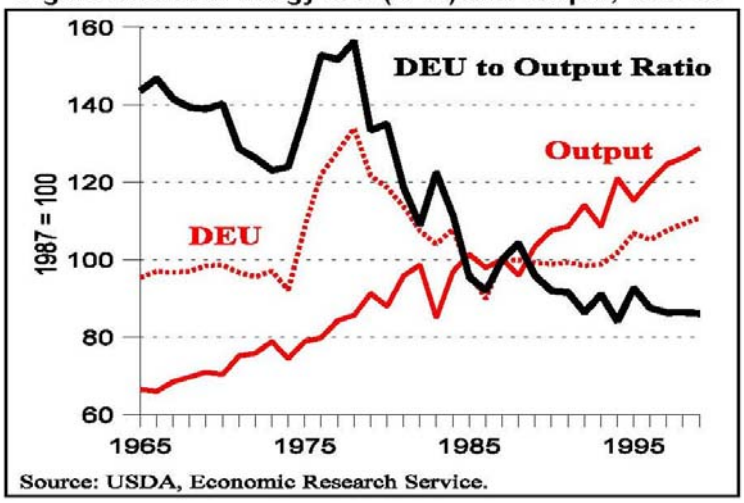
Figure 6. Indirect Energy Use (IEU) and Output, 1965-99



From CRS (Congressional Research Service) "Energy Use in Agriculture: Background and Issues," November 19, 2004, by Randy Schnepf

Agriculture has become about 40% more efficient in terms of direct energy usage from 1965 to 1999

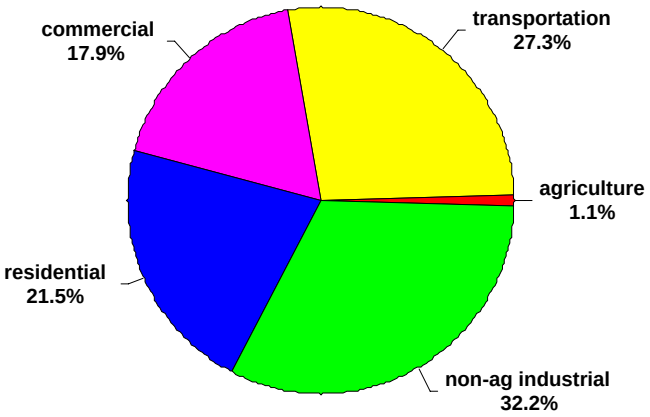
Figure 5. Direct Energy Use (DEU) and Output, 1965-99



From CRS (Congressional Research Service) "Energy Use in Agriculture: Background and Issues," November 19, 2004, by Randy Schnepf

U.S. Direct Energy Consumption, 2002

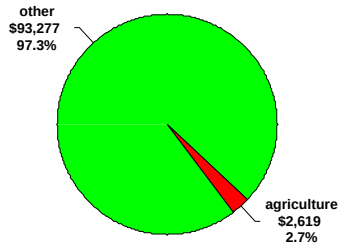
aprox. 98,000 trillion Btu total



as reported in CRS study

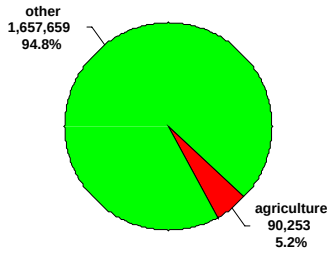
Reducing ag's use of energy won't greatly fix the U.S. energy "problem"

2003 KS value-added income
basic measure
million $



from KSU report to Kansas Inc. in 2006

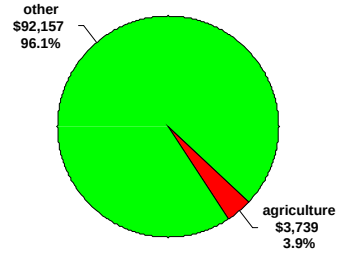
2003 KS employment
basic measure
number of jobs



from KSU report to Kansas Inc. in 2006

Narrow interpretation of ag industry's importance to Kansas economy

2003 KS value-added income
with ag share of other sectors
million $



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2003 KS employment
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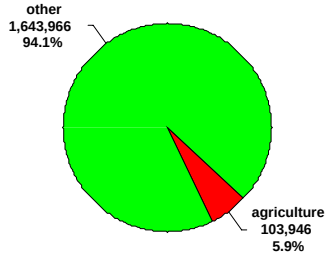
number of jobs

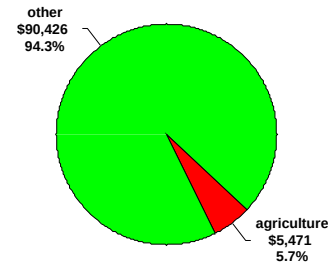


from KSU report to Kansas Inc. in 2006

2003 KS value-added income

also commodity processing & food manufacturing

million $



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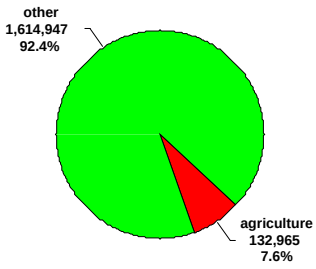
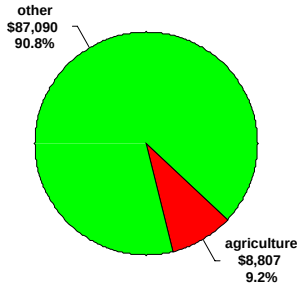


from KSU report to Kansas Inc. in 2006

2003 KS value-added income

broadest measure (all interations with ag)

million $



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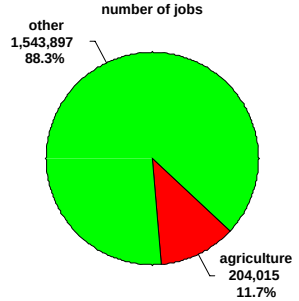
2003 KS employment

broadest measure (all interations with ag)

number of jobs

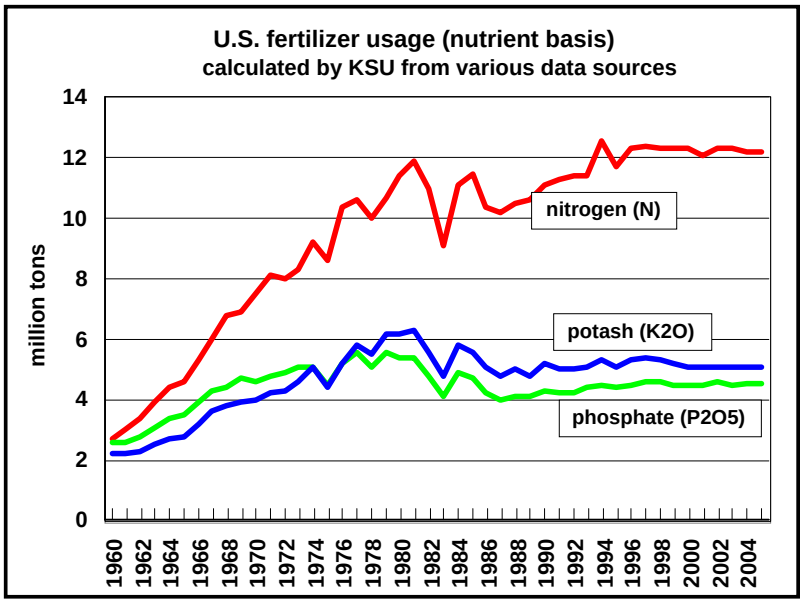


from KSU report to Kansas Inc. in 2006

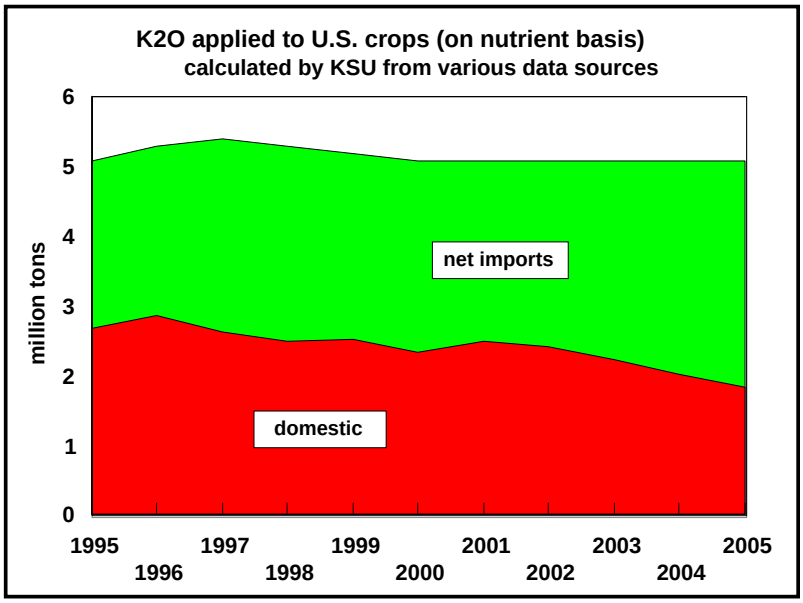
Broadest measure, includes for example, all meat packing industry

Policy motives . . . things to think about

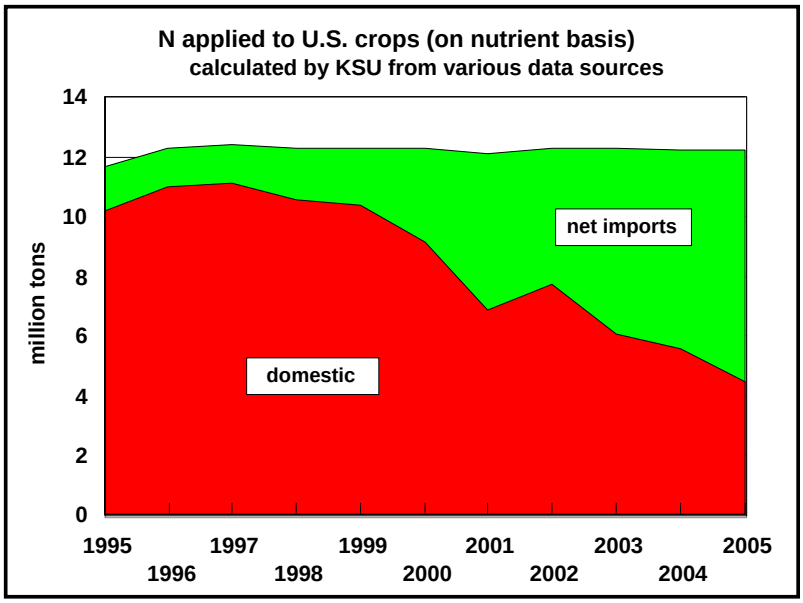
- World is not running out of oil, but it may be "expensive" for awhile
- U.S. energy independency would be very expensive to acquire
  - Ethanol may be good for farmers but it won't greatly reduce dependency on energy imports
  - Protectionist tendencies could be costly
- Saving energy in agriculture won't have a large impact on the U.S. energy "problem"
- But, at the micro scale, energy matters to ag
  - Farm fuel and fertilizer cost



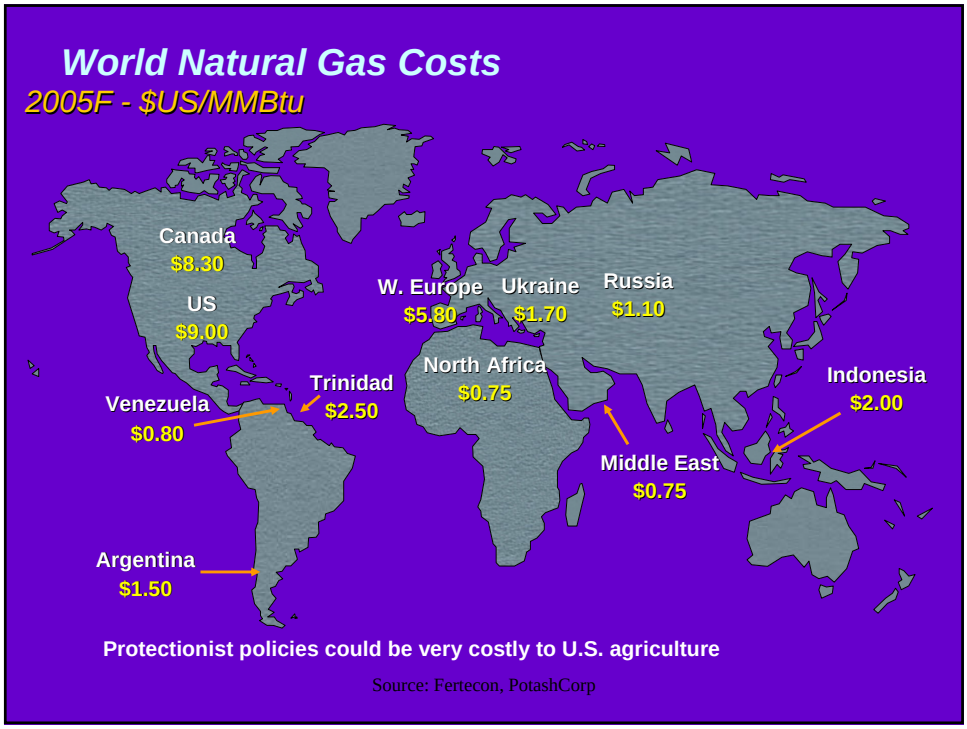
Ag depends on fertilizer and it is highly related to energy prices
Taxing N in 1970's would have been and "expensive" policy given trend



Potash imports are growing in importance



Protectionist policies could be very costly to U.S. agriculture in the short run



Policy motives . . . things to think about

- Carrots preferred to sticks
- Ag producer subsidies:
  - work best where they reinforce or catalyze existing economic trends
  - are best accepted by producers if they enhance future profits
  - get greatest return for taxpayer if they are technology investment oriented, where the technology stays when the subsidy leaves
  - success depends on education & research
  - ag is small but often important politically
- Enough subsidies on ethanol already!
- Farmers generally maximize profits

Renewable Energy

4 Major Renewable Energy Opportunities for Kansas Agriculture

- **Ethanol from Commodity Crops**
  - corn
  - sorghum
- **Biodiesel**
  - soybeans
  - animal fats
  - other feedstocks (annual and perennial oils)
- **Bioethanol**
  - herbaceous energy crops (switchgrass)
  - corn and other crop stovers
- **Anaerobic Digestion of Livestock Manures**
  - dairy operations only

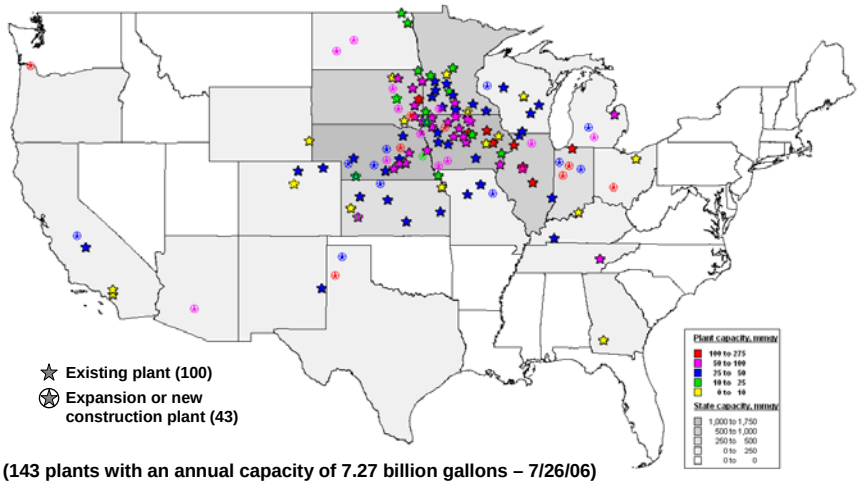
from: Richard Nelson, Biological and Agricultural Engineering, KSU

Ethanol from Commodity Crops

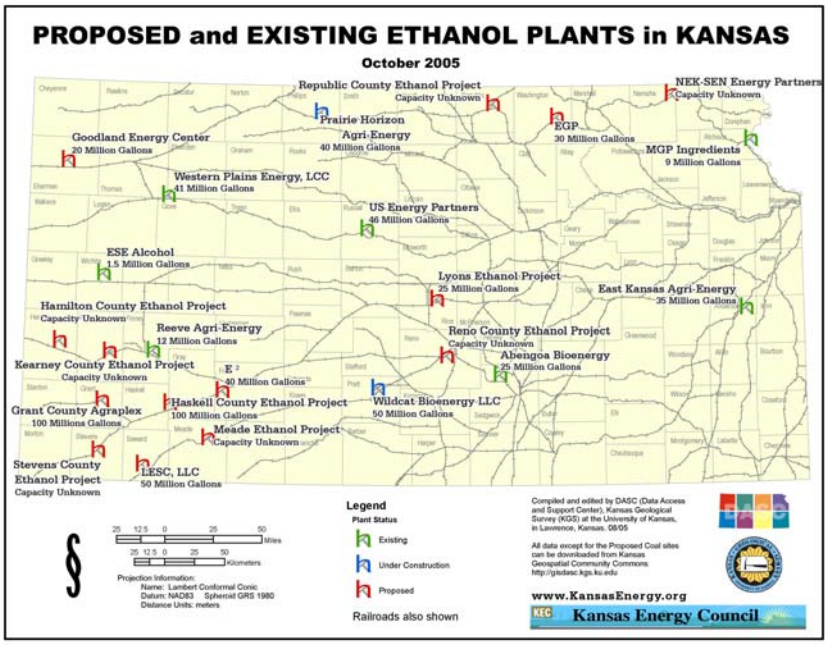
- Known commodity and state and national policies (e.g., subsidies) will influence future size of the industry
- Renewable Fuels Standard (minimum 7.5 billion gallons of renewable fuels) will play a role nationally on future Kansas development as well as the cellulosic ethanol requirement of 250 MGY by 2013
- Drivers of ethanol industry:
  - Subsidies
  - Banning of MTBE in some states
  - Mandatory ethanol inclusion in some states
  - High energy prices

Existing and new ethanol plants

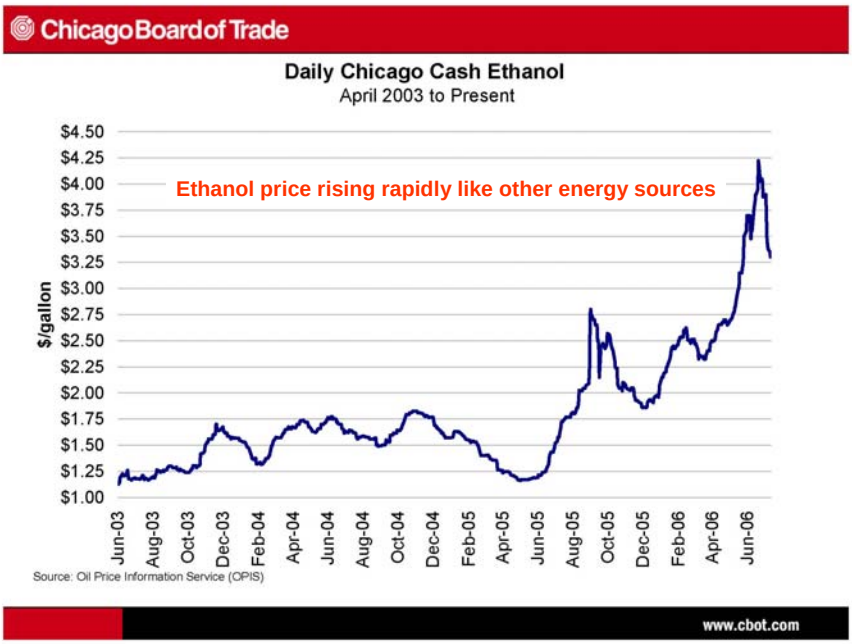
Source: Renewable Fuels Association (RFA), Kansas State University



(143 plants with an annual capacity of 7.27 billion gallons – 7/26/06)



October, 2005

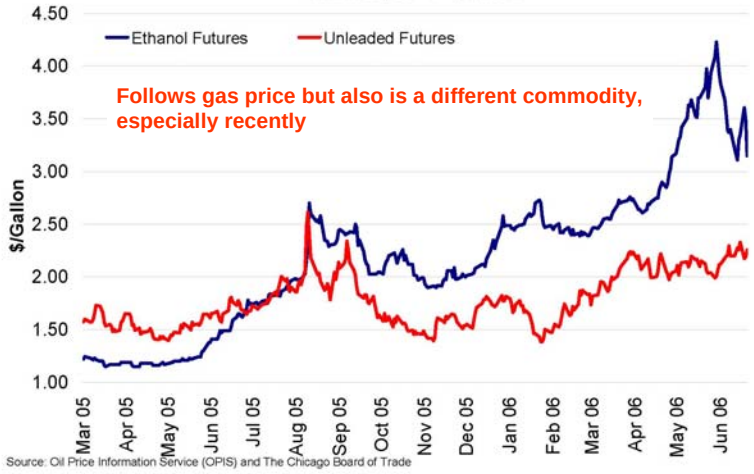


Weekly Chartbook for CBOT Ethanol Futures Contract, www.cbot.com/ethanol

Chicago Board of Trade

CBOT Ethanol Futures versus NYMEX Unleaded Futures

March 23, 2005 - present



Source: Oil Price Information Service (OPIS) and The Chicago Board of Trade

www.cbot.com

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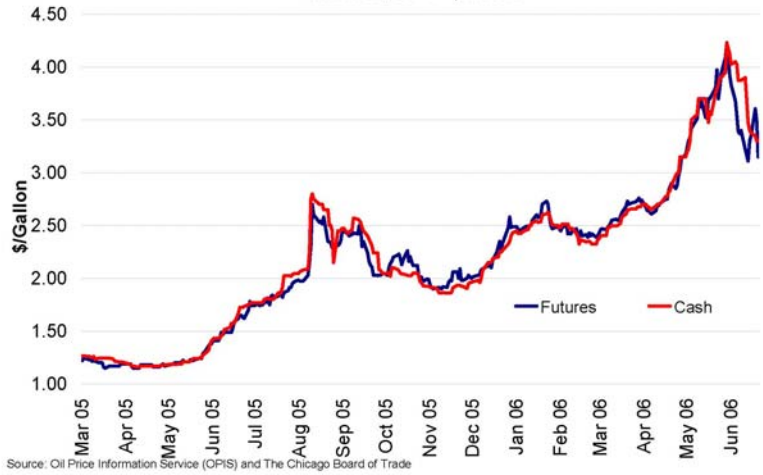
Chicago Board of Trade

CBOT Ethanol Futures versus Chicago Cash Ethanol

March 23, 2005 - present



Source: Oil Price Information Service (OPIS) and The Chicago Board of Trade

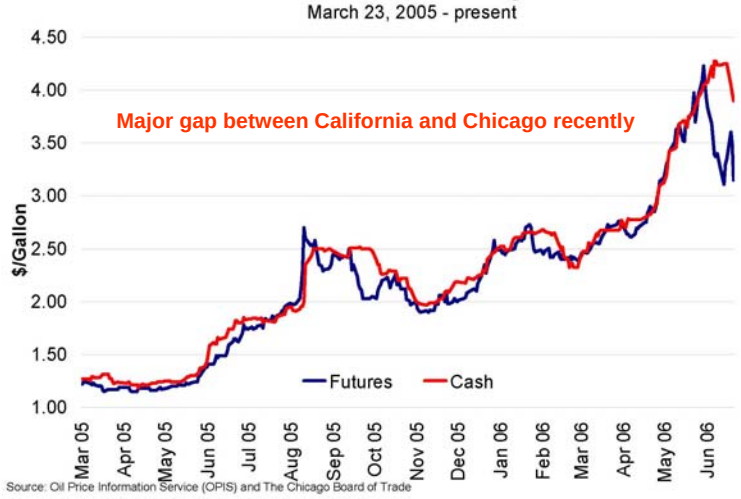
www.cbot.com

Weekly Chartbook for CBOT Ethanol Futures Contract, www.cbot.com/ethanol

Chicago Board of Trade

CBOT Ethanol Futures versus Los Angles Cash Ethanol

March 23, 2005 - present



Source: Oil Price Information Service (OPIS) and The Chicago Board of Trade

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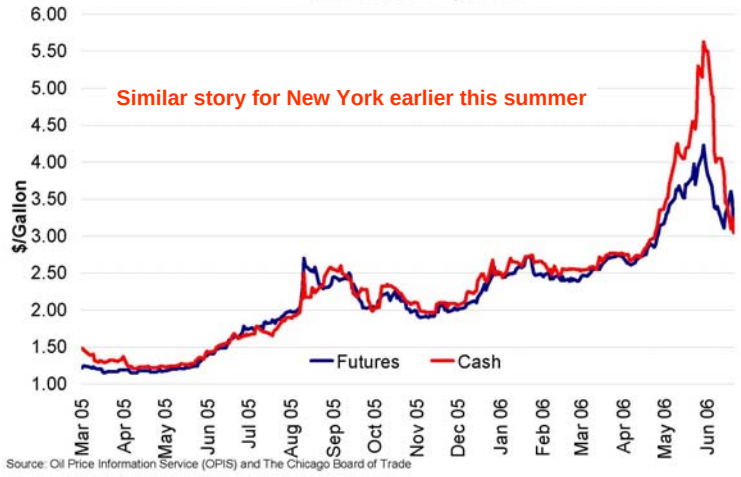
Weekly Chartbook for CBOT Ethanol Futures Contract, www.cbot.com/ethanol

Chicago Board of Trade

CBOT Ethanol Futures versus New York Cash Ethanol

March 23, 2005 - present



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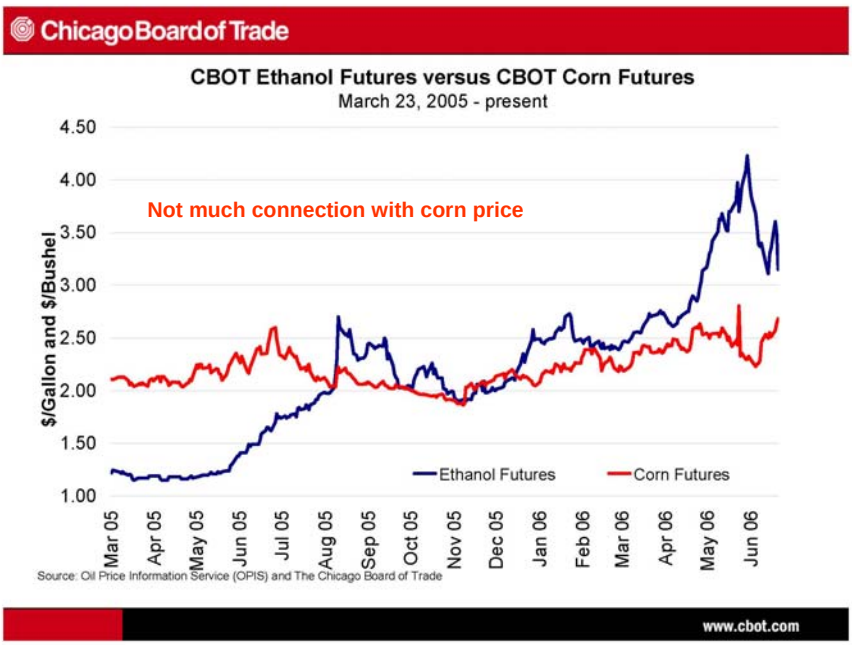

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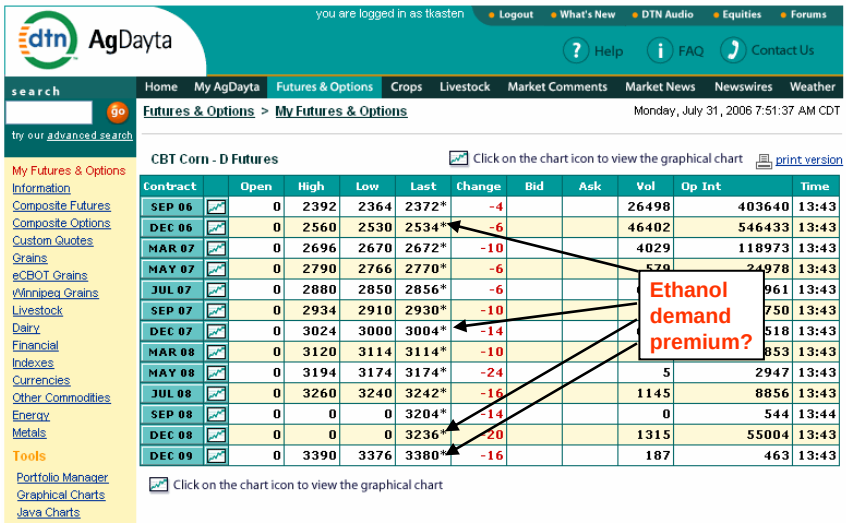
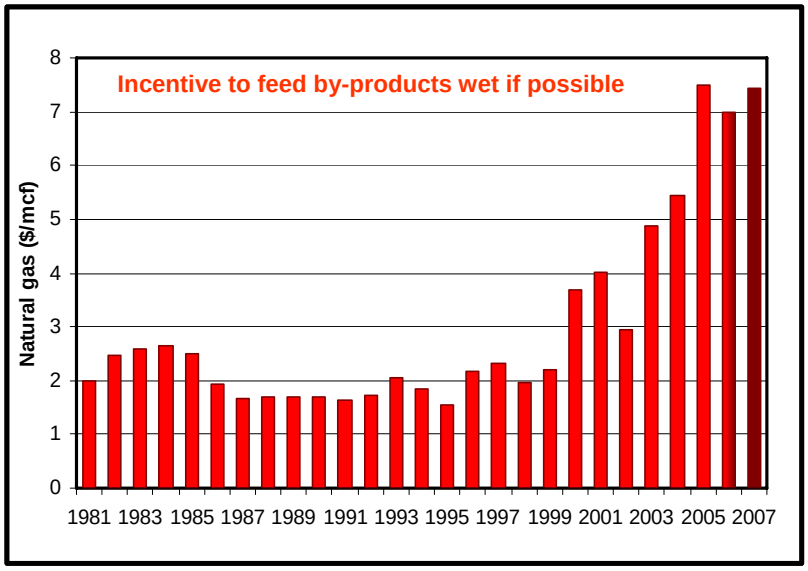
Ethanol consideration for grain producers



Natural gas prices…



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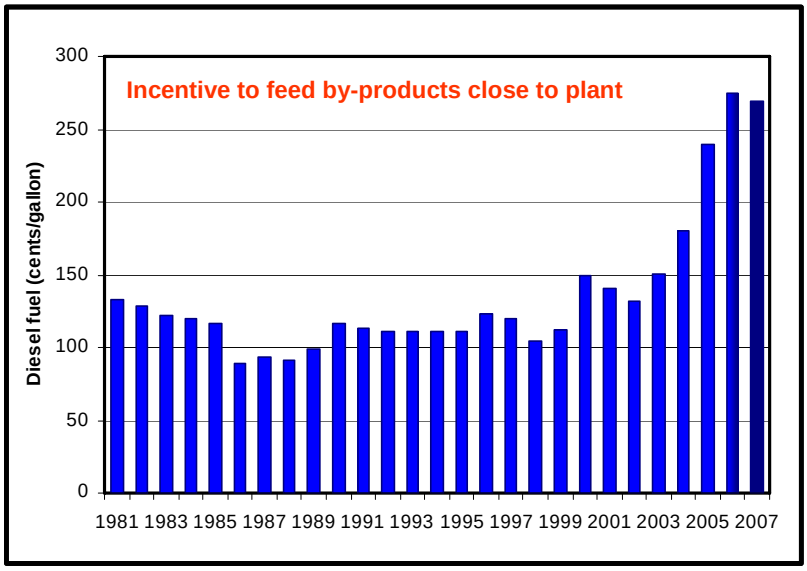
Diesel fuel prices…



Where will (should) future plants locate?

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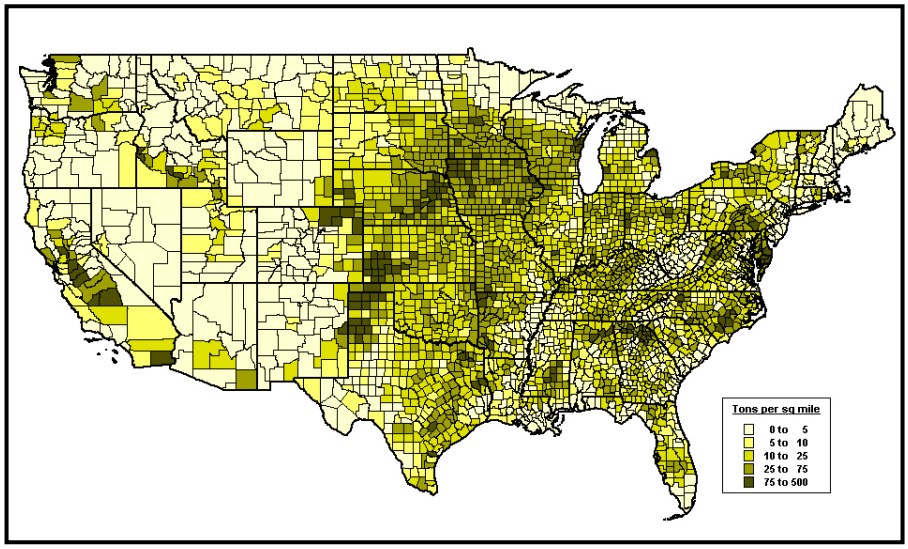
Potential DDGS consumption (51.56 million tons)

Source: Kansas State University estimate



Implies about 17 billion gallons of ethanol. Where will (should) future plants locate?

Should I use ethanol in my vehicles?

	BTU	gas equiv	mileage
Gasoline	125,071	1.00	study
Diesel	138,690	1.11	American
Ethanol	76,000	0.61	Coalition
E85	83,361	0.67	Ethanol
E10	120,164	0.96	0.985
E20	115,256	0.92	0.978
E30	110,350	0.88	0.949

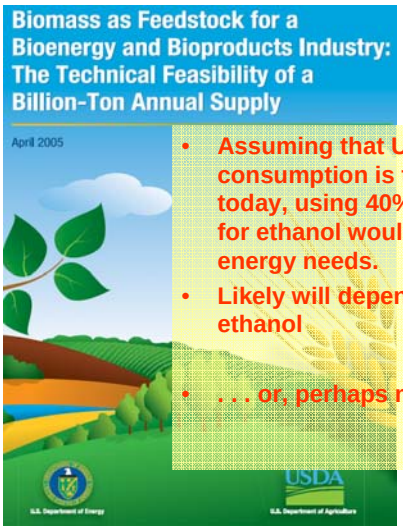
Until we get better information may want to split the difference and buy:
E10 if 2% lower price at pump
E85 if 17% lower price at pump

Biodiesel

- **Main Kansas biodiesel feedstocks are:**
  - **soybeans and animal fats/waste greases**
  - **use as feedstocks depends upon competing market factors and biodiesel demand**
- **Industry growing due to national 'Blenders Tax Credit' and Kansas could potentially increase production and use due to the EPA Ultra Low Sulfur Diesel (ULSD) rules for 2007 – 2014**
  - **low-blend (2%) biodiesel as a lubricity component**
  - **demand of 8+ mil gal for KS on-highway (760 U.S.)**
- **Small-scale (e.g., on-farm) biodiesel production is not feasible; community-scale possible depending upon:**
  1) **Market demand**
  2) **Sale of by-products**

from: Richard Nelson, Biological and Agricultural Engineering, KSU

National Cellulosic Biomass Focus



- **Assuming that U.S. energy consumption is the same in 2025 as today, using 40% of the U.S. corn crop for ethanol would replace 1% of our energy needs.**
- **Likely will depend more on cellulosic ethanol**
- **. . . or, perhaps more wind and solar**

25x'25
AMERICA'S ENERGY FUTURE

Potential Biomass Feedstocks for Meeting the "Billion Ton" and "25x25" National Goals

- **Corn Stover**
  - Potential exists in Kansas for use of corn stover, but serious questions arise concerning the sustainability of the land base with respect to consistent removal and cost
  - Resource assessment (supply curves) being developed for edge-of-field costs of $5 to $35 per dry ton

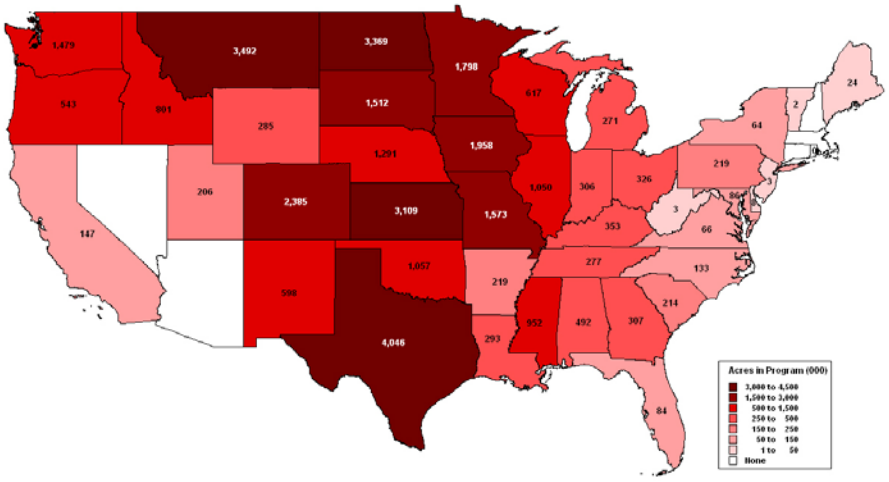
- **Herbaceous Energy Crops (switchgrass)**
  - Potential exists in Kansas for use of herbaceous energy crop production, but competing land uses as well as established, viable end-use markets are present impediments to development
  - Resource assessment (supply curves) being developed for edge-of-field costs of $5 to $35 per dry ton

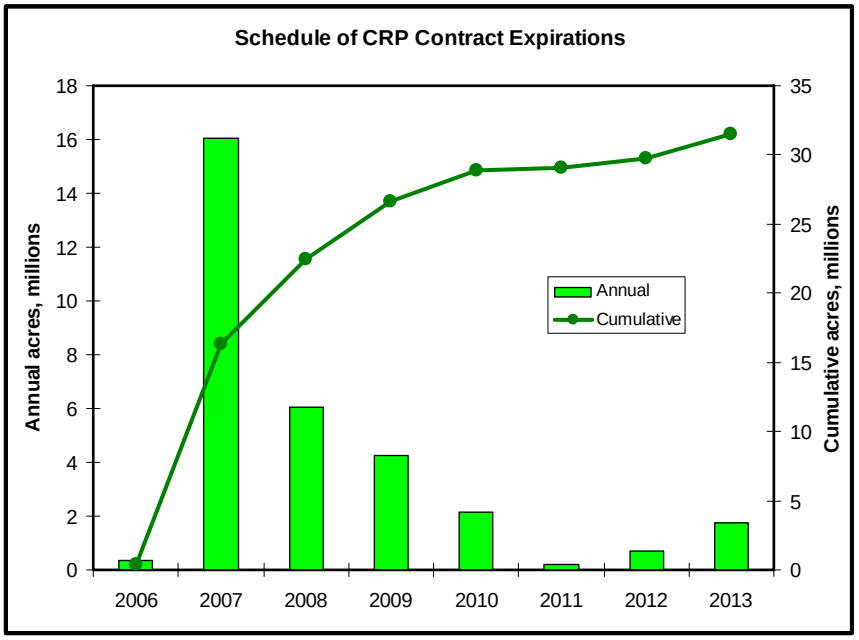
from: Richard Nelson, Biological and Agricultural Engineering, KSU

Bio-ethanol (cellulosic)

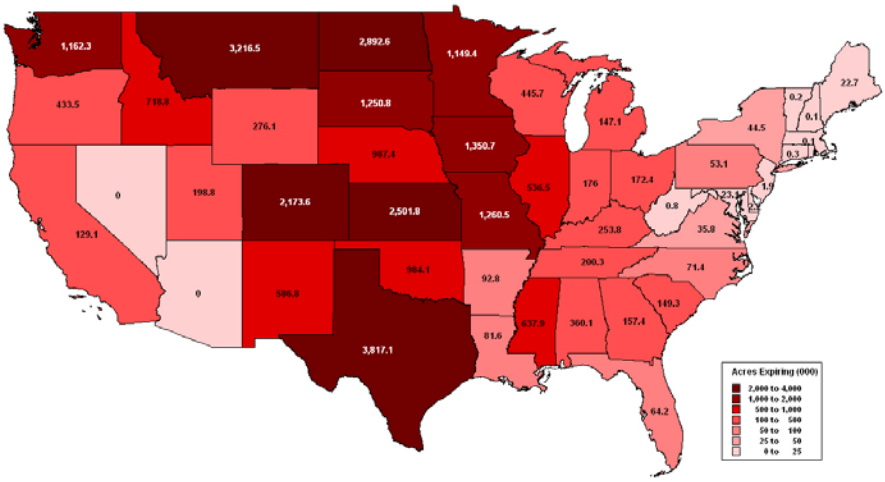
- Grains: 100 gal/T of input (around 90%dm)
  - 150 bu/a corn crop = 420 gal/acre
  - At $2.50/bu corn will be $0.89/gal for feedstuff
- Biomass 50-70 gal/T of input (potential>100)
  - Convert from grain to forage production?
    - 20 T/acre corn silage (7.8 T 90dm) = 390-546 gal/a
  - Sell crop residue
    - Wheat straw sells for $45/T, which implies a feedstuffs cost of $0.64-$0.90/gal
- Would have a hard enough time competing even if manufacturing costs were the same as with grain-based ethanol plants
  - Or will grassland or CRP switch to switchgrass?

Current acres in CRP, 2006
(total = 36,015 thousands)





Acres in CRP scheduled to expire in 2006-2010 (total = 28,822 thousands)



100% of this would be 3 bil. gal. ethanol at 70 gal/T and 1.5 T/acre of switchgrass

Blurb from DTN pertaining to CRP being used for production (6/28/06)

U.S. hunting and fishing groups as well as other wildlife and conservation organizations have reacted with some concern about the possibility that the federal government may permit the harvesting of biomass from land enrolled in initiatives such as the Conservation Reserve Program. With all the talk of moving to alternative fuels -- especially cellulosic ethanol -- some in Washington have pointed out that CRP acreage could be a fine place to harvest plant material for conversion to fuel.

A coalition of more than 20 outdoor groups recently took a step to assure they would have a seat at the table when Congress sits down to write the conservation title of the next farm bill. In a letter to key House and Senate members, the groups recommend that legislators make certain to assess the effects on wildlife and soil and water quality of harvesting biomass before deciding it would be good to remove stubble and vegetative cover from CRP acres. The groups also volunteered to provide Congress with their collective wildlife, habitat, and conservation expertise and research data as the conservation title is being drafted.

There currently are about 36 million acres enrolled in the CRP.

Anaerobic Digestion of Dairy Manure

- **Energy production (Btu and kilowatt-hours) determined for Kansas dairy operations and herd sizes of 100 – 10,000+ head**

- **Cost analysis ($/kW-h production cost) based on Western Governors' Association data**

  http://www.westgov.org/wga/initiatives/cdeac/Biomass-supply.pdf

On-site production cost ranges from $0.0731 to $0.243 per kW-h for herd sizes greater than 250

from: Richard Nelson, Biological and Agricultural Engineering, KSU

Will We Make the 25x25 goal?

- **Ethanol might make 3.75% if . . .**
  - **corn yields increase 1.5%/yr**
  - **U.S. energy consumption is flat**
  - **40% of corn grain crop to ethanol**
  - **Biomass ethanol double grain-based ethanol**
- **6% renewable energy in 2005**
  - **3.5% is non-hydroelectric (NH)**
- **NH would need to increase 6 fold!**
- **Oil and natural gas won't sit idly by**
  - **25x25 goal will be abandoned along the way**

Summary

- **Renewable energy will make small inroads into the overall energy picture**
  - **Grain farmers will benefit; livestock farmers??**
- **Petroleum energy will continue to dominate in our lifetimes**
- **Energy prices will fall again as supply and demand equilibrate**
  - **Tough on farmers in the near future**