

Biofuels and Transportation Impacts and Uncertainties

Some Observations of a
Reformed Ethanol Skeptic

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Aka-"Ethanol Skeptic"

UW-Extension
Ethanol Study Tour
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Topics

- Why Biofuels
- Ethanol Economics
- Ethanol Transportation Equipment and Infrastructure Requirements
- Changes in US and Midwest Agriculture
- Impacts on US and World Grain Markets
- The Uncertainties of Cellulosic Ethanol

Why Biofuels?

- **National Security**
 - Reduce Imports of oil
- **Peak Oil**
 - Replace Fossil Resources
 - A Transitional Fuel
- **Trade Implications**
 - Balance of payment issues
- **Agricultural and rural resurgence**
 - Less government aid
 - Higher prices boost main street businesses

Why Biofuels?

- **Rural Development**
 - Economic Revival
- **Environment**
 - Reduce C, SO_x, NO_x emissions
- **Bio-refineries versus Oil Refineries**
 - Low cost
 - Fast Construction
 - Much Less pollution
 - Less Environmental Opposition

Policy History

- The US has subsidized corn based ethanol since 1978 with a subsidy ranging between **40 and 60 cents** per gallon.
- The current federal subsidy is **\$.51** per gallon, and there are state subsidies as well.
- Minnesota has mandated year round ethanol use since 1993
- A federal import **tariff of \$.52** a gallon remains in place with minor exceptions
- US Potential E-10 demand is **14 billion gallons** (the blend wall)

Policy History

- **Energy Policy Act of 2005 (EPA05)** establishes **Renewable Fuels Standards (RFS)**
- **EPA05** requires 4 billion gallons of ethanol in 2006 increasing to 7.5 Billion gal in 2012
- RFS standard is based on current year production
- **2007 RFS standard is 4.02 %** and will increase next year
- All “Obligated Parties” must meet RFS standard established by EPA each year

- **2007 State of the Union Address**
35 billion gal of alternative fuels in 2017 including 20% of gasoline use from renewable sources

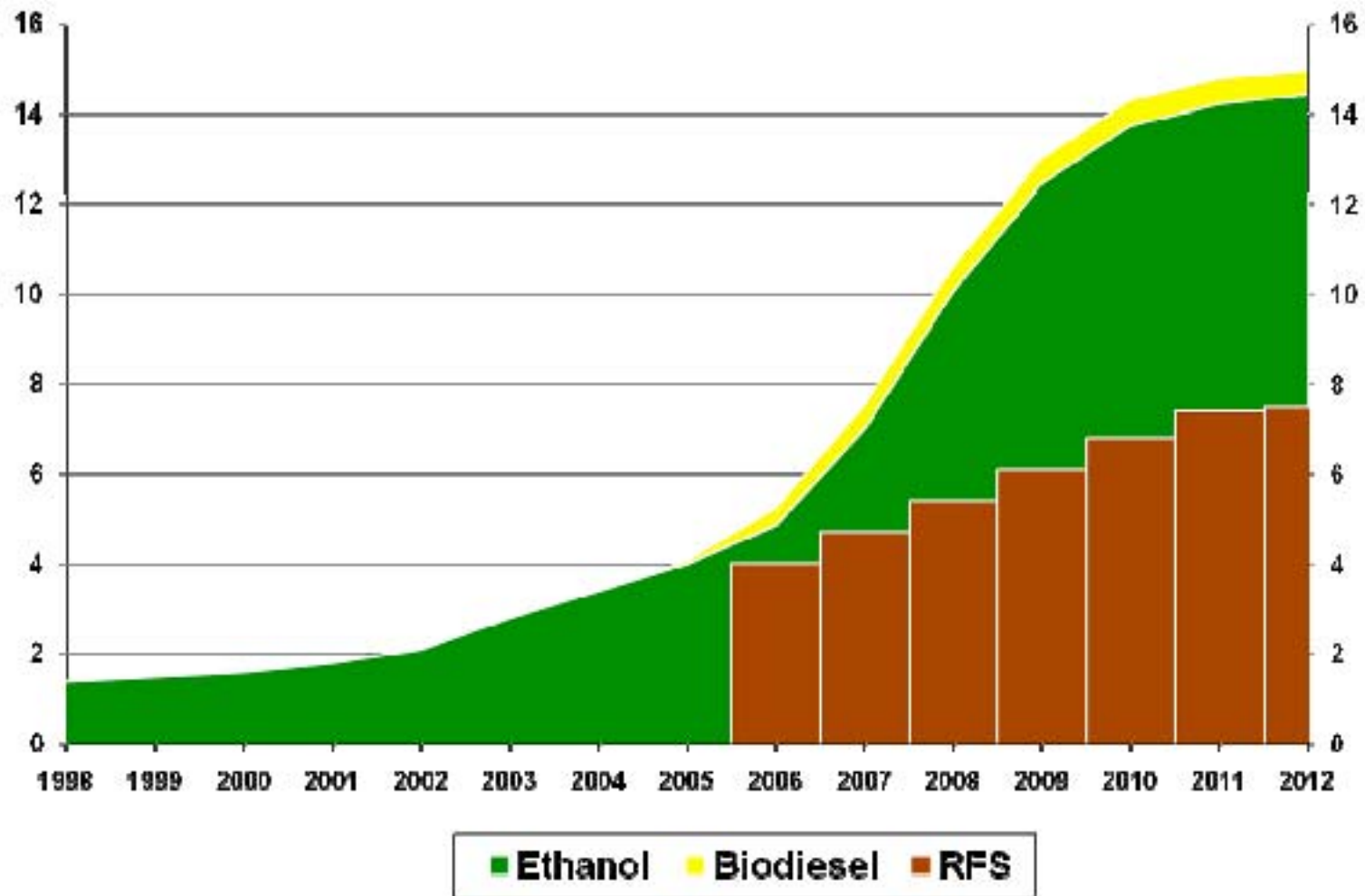
RFS Credit Arbitrage

- All “Obligated Parties” must meet RFS standard established by EPA each year
- 2007 standard is 4.02 %
- “Obligated Parties” can buy RFS credits from others who use more than standard
- Facilities in EPA attainment areas can buy credits on paper and avoid transportation (and other costs)

Implications and Outlook

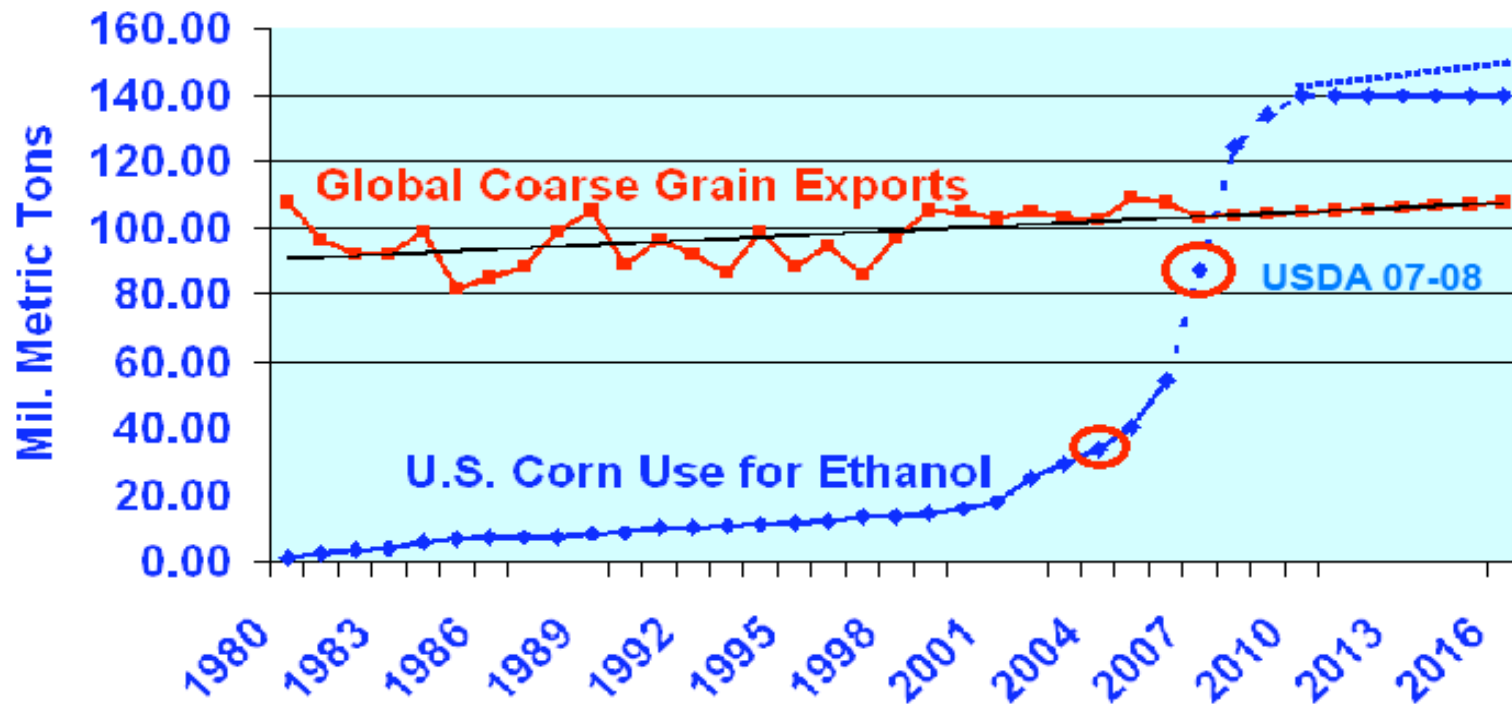
U.S. Biofuel Production

billion gallons



Source: FAPRI

Mil. Tons U.S. Corn Use for Fuel Ethanol & Global Coarse Grain Exports



Wisner

Crop Acreage and Production Responses

- US **corn acreage increased almost 20 %** from in 2007 from 2006.
- Corn production increased **25 %** from 10.6 billion bushels in 2006 to 13.2 billion bushels in 2007
- Most of the increase in corn acres came from soybeans plantings which decreased by 16% and cotton which decreased by 28%
- Corn exports remain high because of demand and the weak dollar

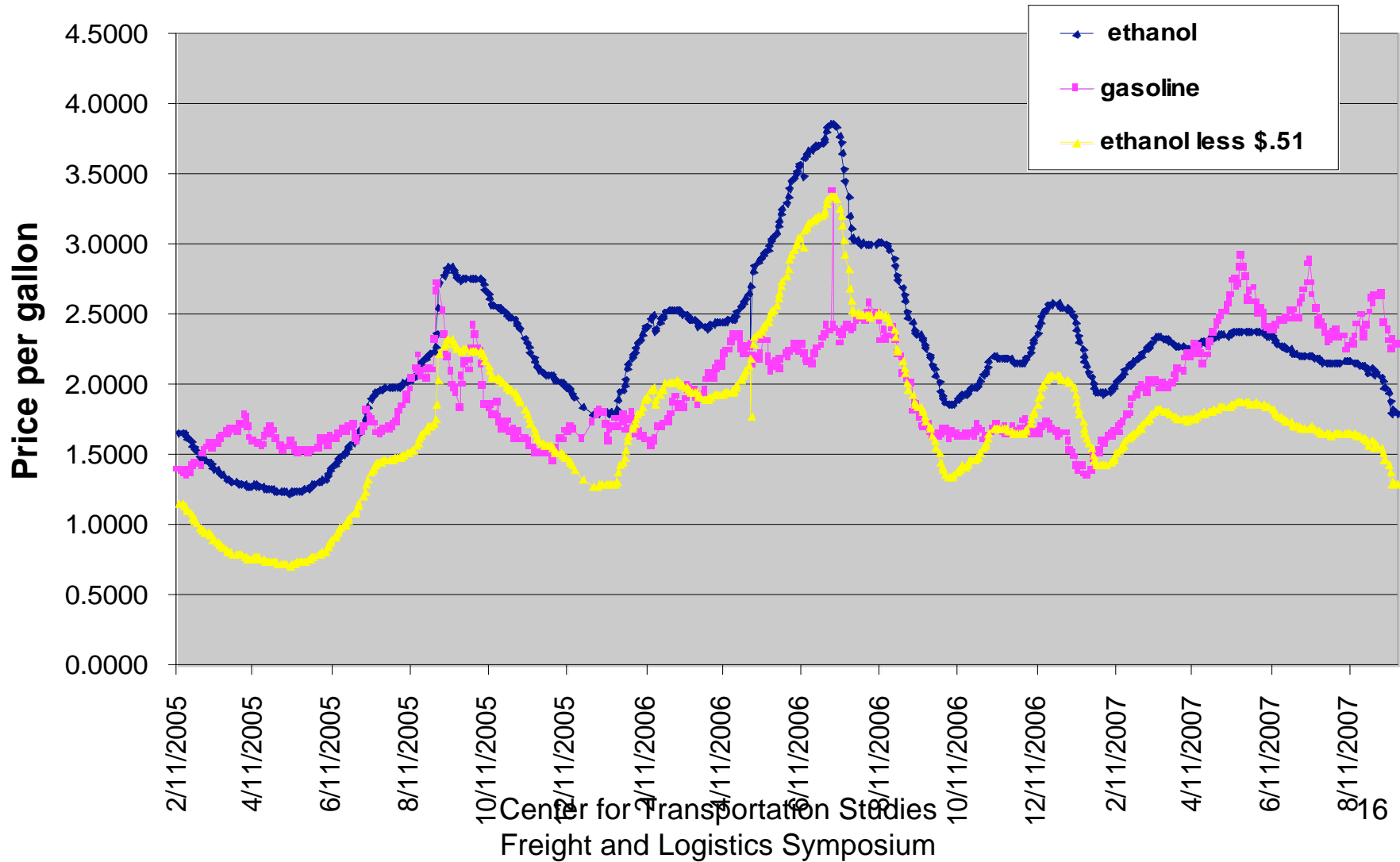
Implications for Roads and Congestion

- More grain from farm to first handler because corn yields are three times soybeans
- Longer hauls when corn bypasses local elevator to ethanol plant
- Changes in local market patterns
- Changes in export routes and quantities

Ethanol Economics

- Ethanol has value as an **ADDITIVE** to gasoline and as **ENERGY**
 - It has **additive value** as an **octane enhancer** since its octane is 112 compared to 87 for regular gasoline
 - It has **additive value** as an **oxygenate** for reducing air pollution replacing MTBE
 - The **additive value** averaged 25 cents per gallon over the past 7 years but could fall to zero
 - About half of US gasoline is now a 10% blend
 - The **ENERGY** content value is about 68% of gasoline

Minneapolis Gasoline and Ethanol Prices 2005-2007



Conclusion

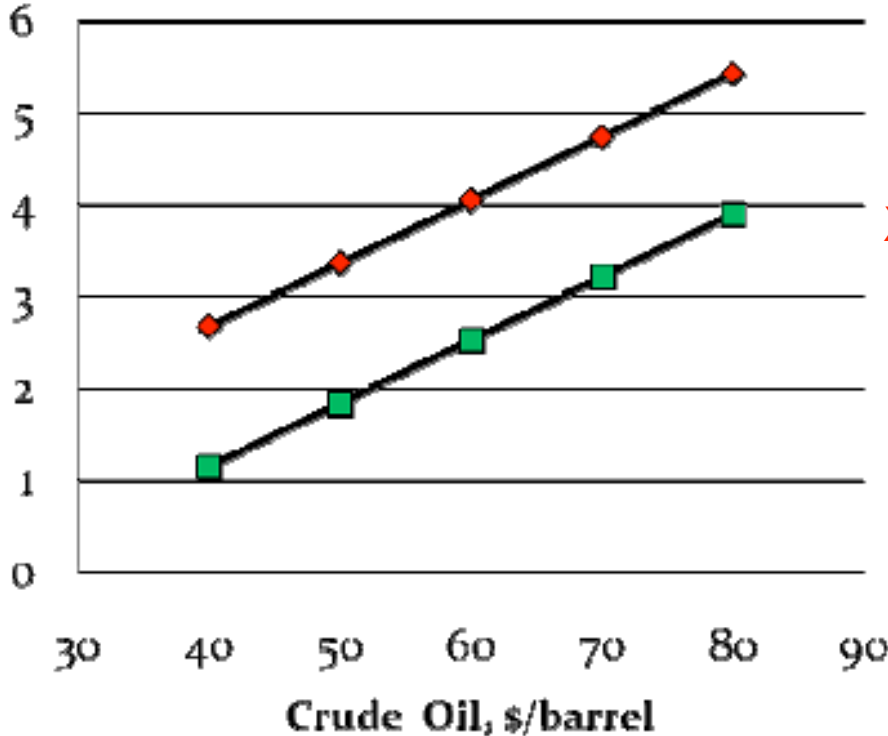
- The ethanol market price is now primarily based on its energy content (68% of gasoline) and the federal subsidy. This will probably continue.

Question

- Is the Ethanol Boom over??

Corn Break-even

Corn, \$/bushel



X Approximate NOV 26
-♦- 51 cent tax credit
-■- No tax credit

Source: WASDE 10

Will the Industry Stabilize

- Current federal subsidy is \$.51 a gallon
- Expires 12/31/2010
- Shift to a variable subsidy tied to price of crude oil
- Pay increasing subsidy as crude oil prices declines below \$50 ??

Basic Location Theory

With Equal Transportation Costs

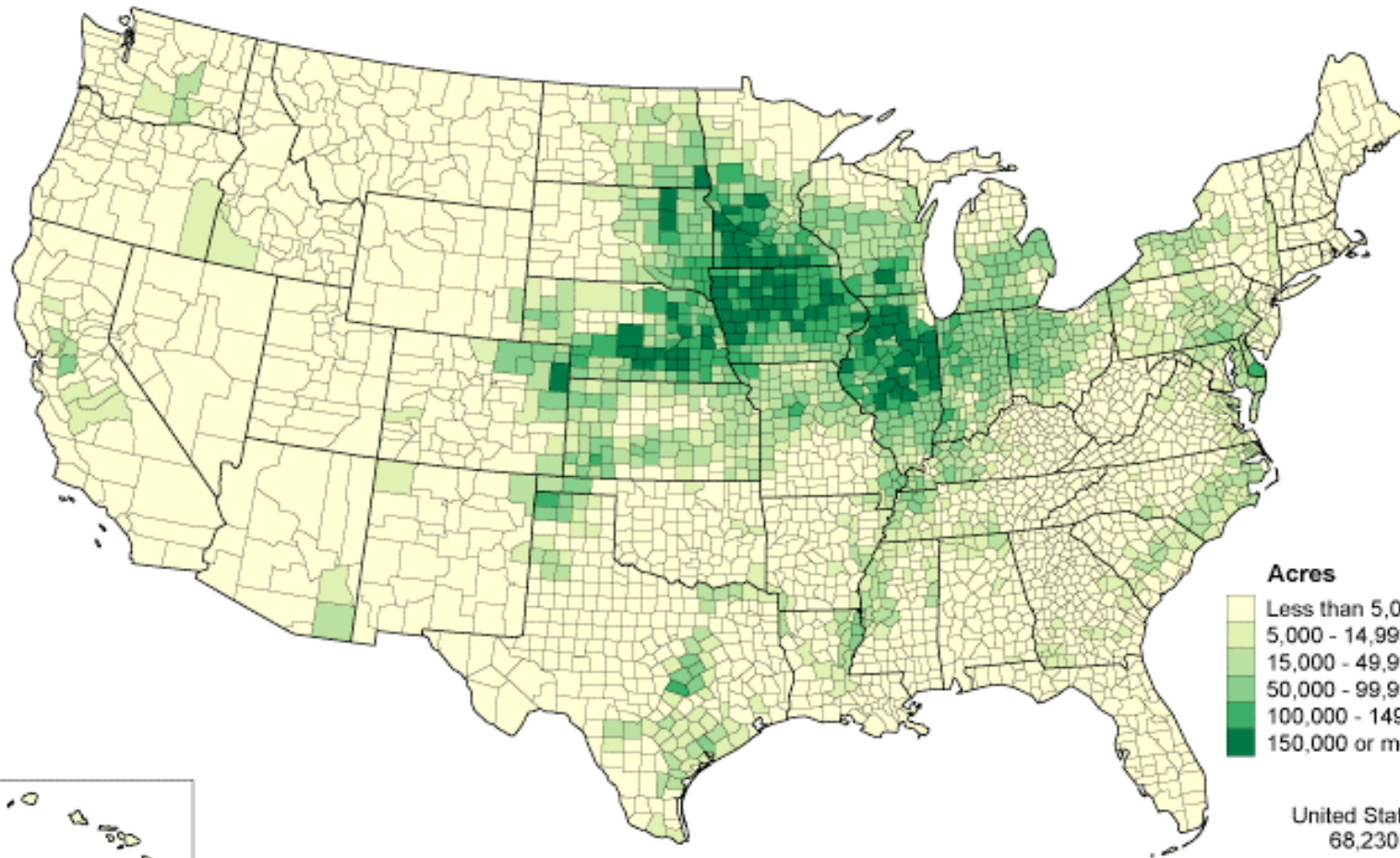
Where to Locate Plant

- If Process is **weight losing** –Produce at raw material source
- If Process is **weight gaining** and /or product is perishable- produce at the market

Basic Location Theory With Equal Transportation Costs Where to Locate Plant

- Ethanol Production is weight losing
- 1 Bu corn weighs (56 pounds) and Yields
- 2.8 gal ethanol (19 pounds)
- (DDGS) (18 pounds)
- CO₂ Liquids (19 Pounds)

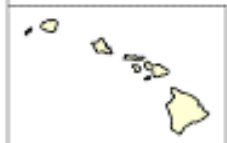
Corn for Grain, Harvested Acres: 2002



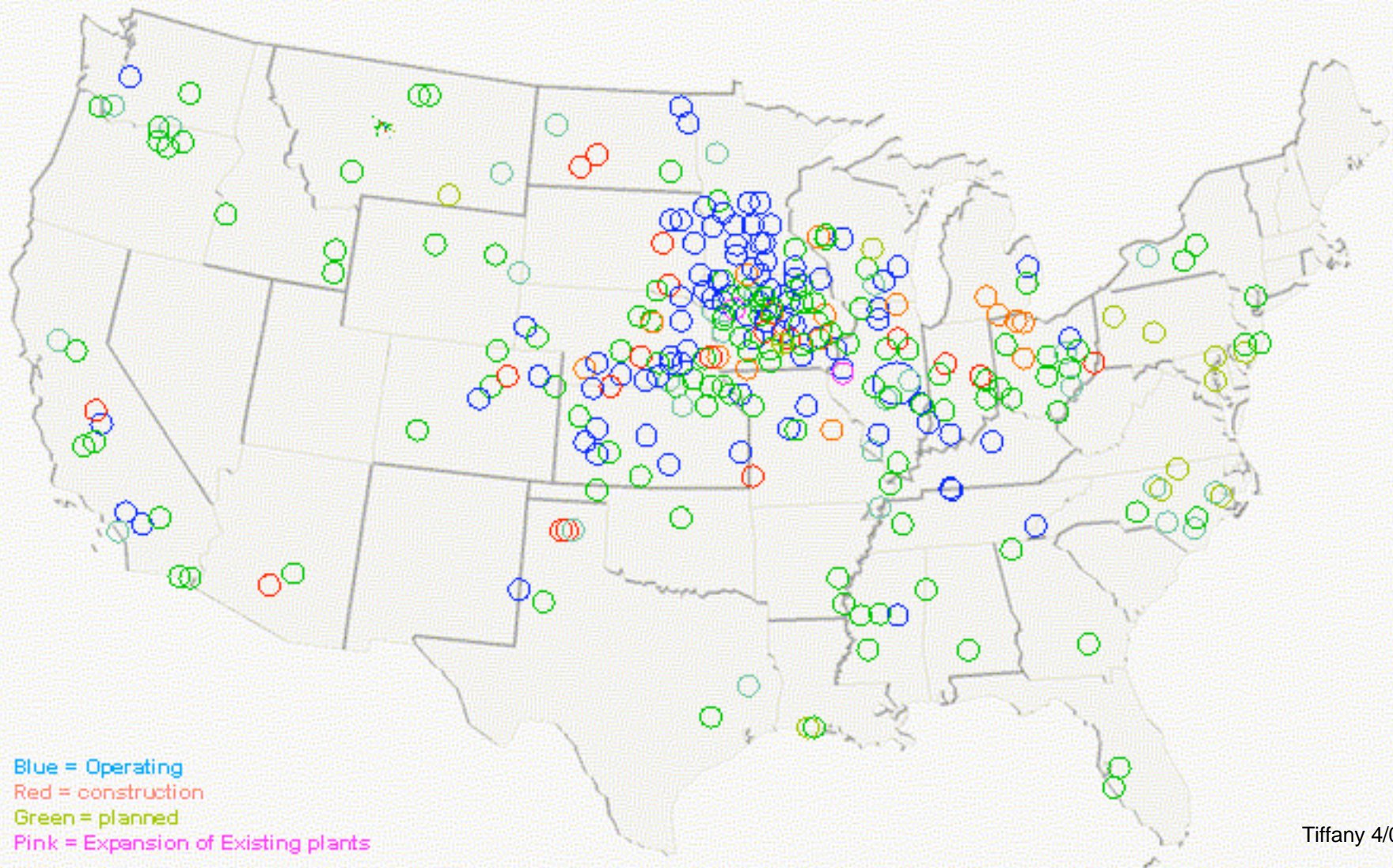
Acres



United States Total
68,230,523



Existing & Planned U.S. Corn Processing Plants

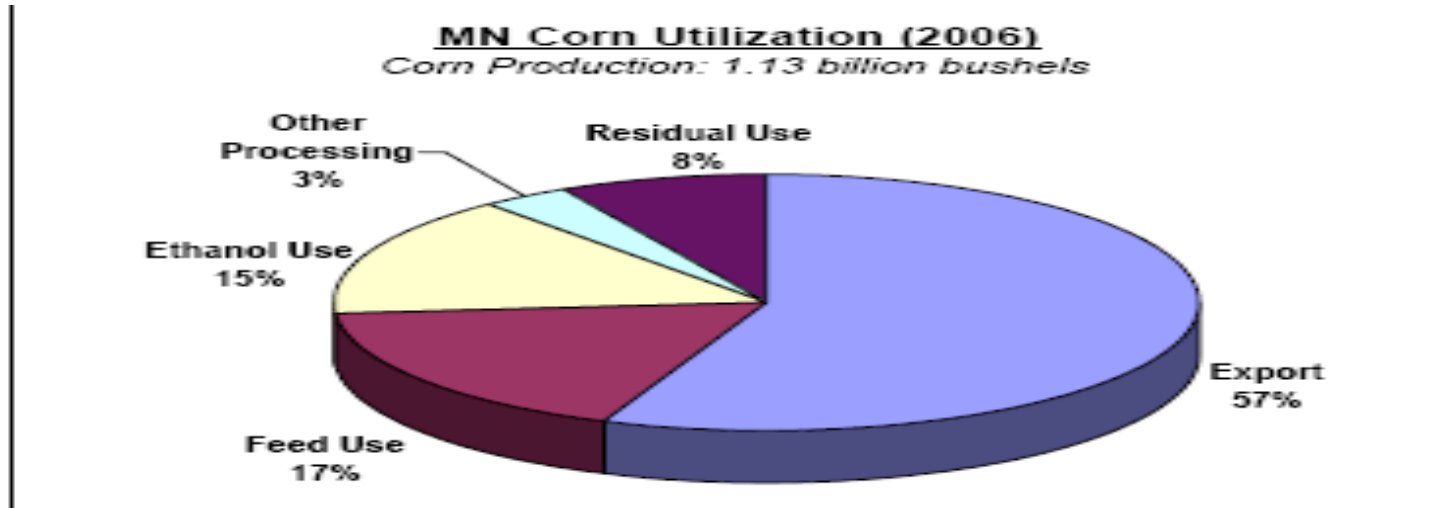


Tiffany 4/07

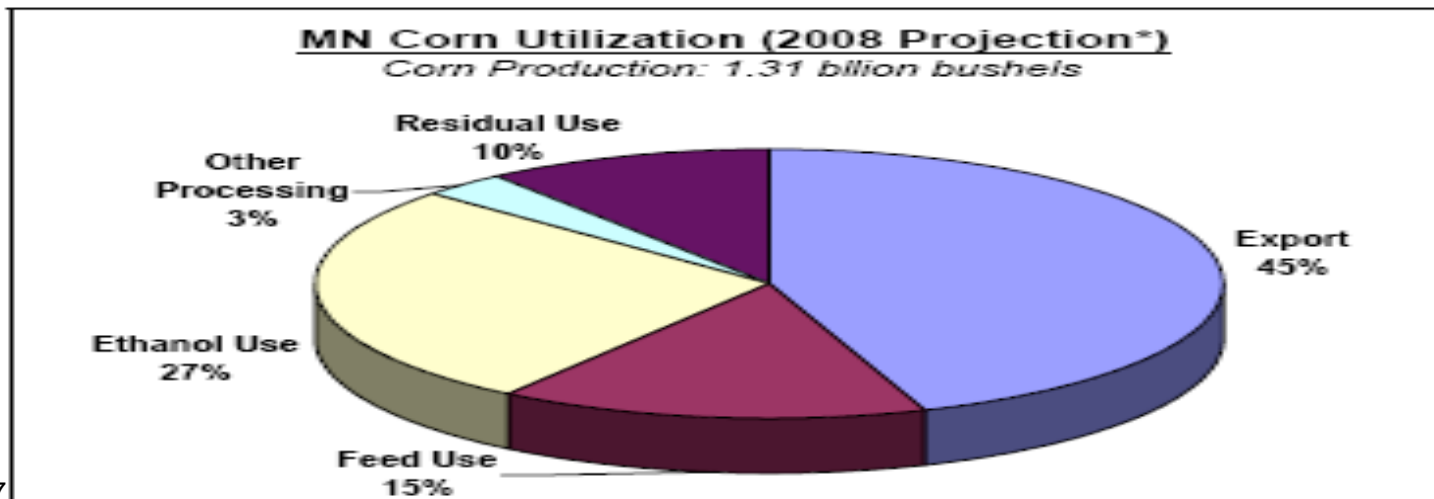
Data are from Terry Francel at AFBF, Press releases, and Renewable Fuels Association

Impacts of Minnesota Doubling of Ethanol Production

2006	170 mil bu for ethanol	650 mil bu exported
2008	353 mil bu for ethanol	590 mil bu for export



Source: PRX and MDA



*Based on PRX data and MDA estimates

DDGS

Distillers Dried Grains and Solubles

- Mid-level protein feed
Lacking the amino acid balance of soybean meal
- 28% Crude Protein
- Feed value higher than corn
- Poorer bulk density than corn
- Perishability and transportation issues



Ideal Location

- Have Feedlot Next to Ethanol plant so DDGS have no transportation costs

Moving DDGS Long Distances

- Rail capacity is a short run constraint
- Can ship dry DDGS in 5700 CF grain hopper cars
- Weight penalty -- DDGS bulk density less than corn and beans
- Railroad owned hopper cars **not permitted** for DDGS because of flow issues.
- New larger cars with wider hopper doors will become the standard but have long manufacturing lead times.

Ethanol Transportation Implications

- 90 % of the ethanol production capacity is in 8 Midwestern States
- 80% of the US population (and implied ethanol demand) lives along its coastlines
- Transportation costs are typically the 3rd largest producer expense after feedstock and energy
- Ethanol Movement by Mode in 2005
 - Rail 60%
 - Trucks 30%
 - Barge 10%
 - Pipeline 0%

Why No Pipeline Movements ?

- Corrosion Issues
- Adherence to water
- Small volumes (less than 5% of gasoline to date) make dedicated lines relatively uneconomic
- Dispersed origin locations

Pipeline Movements Will Evolve

- Growing total volume of ethanol
- Clustering of plants in Midwest
- Probably small dedicated lines
- Solutions to the corrosion and contamination issues are under investigation

Rail Transportation Issues

- Limited number of blenders who can take 100 (or 30 car trains)
- Many plants located on short lines
- Tank cars -30,000 gal Capacity
- \$95000 per car (\$9.5M per 100 car train)
- Two year wait list

Impacts on US and World Grain Markets

- Substitution of DDGs for feed grains in world export markets
- High prices will boost grain production in many regions of world
- More soybean production in South America (and further loss of US soybean export markets)
- Expansion of sugarcane ethanol in Brazil and elsewhere
- Development of a world biofuels market

Cellulosic Ethanol

Solution or Bottomless Subsidy Pit?

- At least 2 and possibly 4 pilot plants are being developed with large amounts of government aid
- Possible feed stocks include
 - Corn stover (and/or corn cobs)
 - Prairie grasses
 - DDGS
 - Forest residues
- Major storage and Handling Issues
(Consequently in-plant burning as processing fuel is quite likely)

Thank You
Questions??

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Major Countries with Ethanol Fuels

- **U.S.** – likely production of 14-15 bil. gal. from corn in 3.5-5 years
- **Brazil** –89 new ethanol plants to be built, 2007-2011
 - 2% biodiesel mandate by 2008 & 5% by 2013
- **China** – 3 corn-based plants, emphasis shifting to other feedstocks
- **EU-27** – 5.75% of motor fuel to be renewable by 2010, 10% in 2020
- **Canada** – 5% ethanol mandate by 2010, 2% biodiesel by 2012
- **Thailand** – ethanol from sugar, maniac

Biodiesel– Competition for crop land

MINIMUM SOYOIL PRICE FOR BIODIESEL BREAKEVEN at GIVEN WORLD CRUDE OIL PRICE

PRX_C_US_BA, GTB-06-03, Mar-14-06

		Crude Oil Price, \$/bbl								
		\$30.00	\$35.00	\$40.00	\$45.00	\$50.00	\$55.00	\$60.00	\$65.00	\$70.00
Add biodiesel										
Soybean	\$0.19	(\$0.10)	\$0.02	\$0.14	\$0.25	\$0.37	\$0.49	\$0.61	\$0.73	\$0.85
Oil Price	\$0.20	(\$0.18)	(\$0.06)	\$0.06	\$0.18	\$0.30	\$0.42	\$0.54	\$0.66	\$0.78
\$/lb	\$0.21	(\$0.25)	(\$0.13)	(\$0.01)	\$0.11	\$0.23	\$0.35	\$0.47	\$0.58	\$0.70
	\$0.22	(\$0.32)	(\$0.20)	(\$0.08)	\$0.04	\$0.15	\$0.27	\$0.39	\$0.51	\$0.63
	\$0.23	(\$0.39)	(\$0.28)	(\$0.16)	(\$0.04)	\$0.08	\$0.20	\$0.32	\$0.44	\$0.56
	\$0.24	(\$0.47)	(\$0.35)	(\$0.23)	(\$0.11)	\$0.01	\$0.13	\$0.25	\$0.37	\$0.48
	\$0.25	(\$0.54)	(\$0.42)	(\$0.30)	(\$0.18)	(\$0.06)	\$0.05	\$0.17	\$0.29	\$0.41
	\$0.26	(\$0.61)	(\$0.49)	(\$0.38)	(\$0.26)	(\$0.14)	(\$0.02)	\$0.10	\$0.22	\$0.34
	\$0.27	(\$0.69)	(\$0.57)	(\$0.45)	(\$0.33)	(\$0.21)	(\$0.09)	\$0.03	\$0.15	\$0.27
	\$0.28	(\$0.76)	(\$0.64)	(\$0.52)	(\$0.40)	(\$0.28)	(\$0.16)	(\$0.05)	\$0.07	\$0.19
	\$0.29	(\$0.83)	(\$0.71)	(\$0.59)	(\$0.48)	(\$0.36)	(\$0.24)	(\$0.12)	\$0.00	\$0.12
	\$0.30	(\$0.91)	(\$0.79)	(\$0.67)	(\$0.55)	(\$0.43)	(\$0.31)	(\$0.19)	(\$0.07)	\$0.05
	\$0.31	(\$0.98)	(\$0.86)	(\$0.74)	(\$0.62)	(\$0.50)	(\$0.38)	(\$0.26)	(\$0.15)	(\$0.03)

For Blue Sky Scenario, PRX adopts a crude oil price of \$50/bbl and thus a minimum 24 cent/lb soyoil price, to evaluate impact of subsidized biodiesel market.

Source: Dr. Terry Francel, American Farm Bureau Federation

Ethanol Demand Sources

	Blend
• Oxygenates for air pollution	5.7%
• Octane Enhancers	7.5%
• BTU Substitutes	10- 85%
• RFS Requirement 2007	4.02 %
• RFS Requirement 2010	5.21%
• Exports	