



Commercialization of First Generation Biofuels

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Outline

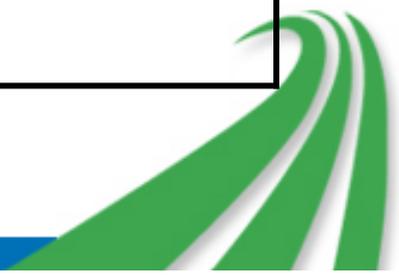
- Discuss the likely increase in ethanol and biodiesel production over the next several years
 - Describe ethanol and biodiesel production costs
 - Note developments in the market prices for ethanol and biodiesel
 - Discuss the impact of biofuel production on crop production and food costs in the United States
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Ethanol production has been growing rapidly and is expected to continue doing so for at least the next two years.

Year	Ethanol Production (bill. gallons per year)	Ethanol Production Capacity on Jan.1 (bill. gallons per year)
2004	3.4	3.1
2005	3.9	3.6
2006	4.9	4.3
2007	6.3*	5.4
2008	9.8*	7.2*
2009	13*	12.5*

* Projected





Biodiesel production also has been growing rapidly.

- **Biodiesel production (million gallons per year)**
 - 25 in 2004
 - 75 in 2005
 - 250 in 2006
 - **The industry production capacity is much larger, 1.39 billion gallons, although it is difficult to know how much is dedicated to other products.**
 - **USDA Baseline 2/07 projects (million gallons per year) from soybean oil**
 - 360 in 2007
 - 620 in 2008
 - 645 in 2009
 - **Additional biodiesel can be produced from**
 - Other vegetable oils
 - Corn oil from ethanol plants
 - Yellow and brown grease
 - Animal fats
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Continued growth of both ethanol and biodiesel depends on profitability.

- The major factors expected to determine industry profitability over the next several years are
 - Policy
 - Cost of feedstock
 - Price of petroleum
 - Market premium for ethanol and biodiesel





Grain Ethanol Production Costs

- The standard plant has remained much the same, but the size of the “small plant has increased from 48 to 60 mgpy,
- and the investment costs have gone up.

Investment Per Gallon of Annual Capacity

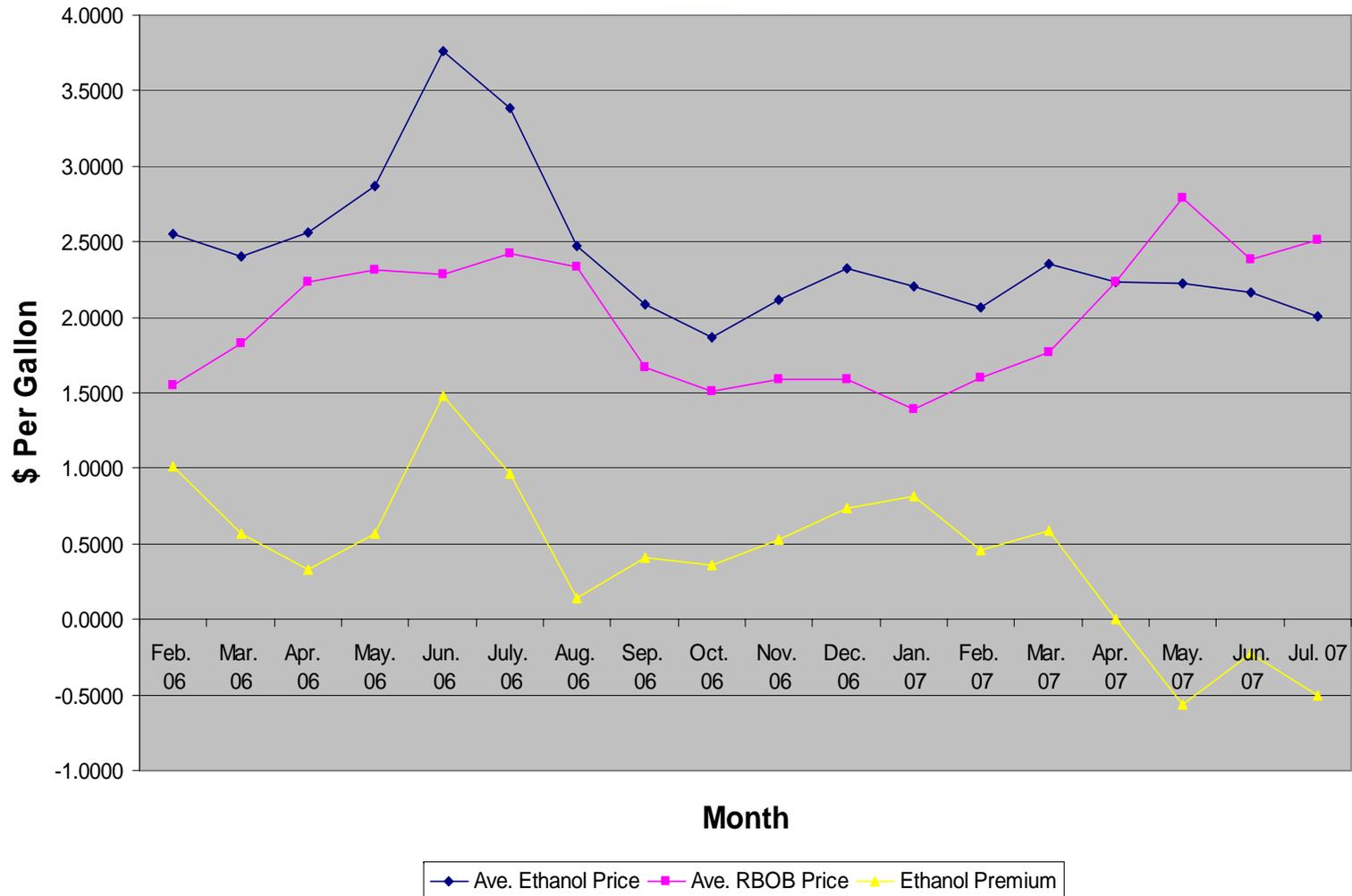
<u>mgpy</u>	<u>2003-2005</u>	<u>2006-2007</u>
48/60	\$1.25	\$1.875
120	0.97	1.50



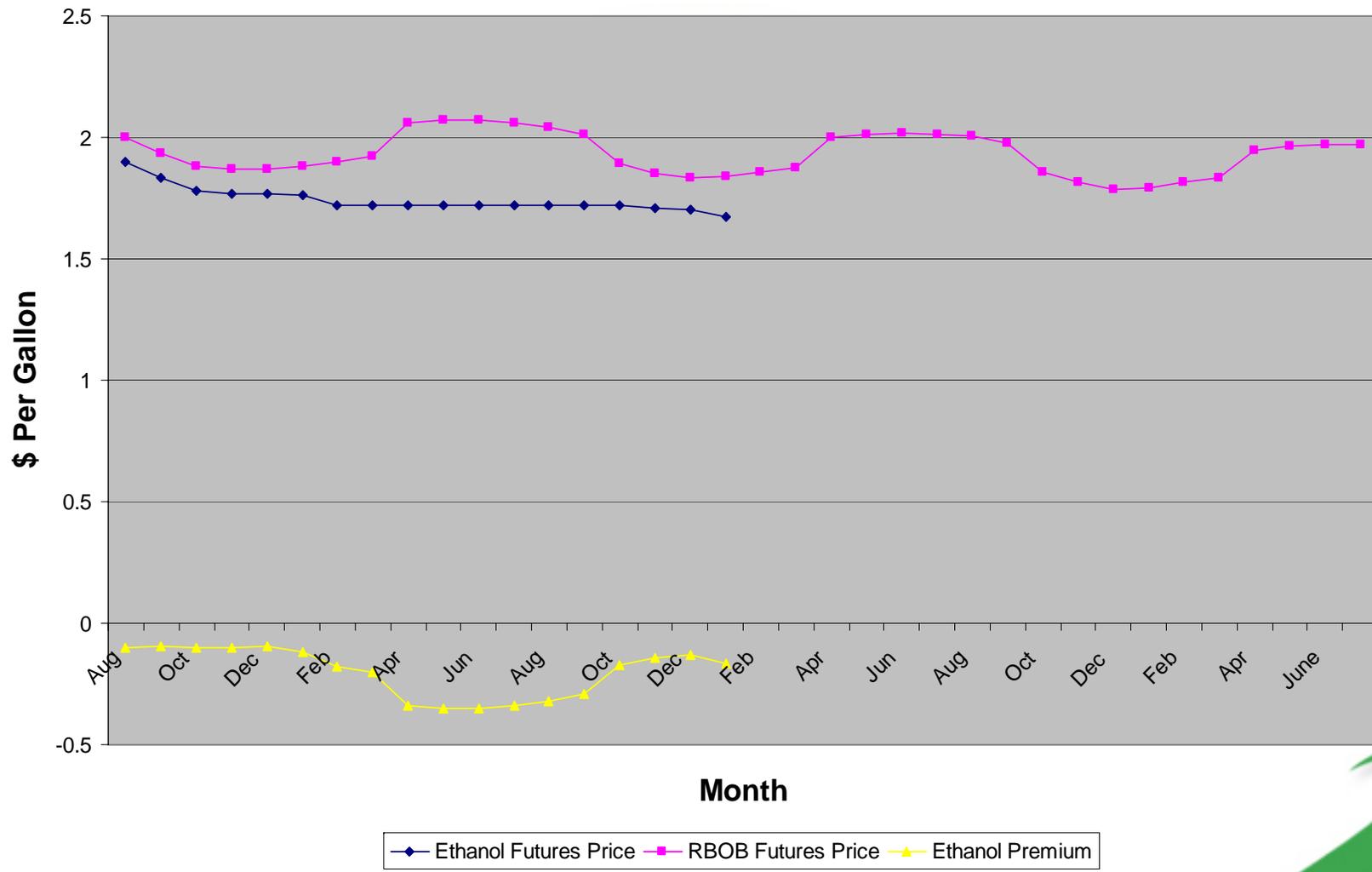
Estimated Ethanol Production Costs for New Construction

	0% Return on Equity		12% return on Equity	
Corn Price \$/Bushel	60 Million Gallons per Year \$/Gallon	120 Million Gallons per Year \$/Gallon	60 Million Gallons per Year \$/Gallon	120 Million Gallons Per year \$/Gallon
2.00	1.19	1.14	1.32	1.24
3.00	1.44	1.40	1.57	1.49
4.00	1.70	1.66	1.83	1.75
5.00	1.96	1.91	2.08	2.00
6.00	2.21	2.16	2.34	2.25

Monthly Average Ethanol and RBOB Prices at Chicago February 2006 through July 2007



Ethanol Premiums Implied By Futures Markets August 2007 through January 2009





Future Ethanol Prices Are Expected to be Lower

Year	Ethanol Futures Price	RBOB Futures Price	Ethanol Premium
Sept. 07 – Aug. 08	\$1.75	\$1.96	\$-0.21
Sept. 08- Aug. 09	\$1.70	\$1.93	\$-0.23



Estimated Average Wholesale RBOB Price and Corresponding Ethanol Prices

Refiners Acquisition Cost \$/Barrel	Wholesale RBOB \$/Gallon	Ethanol Energy Value \$/Gallon	Ethanol Energy Value plus Excise tax Credit \$/Gallon
40	1.24	0.83	1.34
50	1.54	1.03	1.54
60	1.84	1.23	1.74
70	2.14	1.43	1.94
80	2.44	1.63	2.14
Average RBOB Price \$/Gallon = 0.0370 + 0.300* Price Crude Oil \$/Brl.			



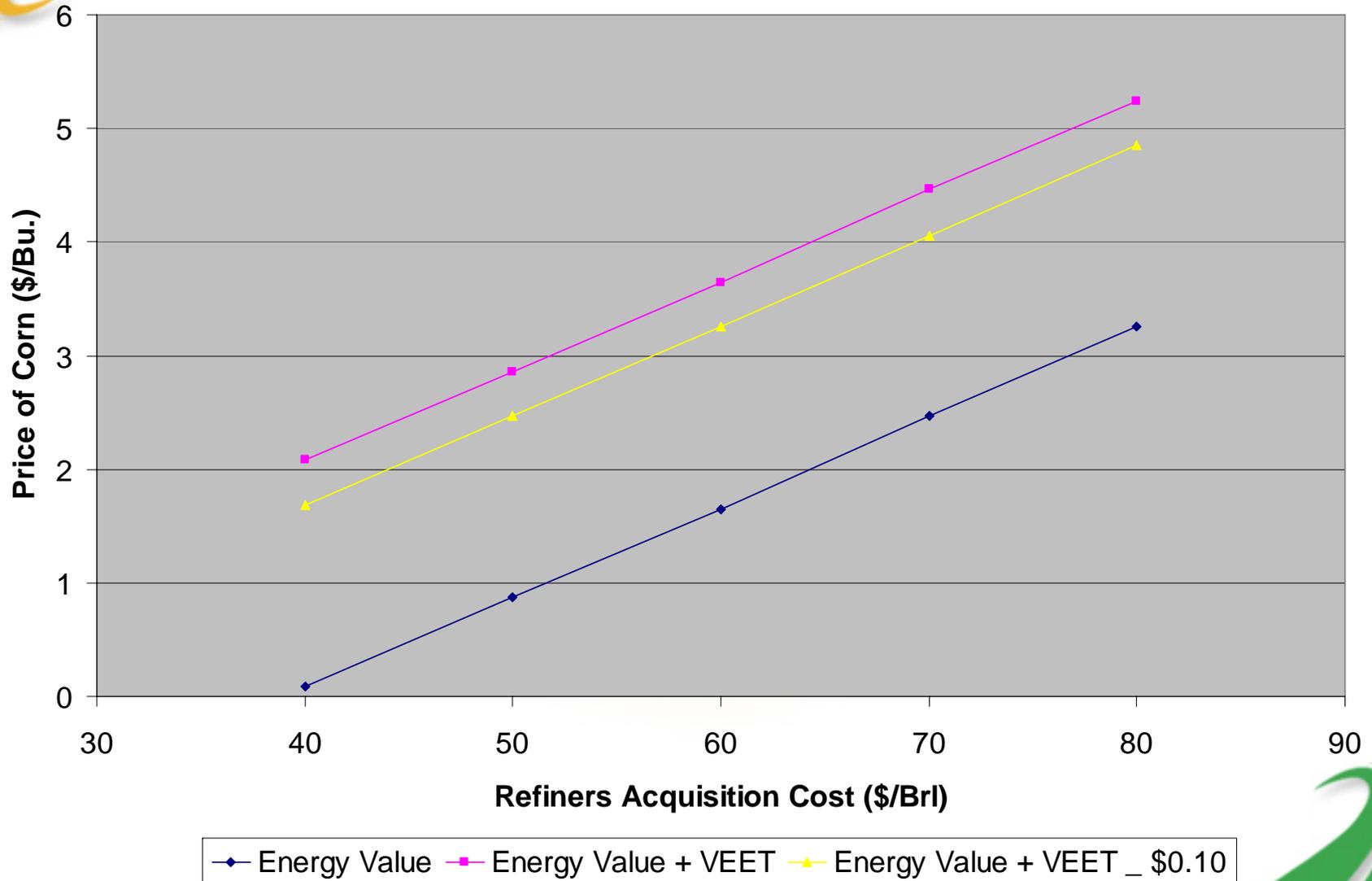
How Much can ethanol plants afford to pay for corn in 2007/08?

- With Crude Oil at \$60 per Barrel, New Plants Can Earn 12% on Equity When Corn Costs

Excise Tax Credit \$/Gallon	Ethanol Price \$/Gallon	60 Million Gallon Plant \$/Bushel	120 Million Gallon Plant \$/Bushel
\$0.51	1.74	3.65	3.96
\$0.41	1.64	3.26	3.57
\$0.00	1.23	1.65	1.96

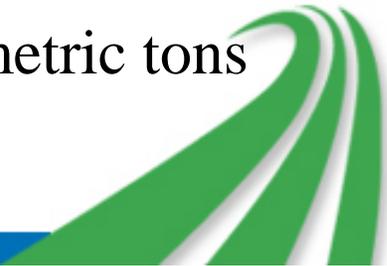
- A \$0.10 increase (decrease) in the ethanol price a plant receives increases (decreases) the amount a plant can pay for corn \$0.39 per bushel.
- 

Corn Price Resulting in a 12% Return to Equity





Co-Product Production and Utilization

- Ethanol production capacity is currently 80.5% dry mill and 19.5% wet mill. We currently produce about 2.76 million metric ton/billion gallons of ethanol.
 - It appears we have enough livestock to utilize the increased co-product feeds produced, although there are likely to be excess supplies for short-run periods during the next two years.
 - Removal of oil from thin stillage reduces the feed output to 2.56 million metric tons /billion gallons of ethanol.
 - Fractionation reduces feed output to 2.04 million metric tons per billion gallons of ethanol.
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Use of Co-Product Feeds (Cont.)

- **Exports of DDGS were 1.5 million metric tons in 2006. EU (9%), Canada (37%), Mexico (15%), and Asia(20%).**
 - **Potential non-feed uses of distillers grains**
 - **Combustion use for process heat and/or drying**
 - **Gasify for fuel use or as feedstock to produce more ethanol**
 - **Industrial uses**
 - **fertilizer**
 - **fiber board or other construction uses**
 - **Human food use (limited to food grade facilities)**
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Biodiesel Production





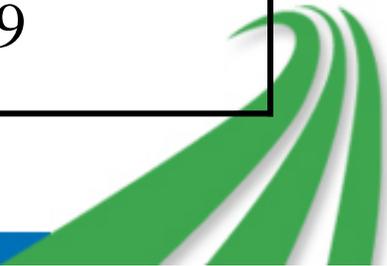
Biodiesel Production Costs and Profitability

- Cost analysis is based on data reported by Roger Ginder and Nicholas Paulson, “The Developing Biodiesel Industry,” AAEA Annual Meeting, Long Beach, CA, July 24, 2006.
 - Investment costs for turn-key biodiesel plants
 - \$1.47 for 30 million gallon/year plant
 - \$1.10 for 60 million gallon/year plant
 - Estimated operating and capital costs assuming 12% rate of return on capital
 - \$0.50 per gallon for 30 million gallon plant
 - \$0.42 per gallon for 60 million gallon plant
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Estimated Cost of Biodiesel Production from Soybean Oil for New Construction

Degummed Soybean Oil \$/lb.	Annual Plant Capacity	
	30 Million Gallons \$/Gallon	60 Million Gallons \$/Gallon
0.20	1.97	1.89
0.25	2.34	2.26
0.30	2.71	2.63
0.35	3.07	2.99



Estimated Average Wholesale #2 Diesel Fuel Price

Refiners Acquisition Cost \$/Barrel	Wholesale #2 Diesel Price \$/Gallon
40	1.25
50	1.59
60	1.93
70	2.26
80	2.60

Mon. Ave. Price \$/Gal.= $-0.0908 + 0.0336 * \text{Price of Crude Oil/Brl}$



What can biodiesel plants afford to pay for feedstock?

The netback price=

- the wholesale price of #2 diesel
- + market premium for biodiesel
- plant's marketing and transportation costs

With \$60 crude oil this is expected to be

$$\$1.93 + 1.20 - .20 = \$2.93$$

If plants receive \$2.93 for biodiesel, they could earn a normal return on equity when soybean oil cost

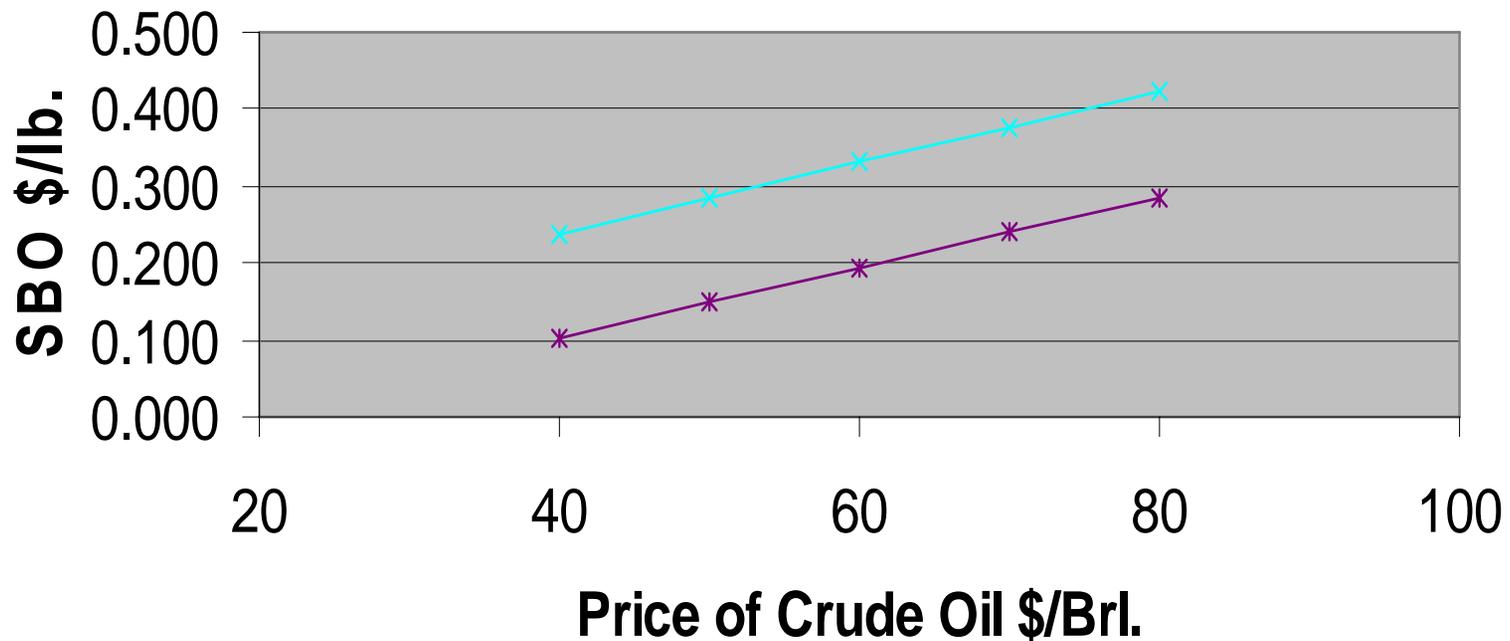
- \$0.331 for a 30 million gallon plant
- \$0.342 for a 60 million gallon plant

A \$10 increase in the price of crude oil should increase the price of diesel about \$0.336 per gallon and the amount a plant can pay for soybean oil \$0.045 per pound.



Biodiesel

Breakeven Price of Soybean Oil By Price of Crude Oil

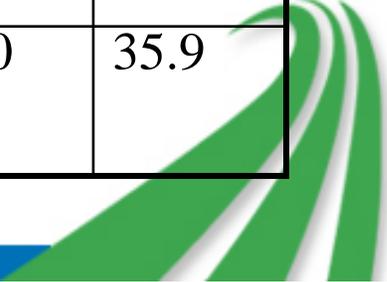


- x— Breakeven SBO Price w/Excise Tax
- *— Breakeven SBO Price w/o Excise Tax



Projected Ethanol Production and the Corn Acreage Required to Supply Projected Uses

Marketing Year	06/07	07/08	08/09	09/10	10/11
Ethanol Prod. (Bill.Gal.)	6.0	9.5	12.5	13.0	13.5
Corn for Ethanol (Bill.Bu.)	2.150	3.518	4.550	4.810	4.910
Ac. Planted (Mill. Acres)	78.3	92.9	92.9	93.4	93.4
Ac. Harvested (Mill. Ac.)	70.6	85.4	85.4	85.8.	85.8
Ave. Yield (Bu./Ac)	149.1	152.8	152.6	154.5	156.4
An. Production (Bill. Bu.)	10.535	13.049	13.032	13.256	13.419
% of An. Production	20.4	26.0	34.3	35.0	35.9





Implications of Increased Ethanol and Biodiesel Production for Crop Production

- **Where does the additional land for corn come from?**
 1. **In 2007 it came primarily from soybean, cotton, rice and minor amounts from pasture and hay.**
 2. **In subsequent years the additional acres come from wheat and reductions in several other crops, and CRP.**
- **Some areas of concern:**
 1. **Can we keep average corn yields on trend? Variability?**
 2. **Lower carryover of corn and beans will lead to more price volatility.**
 3. **Environmental impacts of increased corn production.**

Sources: Acreage Report (06/29/07) & USDA Baseline 2/07





Implications of Increased Ethanol and Biodiesel Production for Soybean Production, Crush and Use

- **Planted acreage in 2007 declined about 15% from 2006. 2007 production is projected to be down 17 % from 2006. Acreage planted is not likely to increase very much unless corn acreage declines.**
- **After stocks decline, the projection indicates we will export fewer soybeans and less oil, but more meal.**
- **Crush a larger part of the crop in future years and use more oil domestically**
 - **food use increases in relation to population**
 - **soybean oil used for biodiesel production increases from 1.6 billion lbs. in 2005/06 to 4.4 billion pounds in 2007/08 and 4.96 in 2010/11.**

Source: USDA Baseline 2/07



Impact of Higher Corn Prices on Food Prices in the U.S.

•A recent CARD study estimated the impact of a 30% increase in the price of corn, and associated increases in the prices of wheat and soybeans on consumer prices of food. The estimated impacts were:

- egg prices increase 8.1%
- poultry prices increase 5.1 %
- pork prices increase 4.5 %
- beef prices increase 4.1 %
- milk prices increase 2.7 %
- all food consumed at home prices increase 1.3%
- all food consumed away from home prices increase 0.9%
- all food consumed (home and away) food prices increase 1.1%

• Low-income consumers in the U.S. will be more affected than high- income consumers.

• Low-income consumers in other countries will be hurt more by more expensive food.





Some Concluding Comments

- The rapid increase in ethanol production is expected to increase the price of grains, but the amount of increase is likely to be tempered by declining market prices for ethanol.
 - The rate of increase in biodiesel production is very uncertain, given the policy environment and the current price of vegetable oils.
 - Liquid fuels from cellulose are coming, but they will not be much of a factor until after 2015.
 - We currently have policy variables to address the food-fuel tradeoffs. The size of the excise tax credits for ethanol and/or biodiesel can be made dependent on the crude oil price, so they protect the biofuels industry in the event crude oil prices decline, while reducing the impact on feed prices during periods of high crude oil prices.
 - As the number of alternative fuels increases, we need to develop a system of incentives based on a common goal. For example, we could tie the incentive to the impact of the alternative fuel on carbon emissions.
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Current Federal Policy for Ethanol

- **Energy policy Act of 2005**
 - **Renewable Fuels Standard**
 - **RFS replaced the reformulated gasoline oxygenate requirement**
 - **neither banned MTBE nor created liability protection**
 - **federal winter oxygenate program continues**
 - **Volumetric Ethanol Excise Tax Credit - \$0.51/gallon**
 - **(expires 12/31/2010)**
 - **Small Producer Tax Credit (\$0.10/gal. on first 15 million gallons)**
 - **(expires 12/31/2010)**
 - **Ad valorem tariff of 2.5% and a secondary duty of \$0.54 per gallon except for the countries that qualify to import under a trade agreement (NAFTA) or the Caribbean Initiative (expires 12/31/2008).**
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Current Federal Policy for Biodiesel

- Volumetric excise tax credit
 - \$1.00 per gallon for biodiesel produced from virgin oils
 - \$0.50 per gallon of biodiesel made from used oils
 - expires 12/31/2008
 - Small Producer Tax Credit
 - \$0.10 /gallon on first 15 million gallons
 - expires 12/31/2008
 - No tariffs on importing oils or biodiesel.
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U.S. Supply of Biodiesel Feedstocks

Oil Type	Million Pounds*	Million Gallons**
Crops		
Soybean Oil	18,309	2,446
Cottonseed Oil	847	113
Sunflower Oil	558	74
Peanut Oil	84	11
Corn Oil	2,436	325
Canola Oil	603	80
Total	22,836	3,044
Other		
Yellow Grease & Grease	2,656	332
Lard	1,090	131
Edible Tallow	1,894	228
Inedible tallow	3,696	445
Poultry Fat	4,204	507
Total	13,540	1,643
Total Supply	36,376	4,687

•Pounds of oil are 2000-2004 ave. from Bureau of the Census and Agricultural Marketing Service, USDA. Pounds of yellow grease and inedible tallow are a 2002-2003 average from US Department of Commerce, US Census Bureau. *Current Industrial Report*, M311K (03)-13, March 2005. Poultry fat is based on the ave. slaughter for 2000-2004, USDA.

** Potential gallons of biodiesel are computed using a conversion ratio of 7.5 pounds for vegetable oils, 8 pounds for yellow grease and 8.3 pounds for lard, tallow and chicken fat (Fortenberry).

Thank You!
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