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# ETHANOL MARKET PRODUCTION AND CORN USE

- In 2000, 1.6 billion gallons of ethanol, In 2005 4 billion gallons of ethanol, In 2006 5 billion gallons expected
- Over 111 plants in 19 states. RFA says 75 under construction, 8 expanding for a total 8.9 billion gallons per year during 2008-09.
- In 2005, ethanol 3% of 140 billion gallons used
- In 2000 6% of corn crop, In 2005 14% of the corn crop USDA projects 20% of the 2006 crop – ethanol will equal amount of corn exported
- A number of factors contributed to rapid increase in ethanol production

# ETHANOL PRODUCTION COST

- 1986 – 1998 cost declined
- A higher yield per bushel of corn
- A lower cost of enzymes required for conversion
- Production automation lowered labor costs
- Energy input cost fell
- Between 1998-2002 Avg. cost at 95 cents per gallon
- Since 2002, rose 10-15 cents per gallon – now \$1.45

# ETHANOL COPRODUCTION ANIMAL FEED

- 17 pounds of DDGS produced per bushel of corn
- Distillers grains sold as DDGS with 13% moisture
- WDG with 67% moisture
- Modified with 50% moisture
- Max 25% DDGS for Dairy feed rations – ruminants 40% DDGS for Fed Cattle
- Monogastric poultry and hog rations – 5 – 15% DDGS
- Used for both energy and protein – one third of corn used for feed in ethanol production
- Product quality issues – drying, handling, shipping costs

## Ethanol's Long Term Prospects and Implications for U.S. Agriculture

- 60 more ethanol plants under different stages of planning?
- New facilities large – 50 – 100 million gallons.
- Ethanol capacity could rise to 11.6 billion by 2008-9 and over 10 more by 2010
- Is such production likely and what does it mean for Agriculture?

# Gasoline and ethanol prices

- Surge in oil prices has made biofuels cost competitive
- (WTI) annual average nominal price \$19.25 per barrel in 1999 to over \$41 in 2004 expected \$70.29 in 2006 (EIA). EIA expect the same in 2007
- EIA estimates that the average retail price for gasoline rose from \$1.85 per gallon to a forecast \$2.72 per gallon in 2006.
- Wholesale, rack prices of ethanol traded at 35 to 50 cents premium to wholesale gas prices – the rack price reached \$3.00 per gallon.
- CBOT futures prices. Around \$2.00 per gallon
- If crude oil is above \$50 (2005 \$) per barrel per EIA and corn prices don't rise considerably – ethanol will be used as gas extender.
- Below \$30 per barrel no incentive beyond RFS

# Corn prices

- Rising corn prices could reduce the profitability of corn ethanol
- Net feedstock cost of corn this summer 50 to 60 cents per gallon ethanol rack price was \$3.50
- 1996 Net feedstock costs were \$1.50 and equal to ethanol rack prices
- Financial model for a 45 million gallon per year drymill
- With ethanol prices at the plant of \$2.25 – could pay up to \$5.00 per bushel of corn and cover operating expenses.
- \$3.24 in 1995/96 – corn prices exceeded \$3 in only 3 other years

# Effects of Expanded Ethanol Production

- Baseline assumed 7.5 billion gallons during 2012/13 crop year 2.75 billion bushel of corn versus 2.15 billion in 2006/07.
- Planted acreage would rise to 85 million in 2012, up from 81.8 in 2005 and 79.4 in 2006.
- Corn prices increase to \$2.60 per bushel versus \$1.99 in 2005/2006 and \$2.35 in 2006/07.
- U.S. corn feed use decline's slightly, corn exports rise slightly to 2.2 billion bushels in 2012/13
- Yield rises from 148 bushels per harvested acre in 2005 to 158.5 in 2012/13
- Soybean acreage, export decline, oil demand rises, prices rise.
- Livestock profitability declines, prices decline
- Hog and broiler prices stable.

- 1) Ethanol production is exceeding most analysts' expectations, including USDA projections.

2) Gasoline and ethanol prices are likely to stay high enough over the next several years to maintain ethanol expansion.

- Limited crude oil production
- Continued world economic growth

3) Corn ethanol returns are such that plants can remain profitable over a wide range of corn prices.

- Various state incentives – Minnesota, Nebraska, South Dakota

4) Corn prices could set new record highs over the next 5 to 6 years.

- Weather
- exports

5) Ethanol plants will likely continue to operate even if corn prices rise well above past record highs. Ethanol plants will be able to bid corn away from a variety of other uses over a wide range of corn prices.

- Exports are more elastic – price sensitive

6) The United States will need substantial increases in corn acreage to prevent exports from declining and livestock profitability from failing.

- Assume 10 billion gallons in 2010 crop year
- Corn yield is 155 bushels per acre, ethanol yield is 2.8 gallons per bushel of corn and 15% of corn used as DDGS
- Corn acreage would have to rise to 90 million acres in 2010, 5.5 million more than in USDA's 2006 baseline projection and 10 million more than the average planted during 2005 and 2006.
- Corn prices rise to \$3.10 - \$3.20 a bushel
- Corn exports, domestic feed decline, yield rise to reduce acreage and price effects.

7) The Conservation Reserve Program (CRP), which has 36 million acres set aside from crop production for environmental reasons, may provide a source of additional crop acreage.

- May seek to not enroll in CRP
- CRP where 25% of harvested cropland producing non-irrigated corn and soybean farmed sustainably
- 4.3. to 7.2 million acres in CRP could be used for corn or soybean in a sustainable way

8) It is likely other exporters (such as Brazil and Argentina) will have to supply more corn to the world market as world meat demand rises and U.S. corn ethanol production increases.

9) Corn stocks are likely to be increasingly tight and corn prices high, so the corn sector will be highly vulnerable to market disruptions- ethanol plants and other users will be operating in a much riskier environment that we have today.

10) Corn ethanol alone cannot greatly reduce U.S. dependence on crude oil imports.

- In 2006 ethanol equivalent to 1.5% of U.S.
- 58% of all crude used in the United States is imported

11) Cellulosic ethanol production appears to be the best renewable alternative for reducing crude oil imports.

12) Even so, ethanol growth is manageable in the near future. Markets will work over the longer term, but the allocation function of market prices can mean substantial costs for some sectors, so the evolution of ethanol bears close monitoring.

- Corn yield increases and acreage withdrawals from CRP
- Yield exceed 155 bushels per acre by 2010?
- Each 5 bushels increase in yield above current trend would add 2.5 million acres in corn planting.

# Biodiesel Production and Soybean Oil Use

- CCC Bioenergy Program in FY 2000
- 500,000 gallons in 1999 to 28 million gallons in 2004.
- 2005, 91 million gallons of biodiesel – 65 million supported by program.
- FY06 – will reach 245 million in 2006 – 170% increase year over last year and 490 fold since 1999.
- 87 commercial U.S. biodiesel plants
- Capacity 200,000 gallons to 30 million gallons, total capacity about 582 million gallons
- Most plants have capacity below 6 million gallons,
- Newer plants larger – 50 new plants under construction and 13 under expansion expected to add 1.4 billion gallons to capacity.
- Fourteen plants with annual capacity over 15 million gallons.

# Biodiesel Production Costs

- Cost depends on plant capacity, location, plant design, and equipment cost – varies by feedstock
- Rule of thumb \$1.0 per gallon of annual capacity – 5 million gallon with installation cost of \$5 million.
- Processing cost per gallon of biodiesel equals \$0.50 per gallon
- Cost of feedstock is largest expense – soybean oil would cost \$1.95 to produce one gallon of biodiesel, total production cost-excluding capital cost of \$2.49
- Adding, return to investment and costs for transportation, blending and marketing –retail price above \$3.00 per gallon
- Surge in oil prices, excise tax credit, small producer tax credit.

# Biodiesel's Longer Term Prospects and Implications for U.S. Agriculture

- Ability of the feedstock supply to keep up with demand
- Competition for other uses and land constraints
- In 2006/07 biodiesel accounts for 2.6 billion pounds of soybean oil, 13% of total soybean use. Equals the oil from 229 million bushels of soybean or 8% of estimated U.S. soybean production in 2006.
- Will push feedstock prices up, cause production cost to rise

# Conclusion

- Corn ethanol can play a role to facilitate energy security
- Biodiesel more of an additive than fuel extender
- Ethanol expansion is manageable but needs long run monitoring
- Need cellulosic ethanol with corn ethanol to make a more significant dent in enhancing energy security.