



Ethanol & Co-Products

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CO-PRODUCTS

ETHANOL CO-PRODUCTS

Using the co-products of alcohol production for livestock feeding is a very common feeding practice and as old as the first beer production. Distillers grains were once referred to as the dregs on the industry, however have recently come back into focus due to the expected increase in ethanol production with the renewable fuels standard (RFS).

With this increased focus NCGA has been actively promoting the use of distillers grains in livestock and poultry diets through educational workshops hosted on a regional basis with program partners. NCGA has also created an educational video on distillers grains production to use as a promotional tool with livestock nutritionists and animal consultants. Recently named the #1 by-product feed in the United States, distillers grains research continues to highlight the benefits of this nutrient dense feedstuff for livestock and poultry.

The co-products of wet milling are also very beneficial as a nutrient source for livestock and poultry. Corn Bran, Corn Gluten Feed, Corn Gluten Meal, Corn Germ Meal and Condensed Fermented Corn Extractives (steepwater) are all co-products of the wet milling process used as livestock feed. For more information on wet milling visit the [Corn Refiner's Association](#).

Ethanol Section

[Research Pre-Proposal Application for Distillers Grains.](#)

LINKS TO MORE INFORMATION

[Distillers Dried Grains with Solubles \(DDGS\) in Livestock and Poultry Feeds](#)

[Distillers Grain Technology Council](#)

IDALS

Last reviewed December 2, 2003

ST. LOUIS OFFICE

632 Cepi Drive
Chesterfield, MO
63005

Phone: (636) 733-9004
FAX: (636) 733-9005

WASHINGTON D.C. OFFICE

122 C Street, N.W., Suite 510
Washington, DC 20001
Phone: (202) 628-7001

FAX: (202) 628-1933

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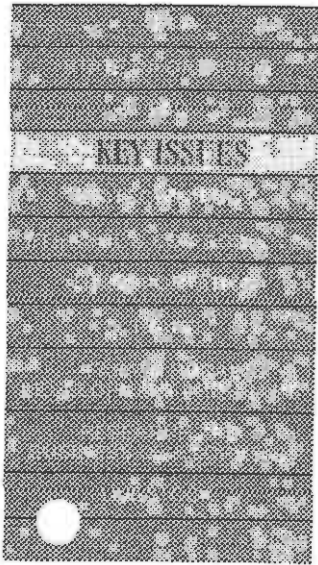
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NEW TOOL FOR FARMERS INTERESTED IN BUILDING AN ETHANOL PLANT

There is a new Internet site available to help farmers assess potential price impacts of a new ethanol production plant. The Ethanol Plant Analyzer allows farmers to run what-if scenarios on how the size and location of an ethanol plant might impact local corn prices. The Ethanol Plant Analyzer is available at: www.extensionecon.montana.edu/eplantalyzer/



ST. LOUIS OFFICE

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Chesterfield, MO
63005
Phone: (636) 733-9004
FAX: (636) 733-9005

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122 C Street, N.W., Suite 510
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ETHANOL, AMERICA'S CLEAN RENEWABLE FUEL

ETHANOL...THE CORN INDUSTRY SUCCESS STORY

For the past 20 years, the NCGA has been working side by side with farmers, industry and government to build the ethanol industry from the ground up. There can be little debate that the results add up to a bona fide success story. In supporting and promoting ethanol, NCGA has adopted the following strategies:

- NCGA has worked hard in Washington, D.C., to get a national renewable fuel standard (RFS). If successful, an RFS will triple the size of the ethanol market in the next ten years.
- NCGA advocates the expansion of ethanol and encourages grower investment as new facilities come online – and we will continue to educate growers on the process required to build an ethanol facility.
- We believe ethanol provides energy security for the United States and we have the necessary resources to make significant contribution to our domestic fuel supply.

[Ethanol Section](#)

CO-PRODUCTS

Using the co-products of alcohol production for livestock feeding is a very common feeding practice and as old as the first beer production. Distillers grains were once referred to as the dregs on the industry, however have recently come back into focus due to the expected increase in ethanol production with the renewable fuels standard (RFS).

- NCGA is working to promote the use of distillers grains in livestock rations across all species, though distillers grains have predominantly fed to beef and dairy cattle, there is growth opportunities in the swine and poultry feeding market, as well.
- NCGA is partnering with other agriculture, ethanol and grain associations helps to leverage funds and promote a consistent message.
- NCGA has been recognized for its leadership in promoting the use of distillers grains and working to pull the industry together.

[Co-Products Section](#)

ETHANOL & CO-PRODUCTS NEWS

[Ethanol Strategic Plan - PDF \(06-04\)](#)

[Duane Adams' Testimony to House Small Business Subcommittee](#)

[The Contribution Of The Ethanol Industry To The American Economy In 2004 \(Urbanchuk\) - PDF \(04-04\)](#)

[2004 Gasoline Price Increases: An Analysis \(Renewable Fuels Association\) -PDF \(04-27-04\)](#)

[Ethanol and the Local Community \(Urbanchuk\) -PDF \(06-02\)](#)

[Letter to USA Today defending Use of Ethanol - PDF](#)

[Letter to Wall Street Journal \(10-09-03\)](#)

[New tool for farmers interested in building an ethanol plant \(10-21-03\)](#)

[Petroleum and Ethanol Fuels: Tax Incentives and Related GAO Work \(9-20-2000\)](#)

[Fossil Energy Use in the Manufacture of Corn Ethanol – Dr. Michael Graboski - PDF \(8-02\)](#)

[USDA The Energy Balance of Corn Ethanol: An Update - PDF \(8-2-02\)](#)

Last reviewed June 1, 2004



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ETHANOL, AMERICA'S CLEAN RENEWABLE FUEL

ETHANOL ECONOMICS

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- [Economics of refining ethanol](#)
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Factors in the Price of Ethanol

Ethanol is sold into the gasoline blending market where it competes with other oxygenates and octane components – as well as with gasoline itself. Ethanol prices are highly correlated with the price of gasoline and gasoline blending components.

The price of corn has very little to do with the price of ethanol. That's why low corn prices do not always indicate low ethanol prices – and why high corn prices do not always lead to high ethanol prices.

The greatest effect on the price of ethanol is the supply and demand for ethanol in specific markets. As MTBE is being phased out due to its groundwater pollution hazard, the demand for ethanol as an oxygenate has increased.

Prices also vary according to time and location. Many consumers have noticed the difference between the prices of winter and summertime gasoline. This is because summertime gasoline is controlled for evaporative emissions. Thus, summertime gasoline is more expensive to produce than winter gasoline. Ethanol blends are no different, and in the winter, gasoline can have a significantly different price than summer blends in the same markets. Additionally, blending economics can vary from one region of the country to another – creating significant differences in the pump price, even though ethanol prices are similar in each region.

Ethanol's Effect on Gasoline Supply and Price

In recent years, the petroleum industry has consistently pointed to shortages in supply as the primary reasons for price increases. The use of renewable fuels such as ethanol increases the volume of gasoline in the United States. Simple economics principles say that increased supplies tend to push prices down, not up.

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Ethanol is taxed at a lower rate than gasoline – and this tax incentive allows ethanol to be priced favorably with gasoline. In other words, adding ethanol to gasoline does not increase the price of the resulting blend – clearly a plus for retailers and consumers.

A significant cost to the oil industry will be the phase-out of MTBE, a fuel oxygenate that contaminates groundwater supplies. This cost is all about getting rid of something harmful – and since MTBE represents about 11% of the fuel supply in RFG markets, one would expect prices to increase until that supply is replaced in reformulated gasoline on the East and West Coasts. Ethanol will increase fuel supplies and the proposed fuel provisions will not require ethanol use where it's not economical.

Ethanol's Effect on Corn Prices

Any market that uses a large amount of the nation's corn supply is bound to have a positive effect on the price of corn. Under the provisions of the RFS, it is expected that ethanol production will consume more than two billion bushels of the nation's corn crop by 2012. That's an increase of some 1.3 billion bushels over current demand.

Studies have shown that corn prices in markets near ethanol plants will increase between 5 cents and 8 cents per bushel. However, ethanol production makes huge amounts of the nation's corn disappear – affecting overall corn supply and helping shore up corn prices nationwide.

According to the U.S. Department of Agriculture, ethanol production adds 30 cents to the value of a bushel of corn. The Renewable Fuels Association notes that ethanol production adds \$4.5 billion to U.S. farm income annually.

Ethanol Tax Incentives

Present law provides for a partial federal excise tax exemption for gasoline blended in prescribed portions with ethanol. On 10% ethanol blends, the exemption is 5.2 cents per gallon. The exemption is scheduled to be reduced to 5.1 cents in 2005 – and expire December 31, 2006.

The ethanol tax exemption provides the price difference between the higher market price of ethanol when compared to the wholesale price of gasoline. A recent study by the U.S. General Accounting Office found that, since 1968, the oil industry has received approximately \$150 billion in tax incentives. By contrast, the ethanol industry has received \$11.2 billion through a partial exemption of the federal excise tax and \$200 million in income tax credits.

According to Citizen Action, "U.S. taxpayers are providing at least \$5 billion a year in tax breaks in the form of foreign tax credits to provide U.S. multinational oil companies with an incentive to invest billions of dollars to find and produce oil overseas so that it can then be exported to the United States."

A 1997 editorial in the New York Times put the real cost of gasoline – including military expenditures to protect oil interests – at \$5 per gallon. Therefore, on balance, ethanol receives fewer tax incentives than other forms of energy.

While this incentive has been extremely important to the ethanol industry, it has taken criticism by the highway industry because of the diversion of funds that would otherwise go to the Highway Trust Fund.

In order to encourage the use of renewable fuels, Congress provided blends of gasoline and ethanol with a lower rate of tax than that imposed on gasoline. Under the gasoline excise tax system, 18.4 cents is paid into the general fund for gasoline. For ethanol, only 13.2 cents is paid into the General Fund (GF). The 5.2 cents deduction is the ethanol excise tax exemption. More specifically, refiners and gasoline marketers using 10 percent ethanol blends receive a 5.2 cents per gallon reduction from the tax paid on straight gasoline. Since federal motor fuel taxes are a primary source of funding for

highway programs, the issue has arisen as to the revenue impact of ethanol-blended fuels on the Highway Trust Fund (HTF).

In April 2003, Senate Finance Committee Chairman Chuck Grassley (R-IA) convened a mark up of energy tax provisions for inclusion in the energy bill. In addition to about \$15 billion in tax incentives for oil, gas, coal and renewable energy sources, the Chairman's mark will include the clarification of the small ethanol producer tax credit we have sought and a new tax incentive for biodiesel. It will also include a provision resolving the "penalty" to the HTF associated with the use of ethanol-blended gasoline. In short, it replaces the existing excise tax exemption that reduces payments to the HTF with a new "Volumetric Ethanol Excise Tax Credit" (VEETC) that is funded through general revenues. Refiners and marketers would claim the VEETC on the same Form 720 filed quarterly when they remit their excise taxes, so the relative value to blenders would be the same. This would not impact the HTF, thus adding approximately \$1.4 billion annually for highway construction. The provision also eliminates the current 2.5¢ diversion to deficit reduction from ethanol blended fuels. Thus adding another \$600 million to the HTF.

The new VEETC provides other benefits. Because it is assessed on a volume basis, refiners will no longer be limited to the 5.7/7.7/10-percent blend levels dictated by the Clean Air Act's oxygen content provisions that may be made obsolete by RFS legislation anyway. Refiners will now be able to optimize their ethanol blend levels for octane, toxic reduction, or volume, depending on their own needs. This flexibility will extend to E-85, e-diesel and ETBE fuels. No longer will those uses for ethanol be limited to the income tax credit. There are no AMT limitations to an excise tax credit. The Internal Revenue Service (IRS), which has been involved in the drafting of this provision, also believes the VEETC will greatly reduce the opportunity for fraud that exists with the current excise tax exemption system. The IRS has seen a dramatic increase in "below the rack" blending over the past 18 months and is concerned there is significant gasoline being purchased at the reduced rate with the promise of later blending with ethanol that never occurs. Under the VEETC, "below the rack" blenders would no longer be allowed to purchase reduced tax-paid gasoline. They would also have to file a Form 720 to claim the VEETC. If the IRS fails to remit the refund within 20 days, the marketers will be paid interest.

Ethanol and Our Balance of Trade

In 1987, the United States trade deficit in crude oil was \$27 billion. In 1990, that figure nearly doubled to \$43.7 billion and by 1999 had increased to \$59.2 billion.

Ethanol helps improve the U.S. balance of trade by displacing imported petroleum. According to a 1997 study by the Kellogg School of Management, ethanol production improved the U.S. trade balance by approximately \$2 billion that year alone – and increased ethanol production and displacement of imported oil can only improve that figure.

Additionally the co-products of ethanol production – such as corn gluten, distillers dried grains (DDGS), corn oil and carbon dioxide – are exported. According to the Corn Refiners Association, more than \$200 million of that is attributable to ethanol production.

The Economics of Refining With Ethanol

When oxygenates began to be added to gasoline, refiners had two primary choices: petroleum-based MTBE and biomass-based ethanol. MTBE became the primary choice in spite of the fact that ethanol contains twice as much oxygen per gallon.

The reason: transportation. MTBE is more easily transported via pipelines. Ethanol absorbs moisture. That's a benefit when ethanol is present in your car's fuel system, but it causes problems during pipeline transport. Pipelines contain moisture and deposits that are absorbed by ethanol, thus changing its state during transport. To this point, the volume of ethanol has not been large enough to justify changes in the pipeline infrastructure that would eliminate those deposits. However, as MTBE is phased out and more ethanol is used, such improvements may occur. Additionally, the flexibility offered to refiners through the fuels provisions of the energy bill would allow them to use ethanol blends in areas of the country that make the most sense economically – thus reducing the need to transport ethanol long distances.

Food vs. Fuel

The production of ethanol does not translate into less grain available for food, since farmers do not grow more or less grain based on ethanol production. Ethanol production uses field corn – most of which is fed to livestock, not humans. In fact, only the starch portion of the corn kernel is used to produce ethanol. The vitamins, minerals, proteins and fiber are converted to other products – including sweeteners, corn oil as well as high-value livestock feed, which helps livestock producers add to the overall food supply.

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ST. LOUIS OFFICE
632 Cepi Drive
Chesterfield, MO 63005
Phone: (636) 733-9004
FAX: (636) 733-9005

WASHINGTON D.C. OFFICE
122 C Street, N.W., Suite 510
Washington, DC 20001
Phone: (202) 628-7001
FAX: (202) 628-1933

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ETHANOL RELATED RESEARCH

Strengthening the corn based renewable fuel industry is one of NCGA's research goals. Ethanol production is the third largest market for U.S. corn, grinding 700 million bushels annually and assisting in the economic development of rural America through thousands of farmer/owners in cooperative ethanol production facilities. A portion of ethanol related research is focused on enhancing the value of co-products such as Distillers Dried Grains and Corn Gluten Feed.

Corn Fiber Utilization

Increased utilization of the undervalued portion of the corn kernel, fiber, should serve to increase demand for corn through new industrial applications. The main customer for corn fiber now, is corn gluten feed sold to the livestock industry, this research opens up many new avenues of chemical application. For more information on corn to chemicals check out Polyols and Fermentation of Corn Fiber. [More info...](#)

Fermentation of Corn Fiber

This project is coordinated with the Corn Fiber Utilization project and combines research efforts with the Corn Refiners Association to better use all portions of the corn kernel. As 11% of the corn kernel is represented by fiber, and is largely hemicellulose, finding a way to turn that portion into ethanol through fermentation is highly beneficial to the corn grower and environmentally friendly. [More info...](#)

DDGS New Market Research

Nearly 3.8 million tons of distillers dry grains are currently created in domestic dry grind ethanol production; farmer owned cooperatives represent 48% of that production. For every bushel of corn made into ethanol, 18 pounds of DDGS are created and must maintain value to contribute to plant profitability. [More info...](#)

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ST. LOUIS OFFICE
 632 Cepl Drive
 Chesterfield, MO 63005
 Phone: (636) 733-9004
 FAX: (636) 733-9005

WASHINGTON D.C. OFFICE
 122 C Street, N.W., Suite 510
 Washington, DC 20001
 Phone: (202) 628-7001
 FAX: (202) 628-1933

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CORN FIBER UTILIZATION

Fiber Utilization Moves to Pilot Phase

Approximately 10% of the corn kernel is fiber, found mainly in the pericarp (the outer coating of the kernel). The vast majority of the fiber is hemicellulose, a chain of primarily xylose and arabinose (known as 5-carbon sugars). During the wet milling process, this fiber is separated and later combined with the soluble proteins from the steeping water to produce a feed product known as corn gluten feed (approximately 20% protein, high fiber).

Corn gluten feed is the lowest value per pound of any of the wet milling co-products and is primarily exported to Europe for use as cattle feed. Distillers grains from the dry grind ethanol process are similar in protein and fiber content and are primarily sold to the domestic cattle and dairy market. Distillers grains, corn gluten feed and corn all compete for a limited livestock feed market.

Converting any of the lower-value, high-fiber feed products into higher-value industrial products will improve the overall corn market. Ultimately fiber separation and process technology can be developed for wet and dry mills, improving the profitability of many corn-based bioproducts.

This project will develop commercially feasible technology to separate corn fiber recovered during the wet milling process into the component substances. Valuable chemicals will be separated from the fiber stream and the sugars will be converted into ethanol or other chemicals, such as propylene glycol or ethylene glycol.

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ST. LOUIS OFFICE
632 Cepl Drive
Chesterfield, MO 63005
Phone: (636) 733-9004
FAX: (636) 733-9005

WASHINGTON D.C. OFFICE
122 C Street, N.W., Suite 510
Washington, DC 20001
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 FAX: (636) 733-9005

WASHINGTON D.C. OFFICE
 122 C Street, N.W., Suite 510
 Washington, DC 20001
 Phone: (202) 628-7001
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FIBER FERMENTATION

Converting Corn Kernel Fiber to Ethanol

The goal of the Fiber Fermentation Project is to develop a yeast that is able to convert more of the sugars in corn to ethanol. There are some sugars in corn that make up a large percentage of the fiber that cannot be converted to ethanol. The most abundant of these sugars are xylose and arabinose, which make up 25% and 15% of the mass of corn fiber respectively. The corn fiber is an undervalued portion of the kernel that is currently found in either the DDGS or corn gluten feed co-products.

The inability to convert these sugars to ethanol results in more than 10 billion pounds of corn fiber, which is sold as a low-cost animal feed. This decreases the profitability of ethanol production from corn. There has been good progress in developing a yeast capable of fermenting xylose. Arabinose utilization, however, has been much more difficult to attain.

Currently the NCGA is working with the Corn Refiners Association and with the National Renewable Energy Laboratory to develop an arabinose utilizing yeast. Good progress has been made during the past year towards solving one of the more difficult steps in conversion. This achievement takes us much closer towards a yeast that is able to efficiently ferment corn to ethanol.

Utilization of the fiber in ethanol production process influences profitability on this 700 million bushel market.

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ST. LOUIS OFFICE
632 Cepi Drive
Chesterfield, MO 63005
Phone: (636) 733-9004
FAX: (636) 733-9005

WASHINGTON D.C. OFFICE
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DDGS

Building Markets for Distillers Grains

Nearly 3.8 million tons of distillers dry grains are created in domestic dry grind ethanol production; farmer-owned cooperatives represent 48% of that production. For every bushel of corn made into ethanol, 18 pounds of DDGS are created and must maintain value to contribute to plant profitability. The capacity for ethanol production is set to double by 2005 and assuming that dry grind production doubles as well, the potential supply of DDGS is almost 7 million tons.

The corn kernel is mostly starch at 61% of the wet weight, with protein, fiber, corn oil and water making up the remaining 39%. The dry grind ethanol process uses most of the starch present in the corn kernel during ethanol fermentation, leaving protein, fat, minerals and vitamins behind in a concentrated form. The forms of this ethanol co-product are Corn Distillers Dried Grains (DDG), Corn Condensed Distillers Solubles (CDS), Corn Distillers Dried Grains/ Solubles (DDGS), and Wet Distillers Grains with solubles (WDGS).

NCGA has been actively promoting the use of DDGS in livestock and poultry diets through educational workshops hosted on a regional basis with program partners. The association has also created an educational video on distillers grains production to use as a promotional tool with livestock nutritionists and animal consultants.

Value-added products from distillers grains are also being explored in greater depth with a feed industry partner.

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Chesterfield, MO 63005
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FAX: (636) 733-9005

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