

Increased demand for ethanol in the US has led to predictions that biofuels will have a 30% share of global energy demand by 2030, writes *Eric Fishhaut*

Impact of ethanol

★ Ethanol production is undergoing exceptional global growth. In his recent State of the Union address, President Bush proposed that the US produce 20% of its energy from renewable sources, including corn-based ethanol and other bio-fuels used to displace some imported oil. There are currently 112 ethanol plants in operation in the US and another 76 under construction. As this trend continues, it is certain to have a substantial impact on the equilibrium of the global energy markets.

Energy independence and environmental concerns are seen as the driving forces behind ethanol development. Ethanol could alleviate oil supply crunches while reducing the carbon dioxide emissions tied to climate change. US and global consumption of the renewable fuel continues to rise and important export markets are being developed in Asia, Europe and the Americas. But the economics of US ethanol have to balance with world oil prices as ethanol production typically costs considerably more than that of fossil fuel. If the high prices of oil are to continue, as most believe, ethanol's increased appeal can be sustained.

Ethanol basics

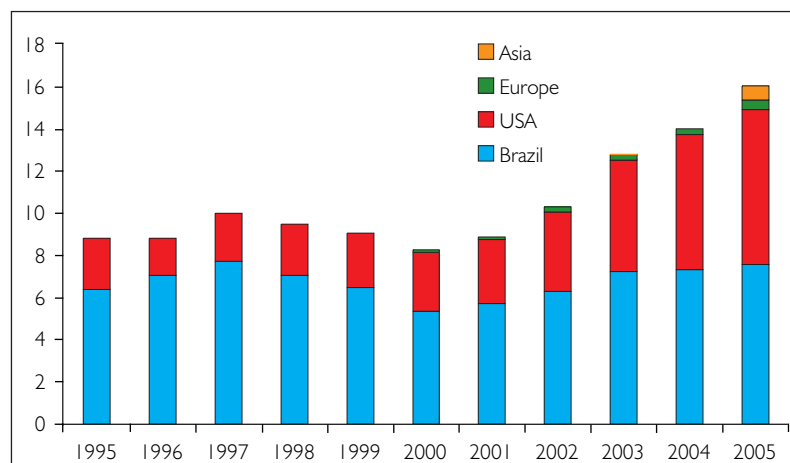
Ethanol is a fuel that comes from agricultural crops such as corn, sugarcane, barley, and wheat – and even from trees and grasses. Unlike fossil fuels, such as petroleum, these are renewable resources that can be continuously produced. They take carbon from the atmosphere and energy from the sun to produce biomass that is then converted into liquid energy like ethanol.

Ethanol is not a new product. In the 1850s the US produced nearly 90 million gallons

every year. In 1908, Henry Ford designed his Model T Ford to run on a mixture of gasoline and alcohol, calling it the fuel of the future.

In 2005, the US overtook Brazil as the world's largest ethanol producer, while both continue to expand production (see figure 1). In Brazil, cars now run either 100% ethanol or a blend of 25% ethanol and 75% gasoline. Many of the fuel consumption trends that began in Brazil are

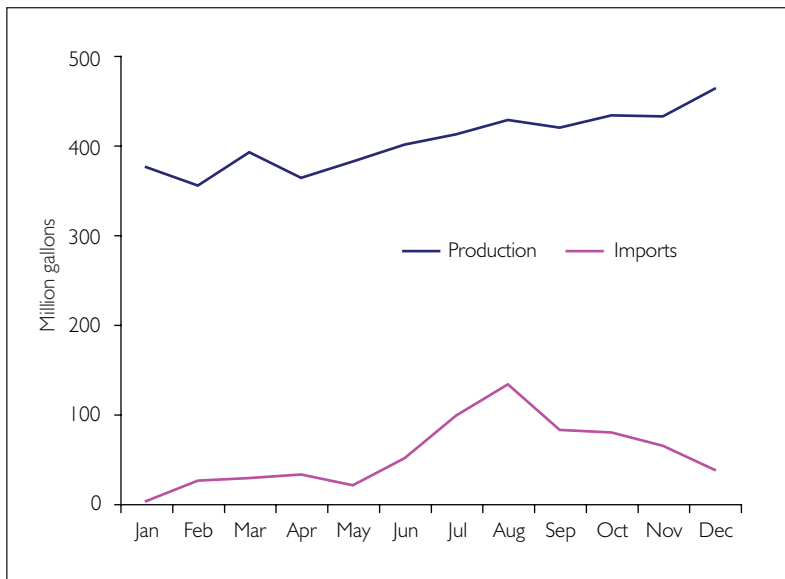
“As growth in ethanol production continues, it is certain to have a substantial impact on the equilibrium of the global energy markets”



F1. Global ethanol production

Global ethanol production in 2005 was 16.2 million tons of oil equivalent. The US and Brazil produced 92% of that supply, while ethanol production remains less than 0.5% of the level of global oil production

Source: British Petroleum



F2. 2006 US ethanol production and imports
 US ethanol production has shown steady monthly growth, while imports from Brazil fluctuate to help meet immediate demand. Imports represented up to 20% of supplies during the summer driving season, when higher levels of oxygenate mix in gasoline is required Source: Renewable Fuels Association

now developing in the US. The presidents of these two countries have just signed a memorandum of understanding to share and promote biofuels. Brazil remains the world's largest exporter of ethanol, with the US accounting for just over half of the 3.5 billion liters Brazil shipped abroad in 2006, despite a \$0.54 per gallon import tariff on Brazilian ethanol.

There is a fundamental production difference in these two regions; corn is the feedstock source of choice in the US, while Brazil utilizes sugarcane. Each crop has its pros and cons as a feedstock for ethanol production. The US Department of Energy reports that the net energy balance (the amount of energy used compared to the amount of useable energy produced) of making fuel ethanol from corn grain is 1.34. By contrast, petroleum gasoline only returns 0.8 units of energy for each unit put into it. However, sugarcane returns about eight units of energy for each unit expended, thus producing about 20 times the energy of corn. So, Brazilian ethanol is six to seven times more energy efficient to produce than US ethanol.

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Energy production

In the US, it currently costs more to produce ethanol than gasoline, and it takes approximately 50% more liquid volume to provide the energy equivalent of gasoline. Regardless, one out of every eight gallons of gasoline sold in the US contains ethanol; most of this is a blend of 10% ethanol and 90% gasoline. Ethanol is used as an octane enhancer to improve air quality.

With US ethanol plants pumping at maximum capacity, there is simply no way they can keep up with the surging demand for this alternative fuel (figure 2). The US fuel industry is blending with an increasing amount of ethanol as it replaces methyl tertiary butyl ether (MTBE), which is being phased out due to its toxicity. By federal mandate, the country must use 7.5 billion gallons of renewable fuels by the year 2012, up from an estimated 5 billion gallons this year. Recently, President Bush set a goal of 35 billion gallons a year of

ethanol and other alternative fuels by 2017 – a fivefold increase over current requirements. The Wall Street Journal predicts that US ethanol demand will likely increase by at least 50% this year alone.

Oil giant BP has gone on record saying that biofuels could provide 30% of the global energy demand by 2030 without harming food supplies. The US Department of Energy is supporting research in to the production of cellulosic ethanol made from non-edible materials, with plans to fund up to \$385 million for several biofuel projects. As the process matures, the government would expect the cost of production to drop from its current level of \$2.26 a gallon to about \$1.07 by 2012, making it competitive with corn feedstock ethanol.

Russia, the world's second-largest oil producer and exporter, plans to build its first major ethanol plant in 2007, according to officials. With a projected cost of \$200-250 million, the plant will produce 300,000 tons of ethanol fuel a year (about 380 million litres, or 100 million US gallons) for export to the European Union. The plant will be placed in the Volgograd region, one of Russia's biggest grain-growing areas, using wheat as its feedstock.

Market pricing

The global market for biofuels in 2005 was about 13 billion gallons, less than 2% of global transportation fuel consumption. Ethanol production costs could be as low as \$1.10-\$1.20 a gallon, although they are rising because of higher corn prices (as illustrated

in figure 3). Corn ethanol can be competitive with gasoline when crude oil is more than \$50 a barrel. The US government creates incentives for the industry, with up to \$0.60 per gallon of tax credits for blending pure ethanol.

To help meet demand for ethanol production, US farmers are expected to grow a record 12.2 billion bushels of corn this year. An estimated 3.2 billion bushels will go into ethanol, up from 2.15 bushels in 2006, according to the US Agriculture Department. And corn growers receive the highest subsidies from the US government of any agricultural products, totalling over \$50 billion in the last ten years.

In 2005, 13% of the US corn crop was used to make ethanol. According to some, this has created shortages and pushed up the price of every product that uses corn as a feedstock. Corn crop prices in the US have effectively doubled to around \$4 per bushel since December 2005 with impacts seen on a wider basis. For example, in some areas of Mexico, the price per kilo for corn tortillas has risen from \$0.63 a year ago to between \$1.36 and \$1.81, recently resulting in the need for the government to apply a price control intervention.

Ethanol's value as a gasoline component seems to rise along with rallies in oil prices. Futures prices for ethanol and unleaded gasoline are relatively volatile and appear to follow similar patterns at different levels. Ethanol prices track the price of unleaded gasoline futures closely, as unleaded gasoline and ethanol are energy substitutes. The relationship between the two as measured over more than a ten-year period has been nearly 60%, suggesting relatively strong but not perfect correlation.

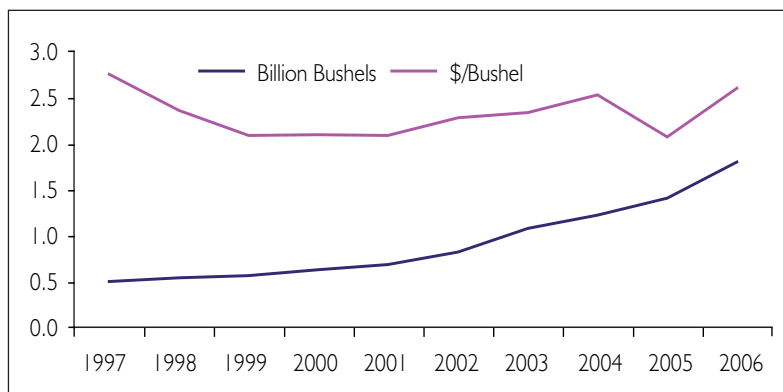
Ethanol trades at a premium to unleaded gasoline, ranging from as little as \$.06 to as much as \$2 per gallon in the last twelve months (as shown in figure 4).

On average, the spread has been about \$0.60 per gallon. At the end of February, ethanol prices (from corn) averaged \$2.20 per gallon in the US, 45% below its record high near \$4 per gallon set last summer and 14% below its price of \$2.55 one year earlier. With unleaded somewhat less volatile so far this year, the spread has been less than \$0.50 per gallon.

The complexities of risk in the energy market continue to grow. While ethanol's importance in the market increases, it

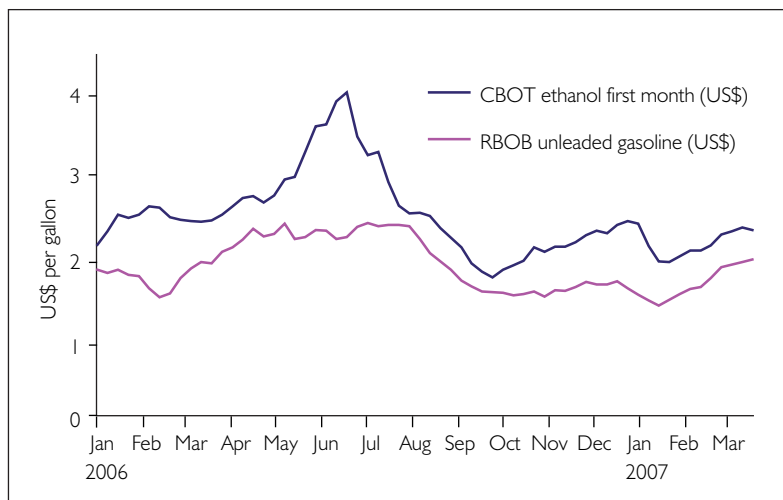
seems apparent that market forces have not been free to seek equilibrium. While few can argue with being environmentally friendly, many argue that the economics of ethanol just don't make sense. For energy risk management, following ethanol and its relationship to oil and gasoline requires an understanding of not only the petroleum and refining markets, but also portions of the global agriculture market and the related government policies. **BR**

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F3. US Corn Production for ethanol

As the amount of corn grown and used in ethanol production has grown over the last few years, the price of corn in the US has moved higher with recent strong momentum Source: CBOT and USDA



F4. Ethanol price relation to unleaded

Comparing the front month ethanol futures price to that of RBOB Unleaded Gasoline shows a relationship with moderate correlation Source: CBOT and Nymex via GlobalView