



Bio-ethanol - an alternative fuel

Ethanol an importance in the energy sector is becoming more widely talked about in the world's media. Below you will find some interesting examples:

On the verge of dramatic transformation

"The global oil industry is on the verge of a dramatic transformation from a risky exploration business into a technology-intensive manufacturing business. And the product that big oil companies will soon be manufacturing argues Mr Van der Veer, CEO Royal Dutch Shell, is greener fossil fuels".

Source: The Economist, 20 April 2006

Bill Gates and Richard Branson invest in ethanol

"The best reason for optimism (for bio-ethanol) is the arrival of entrepreneurial capital. Paul Allen and Bill Gates, co-founders of Microsoft, have both made recent but unrelated investments in ethanol firms. Richard Branson, a British airline boss, has jumped into the fray with Virgin Fuels, a new firm that vows to invest \$300m-400m in ethanol over three years".

Source: The Economist, 9 February 2006

Ethanol from the NZ dairy industry

"In New Zealand, bio-ethanol is made as a by-product of the dairy industry. Lactose is fermented in whey with yeast that converts this sugar into alcohol. The alcohol is then distilled into bio-ethanol. In the future bio-ethanol could be made in New Zealand from waste paper, straw or forestry residues. Many vehicles can use up to 10% ethanol without modification".

Source: www.eeca.govt.nz/renewable-energy2005

Prediction : _ of UK farmland to be used for bio-fuels

"By 2060, the trade association for the UK bio energy industry, British Biogen, predicts that a quarter of the UK's farmland could be producing crops for energy once more".

Source: www.bbc.co.uk, 24 April 2006

National Farmers Union (NFU) president Ben Gill discussed an exciting prospect for improving the environment and farmers' profits. He said that he believes "by 2020 a quarter of the whole landmass of the enlarged Europe will be taken up by growing renewable raw materials. That will be a mix of fuels, starches and speciality oils and all sorts of other products".

Source: www.bbc.co.uk, 24 April 2006

UK needs 10 production plants to meet government requirements

Permission has just been given to create one of Britain's first bio-ethanol plants in Henstridge, which will eventually convert 340,000 tonnes of wheat per year into 131 million litres of ethanol. Green Spirit Fuel's finance director, Arthur Llewellyn insists "The UK will need 10 production plants like the one in Henstridge to meet the government's requirements".

Source: www.bbc.co.uk, 17 January 2006

Brazilian flex cars make up 53% of market

In Brazil, more cars adapted to run on alcohol were sold than conventional petrol-driven cars. "Flex-fuel cars, which run on any combination of ethanol and petrol, took 53.6% of the Brazilian market in 2005".

Source: www.bbc.co.uk, 11 January 2006

18 million corn bushels make 50 million gallons of ethanol

"With today's technology, one bushel of corn yields 2.8 gallons of ethanol. An average ethanol plant today might be able to produce 50 million gallons of ethanol annually. A plant this size would require approximately 18 million bushels of corn".

Source: www.ethanol.org

Sources of Ethanol

Much of the ethanol produced in the world is actually a petroleum product and two million tons of petroleum-derived ethanol are produced annually. Petroleum derived ethanol (synthetic ethanol) is a widely used industrial solvent and has a considerable variety of other applications, including use as fuel additive.

Ethanol derived from crops (bio-ethanol) is an energy resource that may offer environmental and long-term economic advantages over fossil fuel (petrol). Ethanol's energy comes from the carbon-based feedstocks which get their energy from sunlight, water, and photosynthesis. Ethanol can be produced from many feedstocks, such as sugar cane, miscanthus, sugar beet, sorghum, switchgrass, barley, hemp, kenaf, potatoes, sweet potatoes, cassava, sunflower, fruit, molasses, whey or skim milk, corn, corn cobs, grain, wheat, wood, paper, straw, cotton, grain sorghum, barley, other biomass, well as many types of cellulose waste. One result of increased use of ethanol is increased demand for the feedstocks such as corn and sugarcane. Large-scale production of agricultural alcohol for fuel may require substantial amounts of cultivable land with fertile soils and water.

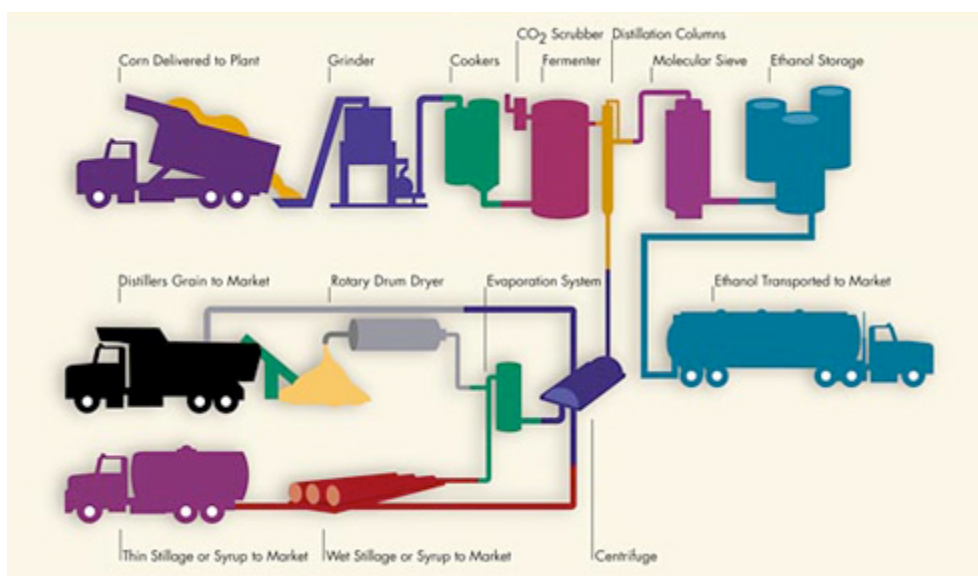
Source: www.wikipedia.com, 11 September 2006

Production

Ethanol can be made by a dry mill process or a wet mill process. The major steps in the dry mill process are:

1. **Milling:** the feedstock passes through a hammer mill which grinds it into a fine powder called meal
2. **Liquefaction:** the meal is mixed with water and alpha-amylase, then passed through cookers where the starch is liquefied. High temperatures reduce bacteria levels in the mash
3. **Saccharification:** the mash from the cookers is cooled and the secondary enzyme (gluco-amylase) is added to convert the liquefied starch to fermentable sugars (dextrose)
4. **Fermentation:** yeast is added to the mash to ferment the sugars to ethanol and carbon dioxide
5. **Distillation:** the fermented mash, now called beer, contains about 10% alcohol
6. **Dehydration:** the alcohol passes through a dehydration system where the remaining water will be removed
7. **Denaturing:** ethanol that will be used for fuel must be denatured, or made unfit for human consumption, with a small amount of gasoline (2-5%)
8. **Co-products.** There are two main co-products created in the production of ethanol: distillers grain and carbon dioxide

Source: www.ethanol.org



Source: www.ethanolrfa.org2005

Ethanol fuel mixtures

Ethanol can be blended with gasoline in varying quantities. The blended fuel is known in the United States as gasohol, or gasoline type C in Brazil. Two common mixtures in the United States are E10 and E85 which contain 10% and 85% ethanol, respectively, while the common mixtures in Brazil are gasoline type C, which contain 20% to 25% ethanol. In many countries cars are required to run on mixtures of ethanol. Brazil mandates cars be suitable for a 25% ethanol blend and The United States allows up to 10% blends. Pakistan, India, China, Thailand and Japan have now launched their national policies. Beginning with the model year 1999, an increasing number of vehicles in the world are manufactured with engines which can run on any gasoline from 0% ethanol up to 100% without modification.

Country production and use of ethanol

More than 90% of the ethanol produced in the U.S. comes from corn. Crops with higher yields of energy, such as switchgrass and sugar cane, are more effective in producing ethanol than corn. Ethanol use and production in the United States is increasing steadily. The USDA estimate ethanol from corn cost \$1.03-1.05/gallon in 2003-05, compared with \$1.27 from molasses, \$2.35 from US beet and \$2.40 from US sugarcane. In August 2005, President Bush signed an energy bill which included a requirement to increase the production of ethanol and biodiesel from 4 to 7.5 billion US gallons (15 to 28 million m³) within the next ten years. It is expected that in the short term the majority of this increase will come from ethanol produced from corn.

Brazil uses sugarcane as primary feedstock. Brazil as of 2004, was the largest producer and consumer of ethanol fuel in the world. Since the 1980s, Brazil has developed an extensive domestic ethanol fuel industry based upon sugarcane production and refining. Brazil produces approximately 4 billion gallons of ethanol per year. Brazil can make ethanol for about \$1.00 per gallon. Newer cars in Brazil are flexible fuel vehicles, capable of using fuels containing any proportion of pure ethanol and/or gasoline. However, Brazil is the only country in the world where farming and production of ethanol is a profitable and widespread substitute for gasoline. The first fuel ethanol plant in Colombia began production in October 2005, with output of 300,000 litres a day. Colombia hopes to have a capacity of 2.5 million litres per day, which is the requirement for adding 10% ethanol to the gasoline. Directive 2003/30/EC of the European Parliament promotes the replacement of fossil fuels by bio-fuels: amongst them bio-ethanol to be blended into petrol. The United Kingdom has adopted a national policy of encouraging the use of biofuels including ethanol but the taxation of alternative fuels like bio-diesel is almost as onerous as that on conventional fossil fuels.

Source: www.wikipedia.com, 11 September 2006