# Ethanol

Transportation accounts for a quarter of the United States green house gases. With this statistic being so high and the need for transportations increasing, scientists are rushing to find a solution to this problem. Many feel that electric vehicles are the solution, while others are looking at alternative fuels. Ethanol has recently been gaining popularity throughout recent years for it's clean burning properties and its availability.

Ethanol is produced from plant matter (i.e. corn, sugar cane, wheat, barley, potatoes) that is broken down intro simple sugars and starches and then fermented and distilled into alcohol.

Chemistry of Ethanol:

Combustion:

$$C_2H_5OH\ (l) + 3\ O_2\ (g) \rightarrow 2\ CO_2\ (g) + 3\ H_2O + Heat$$

In complete combustion ethanol only yields carbon dioxide, heat, and water (mainly vapor).

Nitrogen fertilizer for the crops is produced from air, water, and natural gas in a process that releases 3.6 tons of carbon dioxide per ton of fertilizer. When the fertilizer breaks down in the soil, it releases nitrous oxide; a greenhouse gas that the EPA says is 310 times more effective at trapping heat in the atmosphere than carbon dioxide.

Transportation of ethanol causes NOx, SOx, CO2, and CO because ethanol can only be transported by truck, freight, or ship. Piping ethanol has always been a problem because the fuel picks up impurities on the way from point A to point B. These impurities are unacceptable in ethanol and can damage traditional gas pipeline material.

<u>Pros and Cons</u>

<u>Pros</u>

- Renewable fuel
- Can replace gasoline with little change to cars
- Ethanol reduces the amount of carbon monoxide and other ground-level toxic air pollutants as compared to conventional unleaded gasoline
- Crops such as corn can be grown and produced into ethanol in the United States
- Cheap to refine compared to unleaded gasoline
- Cools climate**

Cons

- There's not nearly as much energy in ethanol as there is in gasoline.
- Creating significant amounts of energy from food crops would deplete the amount of land available for growing actual food for people to eat.
- Producing corn and processing it into 1 gallon (3.7 liters) of ethanol requires 131,000 BTUs of energy; but 1 gallon of ethanol contains only 77,000 BTUs
- Planting, growing and harvesting corn requires about 140 gallons of fossil fuels and costs $347 per acre. (1 acre = 7,110 pounds of corn or 328 gallons of ethanol…. 11 acres to power one car for 1 year)

Solutions:

One possible answer to the ethanol controversy is something called cellulosic ethanol. Cellulosic ethanol is made from nonfood products such as corn stalks, wood chips and switchgrass.

Nitrogen-efficient corn seed that might use up to 30 percent less fertilizer per bushel.

Nitrogen-free fertilizer.

Using machinery that uses Bio-diesel or ethanol.

**Scientists from the Carnegie Institution's Department of Global Ecology studied satellite images stretching over 733,000 square miles of Brazil, where approximately 25% of their automobile fuel comes from sugar cane. They measured temperature, reflectivity and evapotranspiration (the water loss from the soil and from plants as they exhale water vapor). Their conclusion: Expansion of the sugar cane crop cools the local climate by reflecting sunlight back into space and lowering the temperature of the surrounding air as the plants "exhale" cooler water. It lowers local climate about 2.5 degrees Fahrenheit.