Ethanol: Friend or Foe?

Last summer, due to the rising fuel costs, I decided to buy a motorcycle that gets 70 miles to the gallon. When it comes to filling it up, the motorcycle is much easier on my wallet than my gas-guzzling truck. However, my motorcycle requires a certain ritual every time the gas gauge is near empty. When I pull up to a gas pump, the first thing I do is look for the little sticker that says "up to 10 percent ethanol added." If I see this sticker, I do not even bother to stop. I continue on to the next gas station until I finally find one without the fine print underneath the fuel grade. I do this because the manufacturer does not recommend running my motorcycle on a fuel that is mixed with ethanol. But, due to government regulations, it is becoming harder and harder to find pure gasoline that is not mixed. This got me wondering. Why is the government requiring the mixture of ethanol in fuel if it is not recommended by manufacturers? When I looked into this question, I discovered a heavily debated issue over the use of ethanol as a fuel.

The production of ethanol in the United States has grown rapidly, going from 50-million gallons in 1979 to 13-billion gallons that were produced last year (Biello, 2011, paragraph 5). Ethanol's widespread support is due to its potential ability to resolve three of the major problems we face today: dependence on foreign oil, unemployment, and climate change. It has been viewed as the fuel of the future because it is renewable, is produced in the United States, which lessens our dependence on foreign oil and increases jobs, and is cleaner burning. However, over the last few years, the support of ethanol has dwindled because of many factors. These include its incompatibility with certain engines, its effect on food prices, questions concerning its efficiency, and the industry's need for government support. Looking at the big picture, we end up with the ultimate question. Do the advantages of using ethanol as a fuel outweigh the disadvantages? From my research, I have found that the disadvantages of using ethanol as a fuel far outweigh the

advantages, and it is time to move towards an alternative energy that is better suited for our energy needs.

Advantages of Using Ethanol as a Fuel Source

Ethanol is the first and only alternative to gasoline that has the ability to be mass produced and sold, making up approximately 10 percent of the total fuel market (Harkin, 2011, p.237). Many support ethanol's use as a fuel because it is a renewable energy made in the USA. Ethanol is also a cleaner burning fuel than gasoline, emitting less carbon dioxide when burned. All these great attributes are the reason why many believe it is the fuel of the future.

Since ethanol can be produced from corn, it is a renewable resource. Although supplies of fossil fuels are limited, we will always be able to grow more corn to make ethanol. The process of making ethanol is almost the same as distilling alcohol, which has been going on for hundreds of years. First, the feedstock is ground down into a fine powder. Second, water is added to the powder and heated up to form a mash. Enzymes are added to the mash to convert the starch into sugar. Third, yeast is added to ferment the sugars into carbon dioxide and ethanol. Fourth, the mash is distilled separating the ethanol from the solids. The solids left over can be further processed and used as animal feed. Fifth, the ethanol is dehydrated to remove any remaining water. Finally, the ethanol is mixed with gasoline and shipped away to be sold. There are two main ethanol gasoline mixes, E10 (10 percent ethanol and 90 percent gasoline) and E85 (85 percent ethanol and 15 percent gasoline). Due to government tax credits, blends of ethanol and gasoline are cheaper per gallon than pure gasoline. It seems to be a win-win situation considering this renewable fuel is actually cheaper to buy at the pump than normal gasoline.

With so many products being produced in China and other countries, how often is it that we see a product that says "made in USA"? Not very often. The ethanol industry is one of those that can

proudly say that it is made in the United States by our own citizens. Whether it is the farmer who grows the corn, the person who works in the distillery, or the driver of a delivery truck, thousands of Americans are employed by this growing industry. Furthermore, by producing ethanol in the United States, we reduce the amount of oil we have to buy from overseas. Instead of sending money to the Middle East, we keep money in our own pockets by giving it to the corn-growing states of the Midwest. The ethanol industry helps our economy by increasing jobs and reducing the amount of money spent on foreign oil.

Another benefit of ethanol is that, compared to gasoline, it burns cleaner and produces less carbon dioxide. In an extensive study done by scientists at North Carolina State University, cars running on E85 and conventional gasoline were compared head to head in real-world conditions. One of the quantities measured was the amount of carbon dioxide emitted from the different cars' tailpipes. For a Ford Taurus running on E85, the carbon dioxide emission was 397 grams per mile, and on gasoline, it was 423 grams per mile. For a Chevy Lumina running on E85, the carbon dioxide emission was 429 grams per mile, and on gasoline, it was 446 grams per mile (Zhai, Frey, Rouphail, Goncalves, & Farias, 2009, p.916). In both cases, the amount of carbon dioxide emitted was less with E85 than with gasoline. Even though the average difference was only about 22 grams per mile, multiplying this number by every single car on the road would make a huge difference in the amount of carbon dioxide being dumped into the atmosphere. Some believe carbon dioxide and other greenhouse gases are the cause for global warming. If this is the case, ethanol will help reduce the effects of global warming by creating fewer greenhouse gases.

Overall, compared to all other alternative fuel solutions, such as electricity or hydrogen fuel cells, ethanol has had much more success. It is the first alternative to gasoline that has the ability to be mass produced and sold. Ethanol is good for the environment because it can be made from renewable resources, and it is a cleaner burning fuel that reduces the amount of greenhouse gases

being put into the atmosphere. Ethanol is good for the consumer because it is cheaper at the pump than gasoline. Ethanol is also good for the economy, being made in the USA, creating jobs, and reducing our dependency on foreign oil. With all these great benefits, many believe it is the fuel of the future.

Disadvantages of Using Ethanol as a Fuel Source

For a while, ethanol seemed to be a great solution to the energy problem. However, over the past few years, support for it has dropped. Reasons for this drop include that it is incompatible with certain engines, it drives up the cost of food, it produces just as much carbon dioxide as gasoline, the industry requires government support to stay in business, and it is not energy efficient. For these reasons, more and more people have started to question if ethanol has the capability to take the place of gasoline.

Ethanol is not safe to use in engines that were not designed to run on it. It is not recommended for use in things like motorcycles, boats, airplanes, lawnmowers, and older engines because they were not designed to run on an alcohol-based fuel. This type of fuel can corrode certain components such as fuel lines and gaskets. Whenever a machine is going to be sitting for an extended amount of time, ethanol should not be mixed in the gas because it has a tendency to collect moisture. Since there are so many applications for which ethanol should not be used, many people try to avoid using it completely.

Another problem with ethanol is that there is a likely correlation between the increased amount of ethanol being produced and the increased cost of food. This could happen in three different ways. First, corn is a crop that quickly deprives the soil of nutrients. In order to be able to plant it every year, a lot of fertilizer needs to be added to the soil. Since more fertilizer is being used, the cost of fertilizer goes up, which raises the cost of other crops that need the fertilizer. Second,

since there is a larger demand for corn, the price of feed corn for livestock goes up. This raises the cost of meat and dairy products. Third, corn is used to produce high-fructose corn syrup, a sugar replacement. Anything that is made with this syrup will go up in price. Finally, more farmland is being used to grow ethanol corn, which means less land for other crops. The price of the other crops will go up because there are not as many being produced (Ferguson & Zeller, 2010, p.947). Clearly, the increase in corn being grown for ethanol can cause the cost of food to go up in many different ways. The production of ethanol can result in a battle between food and fuel, but, in the end, food is more important.

The most heavily scrutinized aspect of ethanol is the production process, especially related to government subsidies and carbon dioxide emissions. In 2010, the amount of government support for the industry was 5.68-billion dollars (Biello, 2011, "Corn Ethanol: Simply Insufficient," paragraph 1). The only reason the ethanol industry is able to stay in business is due to this massive government support. The process is not profitable because a great deal of energy goes into making ethanol, and the final product has only a small energy gain. On average, every gallon of ethanol contains 84,100 BTUs of energy but costs 81,090 BTUs of energy to produce (Lorenz & Morris, 1995, Table 1). The final product contains only 3.5 percent more energy. In addition, the energy used to produce ethanol is made by burning fossil fuels or coal, which dumps carbon dioxide into the atmosphere. The carbon dioxide that is emitted in the production of ethanol offsets the gains of its being a cleaner fuel to burn in a car. When the cost of labor is factored in, the process of making ethanol costs more money than it yields. The industry requires massive government support because it is not economically capable of surviving on its own due to the lack of efficiency.

Another problem with running a car on ethanol is the decreased miles per gallon. The study from North Carolina State University, previously mentioned, measured the mileage of cars running on E85 compared to conventional gasoline. For a Ford Taurus running on E85, the miles per gallon

were 15.4, and on gasoline, they were 20.0. For a Chevy Lumina running on E85, the miles per gallon were 13.9, and on gasoline, they were 19.6 (Zhai et al., 2009, p.916). The average miles per gallon lost using E85 was 26 percent. Even though ethanol is cheaper per gallon than gasoline, one needs much more ethanol than gasoline to drive the same distance because it is not as fuel efficient.

Many ethanol companies are going out of business because of how economically difficult it is to produce ethanol from corn. With the country going bankrupt, the government cannot afford to provide the billions of dollars that are needed to keep the sinking industry afloat. On top of that, support for the fuel has dropped significantly because it is not compatible with certain engines, it drives up the cost of food, and it produces just as much carbon dioxide as gasoline. For these reasons, it is clear that ethanol is not the fuel of the future.

Conclusion

If we look at the big picture, ethanol is the first alternative to gasoline to be mass produced and comes with its advantages and disadvantages. It is able to meet a few of our energy goals by being a renewable resource that is cheaper at the pump than gasoline. Ethanol is also made in the USA, creating jobs and reducing our dependency on foreign oil. However, "if the entire record U.S. corn crop of 2009 was used to make ethanol, it would replace only 18 percent of the country's gasoline consumption" (Biello, 2011, "Corn Ethanol: Simply Insufficient," paragraph 3). It would be great if ethanol could displace 18 percent of our gasoline consumption, but we could not allocate all of our corn crops to the production of ethanol because corn is needed for food. Ethanol simply does not have the capability to contribute a significant amount to our energy needs. On top of that, ethanol is not compatible with certain engines, it drives up the cost of food, and it is not as efficient as gasoline. Most importantly, the industry requires billions of dollars of government support because ethanol costs more money to produce than it is worth.

When the advantages of using ethanol as a fuel source are weighed with the disadvantages, it is quite obvious that ethanol is not an adequate solution to our energy problem. However, we cannot just forget about ethanol and quickly move on. In a speech on June 15, 2011, Senator Amy Klobuchar (2011) of Minnesota said, “We are talking about pulling the rug out from an industry that provides 10 percent of the nation’s fuel supply and supports nearly 500,000 jobs” (p.245). In order to avoid a complete collapse of a huge part of our economy, the process of switching over to the next idea needs to be slow and steady. Ethanol was a good start, bringing people to the realization that alternative energies can be implemented. However, we need to start moving in a different direction towards a fuel that is a more practical solution to our energy needs. It is time for American engineers to put on their thinking caps and come up with the next breakthrough in alternative energy.

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