The great ethanol debate

The fuel ethanol and distilled beverage market really have the same goals. The end product is the same....make as much alcohol as you can for the lowest cost. However the issues surrounding both industries are quite different. Most of the issues in the ethanol industry are driven by politics, legislation and lobbyists and it doesn't appear that those issues will change anytime soon.

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No. 2 yellow dent feed corn is used to make fuel ethanol. It is indigestible by humans.

Food vs. Fuel

This topic is probably the single most important issue which has faced the ethanol industry over the last few years. How can you take away food from people's mouths and make it into fuel? There have been some very sizeable debates and 'fear-based' tactics used by other industries to try to persuade consumers on this topic. There have been a number of studies conducted that show that there is enough grain being produced through increased farm yield techniques, hybrid selection, etc. on less acres than ever before and increased corn usage for ethanol production has a relatively minor impact on food prices (*www.ethanolrfa.org*).

In reality the major factors that have contributed to this price increase of food over time have been weather related (drought, flooding, etc), the higher cost of energy inputs (oil prices have increased substantially over the past few years), poor economic growth, increased food and energy demand in countries like China and India, poor exchange rates in developed countries, changes in policy and trade practices and increased commodity speculation forcing higher prices for feedstocks. All of these factors combined result in higher food costs globally and one cannot single out biofuels production as the main culprit.

One of the myths perpetuated in the US is that ethanol production diverts corn that would otherwise be used to feed the hungry. In fact, approximately 1% of all corn grown in the US is directly consumed by humans. The rest is No. 2 yellow dent field corn, which is indigestible to humans and goes to feeding livestock. Also, a co-product of ethanol production is the high-protein distiller's grain that is used as a livestock feed; approximately one third of every tonne of grain that goes into ethanol is returned back in to highly-sought animal feed, replacing a further volume of field corn and saving livestock producers money.

Of course, good manufacturing practices, environmental stewardship and new technologies will help to alleviate this misperception. Through these practices, there should be enough grain produced for both food and fuel. However, it really is up to individual countries to understand how the production of biofuels impacts not only their economy, but their citizens as well. Countries such as China have decided to limit the amount of starch based substrates that can be used for biofuels and concentrate their development efforts in cellulosic or non-food based raw materials. This will have to happen elsewhere in the world as well if one looks at the projections of increased biofuels demand. This will also help to curb the debate on food vs. fuel, if other 'alternative' feedstocks can be utilised. However, the higher cost of production is making this concept move rather slowly to reality compared to already established starch based production methods.

Indirect land use

Have you ever wondered if ethanol production effects Amazon rainforest destruction? Apparently some people believe it does. The theory of indirect land use assumes that growing grains for biofuel production displaces other crops, which are then grown in other parts of the world, leading to deforestation. The resulting 'carbon belch' of that land conversion must be included in ethanol's lifecycle greenhouse gas calculations. Initial assumptions were that this carbon belch and the perceived emission of GHG (Greenhouse Gas Emissions) through deforestation resulting from increased biofuel production were massive. The theory however is generally flawed due to the research data being based on false or out-of-date assumptions. More dependable recent studies have shown no indirect land use change in other countries due to ethanol production. Studies show that, deforestation in the Amazon has declined sharply just as biofuels production has increased.

Another issue is the use of various model inputs and assumptions that determine GHG for grain based ethanol. A lot of these models widely vary in the carbon intensity for grain based ethanol. Some of the models did not account for DDGS (Distillers Dry Grains with Solubles) inclusion back into the cycle. Depending on which model one uses, grain based ethanol production can be carbon positive, neutral or negative. The relative uncertainty in these models results in no real method being available to reliably measure ethanol's carbon footprint. Now, with the benefit of time and improved scientific processes, those original predictions of negativity for biofuels are being roundly disproven. New ILUC (Indirect Land Use Change) modeling results in elimination of the greenhouse gas penalties for grain based ethanol production.

Various studies show that ethanol reduces GHG through the uptake of carbon dioxide (CO_2) during the growth of ethanol feedstocks. Independent analyses comparing ethanol and gasoline show ethanol reduces GHG emissions from 30–50%. Ethanol production is also becoming more efficient, requiring fewer energy inputs while yielding more ethanol.

A typical ethanol plant dotted through the US mid-west cornfields.

Some studies show that energy requirements for ethanol production have decreased 28% since 2001, electricity demands by 32%, and water use is down to 2.72 gallons per gallon of ethanol production. All of these improvements were achieved while improving ethanol yields by 5.3%. Naturally, ethanol also requires far less fossil fuel inputs than gasoline refining. An analysis released by the US Department of Agriculture in June 2010 concluded that one unit of fossil energy used in the corn ethanol production process results in 2.3 units of energy in the form of ethanol. In fact, it is gasoline and not ethanol that requires more energy to produce. Researchers also found that it takes 1.23 units of fossil energy to produce one unit of energy in the form of gasoline. It is amazing that all of this time and energy have focused on biofuels production and no one bothers to question the impact of gasoline production at all.

Recently the EU has said its biofuels policy will most likely include ILUC components. However, the above mentioned inconsistencies make it difficult to accurately predict GHG and ILUC impacts. Legislation with incorrect assumptions or inconsistent modeling could lead to a severe negative impact in the amount of ethanol production in other parts of the world. More scientific and fact based modeling is needed to get a true measure of the effect of biofuels production on its carbon footprint. Most studies also conclude that sugarcane and cellulosic feedstocks utilised for biofuels production will significantly improve its carbon footprint.

Engine damage

A lot has been made about ethanol and its use in automobile engines. There are a number of stories suggesting that using ethanol can damage engines. The fact of the matter is that ethanol blends have been in the market place for over 20 years with no major issues. Also worthy to mention is that some of the first cars ever built by Henry Ford ran on ethanol. The most common type of blend that is used today is E10 (10% ethanol, 90% gasoline). This type of fuel is being utilised in all engine types, including automobiles, non-road engines and marine engines. There has been no evidence that following proper procedures and manufacturer recommendations, that E10 has caused any damage. Recently in Germany, the introduction of E10 was met with skepticism by consumers based on lack of information and misguided efforts by anti-biofuels industries. The majority of automobiles can use E10 without any issues so the industry needs to educate consumers on their choices of fuels. The information has to be in a form that is easy to understand, informative and factual. The hardest part is to counter the fear-based, non-factual misinformation that is out there on biofuels.

Recently E15 (15% ethanol, 85% gasoline) was approved for use in certain automobiles (1991 models years and higher) in the US. This has been the most tested fuel in the history of the EPA (Environmental Protection Agency). These tests have proven that there are no significant issues while using this fuel in automobile engines. Non-road engines, such as marine, lawnmowers, weed trimmers, etc. are under the process of being tested as well. Again, if used correctly, no major issues or damage should result using this blend.

Higher blends of ethanol can also be used if you have the right equipment. Flex-fuel vehicles are designed to handle all blends of ethanol (up to 85%) and gasoline and all ratios in between. However, there has been a relatively slow effort in providing these vehicles to the marketplace. Brazil has been very successful in introducing these vehicles based on mandates and wanting to be energy independent. The rest of the world has been slow to adapt. There is not much difference in manufacturing costs to make a flex fuel vehicle from a 'normal' one. Make all vehicles this way and let the consumer decide what fuel they want to use. Also, install blender pumps capable of dispensing varying ratios of ethanol. Let the consumer decide what they want.

Substrate sources

Where do we go next with substrates in order to produce more biofuels globally? You have to look at non food sources or non starch sources of feedstock in order to grow the market. Substrates like woody biomass, grasses, municipal solid waste and even algae have been mentioned as potential sources for biofuels. In order to make this work, a lot of research has gone into making cellulosic ethanol closer to reality.

However, more has to be done in order to be more cost effective. This will require more time, effort and money to shift the thought process away from conventional or starch based substrates. Currently, considerable capital, technology implementation, different fermentation organisms, etc. have to be used in order to produce biofuels from these feedstocks.

However, just as technology advancements and yield improvement have increased in conventional biofuels production, this same premise will apply to this market as well. The old saying has been that this type of technology and market is always five years away. This has been said ever since I entered this market twenty years ago. However with the investment and research being conducted today, I believe this is as close to becoming a reality than ever before.

Yet another field of mid-western corn.