Staying Ahead of the Energy Revolution Taking Form on Your Farm

by Bruce Erickson

The Energy Policy Act of 2005 included a nationwide renewable fuels standard to increase America’s demand for ethanol to at least 7.5 billion gallons annually by 2012, a goal that will be already exceeded this year. On January 22 President Bush announced an even more aggressive target of reducing gasoline usage by 20 percent in ten years—part of which will be accomplished by requiring 35 billion gallons of renewable and alternate fuels by 2017. The shift to bio-energy is causing a revolution in agriculture that has many seeing only green. But according to Iowa State University Distinguished Agriculture Professor Neil Harl, the biofuels phenomenon promises to cause the biggest shuffling of the economic deck in decades. Top Farmers should be asking themselves, “Where do I stand to potentially gain or lose as these fundamental shifts take form?” Knowing the elemental drivers of the market will allow crop producers to keep the best perspective as they make key strategic decisions related to their farming enterprises.

What Future Role for Ethanol? The U.S. currently imports about 60% of its liquid fuel needs, consuming about 140 billion gallons of gasoline annually. Ethanol can play a role in reducing our dependence on imported oil, but its impact is limited. If the entire 11 billion bushel corn crop were converted to ethanol, it would supply about 30 billion gallons of ethanol, and with an energy value about 70% of gasoline, could replace about 15% of gasoline use. It is expected that about one third of the corn crop might actually be used for ethanol production by 2012, replacing about 5% of gasoline needs, or possibly just making up for increasing consumption. But ethanol from other sources is expected to play an increasing role.

Thinking Ahead to Cellulosic Energy Sources Liquid energy made from grasses, corn stalks, and trees will need to eventually contribute more than corn ethanol to meet energy goals. Anyone who has seen wood burn or a grass fire knows the energy these substances contain. Corn starch and cellulose are made from the same building blocks—chains of the sugar glucose. But these glucose molecules are arranged differently in cellulose as compared to starch, and making ethanol from cellulosic sources so far has not been as cost-effective as making it from corn.

Using Corn Stalks The potential energy value in all of the cornstalks remaining after harvest across the Corn Belt is substantial. Yet, just as substantial are the challenges of gathering, densifying, storing, and transporting this huge quantity of biomass and perfecting the process to profitably convert it into liquid energy, according to Purdue ag engineer Klein Ileleji. Assuming one quarter of the estimated 230 million tons (at 15% moisture) produced in the U.S. annually could be collected and a conversion rate of 72 gallons of ethanol per ton, this could add 4 billion gallons of ethanol annually.

The Logistics of Biomass One of the biggest considerations regarding the various forms of biomass is in how to get all of this bulk to a processing plant. For a 100 million gallon plant using only corn stalks, it is estimated 1.4 million dry tons of corn stover would be needed annually to keep the plant operating at capacity. If this were baled and stored on farms, this would require 60 trucks, each making four trips per day operating year-around to transport the stalks from within a 50 mile radius. At the plant, trucks would need to be carefully scheduled around multiple unloading points to ensure receiving capacity.
Unlocking the Cellulose in Trees  The energy produced per year by an acre of trees such as hybrid poplars can far exceed that of corn and many other annual row crops, according to Clint Chapple, a biochemist working with forester Rick Meilan and ag engineer Mike Ladisch on biofuel studies in the College of Agriculture at Purdue. Extracting the cellulose in wood for ethanol production is hindered by the presence of lignin, a key component of tree strength. But trees have a number of advantages compared to field crops residues, as they can be left to grow for several years, can potentially be harvested year-round, and are much more dense, lessening storage and transport issues.

Profitability of Ethanol Production.  The federal subsidy of $0.51 per gallon of ethanol was established when crude oil was less than $30 per barrel. At that price of crude oil, the subsidy was necessary to make ethanol profitable. But with crude oil prices much higher in recent years, ethanol production has become highly profitable, stimulating unprecedented investment. But declining oil prices in recent months combined with spiking grain prices have raised concerns about the profitability of future ethanol production, especially plants yet to come into production.

Ethanol’s value comes primarily from the following sources:
1. Energy value as a replacement for gasoline
2. Value of subsidies and policy incentives provided to ethanol
3. Value of ethanol as an additive for oxygenation (to produce cleaner burning fuel) and octane enhancer for gasoline

The energy value of ethanol should remain fairly constant at about 70% of the wholesale price of gasoline. The federal incentive of $0.51 per gallon to blenders of ethanol equates to about $1.35 per bushel of corn used. Ethanol’s future value as an oxygenate could drop sharply as the supply of ethanol begins to exceed the amount needed to replace MTBE.

Soydiesel  The most common method to produce biodiesel is through a process called transesterification, a relatively simple process that yields high conversions with only glycerin as a byproduct. One hundred pounds of plant oil is reacted with 10 pounds of methanol to yield 10 pounds of glycerin and 100 pounds of biodiesel. The simplicity of the process has some contemplating on-farm production, but legal issues related to fuel quality and vehicle warranties are significant considerations.

Utilizing Ethanol Byproducts  The use of distillers’ co-products as feed ingredients could make livestock production near ethanol plants more competitive as the price of corn increases to meet the ethanol demand. The challenges in utilizing DDGS in livestock and poultry rations are mostly due to:
1. Variation in nutrient content between batches
2. Handling, storage, and transportation
3. Effect on animal performance
4. End-product quality (carcass quality, etc.)
5. Nutrient management

Transportation and spoilage issues related to DDGS present considerable challenges. The high oil content of distillers’ grains has the potential to affect digestibility, milk quality, carcass composition, product shelf life, and many other factors. Rations containing DDGS can exceed the animal’s
requirement for nitrogen (due to amino acid differences), phosphorus, sodium, and sulfur. This can result in increased nutrient excretion implications when producers utilize the manure.

**As We Benefit, How do we Protect the Environment?** Marginal land coming back into production and the shift to more corn will have environmental consequences. Corn production and especially corn following corn is more input intensive. Higher grain prices shift the economic justification for more fertilizers, pesticides, field drainage, and others. Removing corn stalks for ethanol will cause increased vulnerability to soil erosion. At the same time, future tree plantations instead of row crops are probably an environmental plus.

**For More Information** To help farmers and the general public better understand the science and issues behind biofuels, Purdue launched a bioenergy web site in December. Please be sure to visit the site at: [http://www.ces.purdue.edu/bioenergy/](http://www.ces.purdue.edu/bioenergy/).