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## *Food vs. Fuel? An Integrated Approach to Producing Both*

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The current focus on biofuels is obviously relative to energy. Webster’s definition of “energy” is:

*The capacity to do work; the property of a system that diminishes when the system does work on any other system, by an amount equal to the work so done...*

“Fuel” has other definitions:

*Combustible matter used to maintain fire, as coal, wood, oil, or gas, in order to create heat or power*

*Something that gives nourishment; food*

*An energy source for engines, power plants or reactors*

The “coal, wood, oil, or gas” reference is interesting. In his book *The End of Oil* (Boston: Houghton Mifflin, 2004), Paul Roberts spelled things out well: an energy crisis struck Great Britain in the eighteenth century—shortage of wood for heating and cooking—led people to figure out they could dig a hole in the ground, bring up coal and heat with that. Some see another energy crisis looming. A *BusinessWeek online* article on February 5, 2007, led with:

*Food vs. Fuel As energy demands devour crops once meant for sustenance...*

And an April 7, 2007, article in the *Kansas City Star* led with

*It’s food vs. fuel in the battle for corn As more of the grain goes toward ethanol, less of it may make its way to the hungry.*

That's an interesting concept considering current concerns over obesity. It's amazing how public perception changes. In February, Tyson's CEO voiced concern that biofuels will lead to higher food prices domestically and across the globe. I didn't realize that Tyson cares what the price of food is, and that's another interesting concept. A recent paper from the Center for Agriculture and Rural Development at Iowa State University stated: "In response to higher feed costs, livestock farm-gate prices will increase enough to cover the feed cost increase." Was anyone here feeding cattle in 1996? As corn prices went up, cattle feeders had no opportunity to raise livestock prices.

## PATENTED PROCESS

At PRIME Biosolutions we use a patented method that ties cattle feeding with anaerobic digestion and ethanol production. It's the process used by E<sup>3</sup> BioFuels; our companies share ownership of the patent. The ethanol plant is unusual in that we've removed the dryers, thermal oxidizer and evaporator. It takes in grain (corn, sorghum, barley) and produces ethanol, wet distillers grains that are directed to the feedlot, thin stillage that can be used as feedstock for the anaerobic digester and carbon dioxide that is used in nutrient removal. The anaerobic digestion unit is fed with manure from the feedlot as well as with thin stillage from the ethanol plant. Heated by waste heat from the ethanol plant, the digester serves as a cooling tower. The digester produces all of the gas needs of the facility, which, otherwise, would be natural gas in the ethanol plant. The digester facilitates economic removal of nitrogen, phosphorus and potassium; we are able to "harvest," those nutrients from the back-side of the system, for recycling. The feedlot consumes all of the distillers grains. There's no drying or hauling—saving freight is a significant advantage. Because the manure goes to the digester, odor is controlled and there is no concern with run-off. Although it's a concentrated animal feeding operation, we have no permitting problems related to run off, *etc.* The cattle are under a roof, standing on concrete slats. The feed lot at Mead, NE, was built in 1969 and is well proven.

## KICKS AT THE CAT

It's a simple concept: energy from the sun is converted by photosynthesis into starch, oil, and fiber and stored in the corn kernel. Our process takes the kernels to the ethanol plant and produces ethanol and distillers grains. In turn, the distillers grain are fed to the cattle. Manure from the cattle goes to the digester along with thin stillage from the ethanol plant. Biogas from the digester is burned in the boilers to create the heat to cook the corn entering the ethanol plant.

Solids from the digester are collected in a pile and we think we know how to take that through a cellulose conversion to generate more ethanol. That completes the loop. Instead of, "Is it food or fuel?" we believe that it's both, although it's all harvested solar energy. We're taking several kicks at the cat. As the corn goes through the ethanol plant we get the first, the biggest and broadest stroke of energy out of what was stored in the corn. What's left then goes to the cattle. The cattle get their opportunity to harvest some energy from those distillers grains. When the manure goes to the digester, that's the third kick—the

digester pulls the energy out of the manure that passed through the animal that passed through the ethanol plant that came from the corn that started with the sun.

The fourth kick is when we process the cellulose in the fiber from the digester and produce more ethanol. So, those are the four components in the harvest of solar energy. There are lots of ways to do it: corn-starch to ethanol, switchgrass to ethanol, yard waste to ethanol or biogas, soybeans to biodiesel, sunflowers to biodiesel, mustard to biodiesel. Soybean growers via the soybean board have done a great job of promoting biodiesel. Soybeans have been grown mainly to produce protein to balance livestock diets. However, we won't need that protein to balance livestock diets anymore if we are going to produce ethanol from corn and have distillers grains left. So, the whole protein market is shifting. Rather than viewing oil as a by-product of soy protein extraction, we've reversed emphasis. Whether geneticists change what we extract from soybean or whether we grow other crops like brown mustard as a source of oil, it's going to be interesting as reasons for growing specific crops change.

### HOW MUCH CORN?

Can agriculture produce enough corn? We started setting land aside in the 1950s and 1960s with the federal land bank. We set aside idle acres in the 1970s and there was the pit program in the 1980s with freedom to farm with LDPs and CRP acres. And now in 2007 we can't grow enough corn. American farmers have not been allowed to grow corn for almost two generations, begging the question, "How much can we grow?" We don't know. We can predict and we can guess and we can do calculations and that's all fine, but let's see what we can do. In recent decades seed companies have been focussed on reducing costs via herbicide tolerance, insect resistance, drought resistance, and fewer days to maturity. We haven't emphasized productivity for many years, so it will be interesting to see how much corn can we produce on an acre. Where can we plant those acres? Pioneer is measuring productivity not just in bushels per acre but as gallons of ethanol per acre, *e.g.* as highly fermentable corn or increased starch percentage. At a recent conference I attended, a farmer asked, "What if we overproduce corn again?" We've gone from "we've got too much" to "now we don't have enough," and these guys are concerned about what happens if we produce too much. But, that's where E85 will come in. We're not going to change the whole country to E85, but there's a wide range in terms of what we can do and the possibility of overproducing ethanol is small.

### EMPHASIS ON METHODOLOGY

From my standpoint, the emphasis should be on the method of producing biofuels, not just how much. Our approach is one, obviously there are others.



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PRIME BioSolutions’ patented integrated biorefinery (IBR) system involves a number of factors that are intended to reduce the cost of ethanol production from corn, including placing the ethanol production facility adjacent to a cattle-feeding operation, using biogas from cattle manure to provide a significant portion of the energy needed to operate the ethanol facility, and subsequently feeding cattle with wet distiller’s grain, a by-product of ethanol production from corn, without incurring significant drying or transportation costs.

PRIME’s business plan includes construction of ten IBR complexes within the next seven years.