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Ethanol

Can Cars Run On Trees?

Christopher Helman, 12.11.09, 6:00 AM ET

HOUSTON -
Ethanol is, for the most part, a federally funded boondoggle that wastes piles of taxpayer money, mountains of corn and lakes worth of groundwater to make a transportation fuel vastly inferior to petroleum-derived gasoline both in energy content and portability.

Congress in 2007 mandated that by 2021 the nation use 36 billion gallons of ethanol a year--roughly one-third of our transportation needs. Right now, we're at roughly 11.5 billion gallons a year. Meeting the mandate without massive subsidies will take some serious scientific genius--especially when it comes to devising an economic way to make cellulosic ethanol out of trees and other plants we don't eat. Most of the nation's 1,500 or so biofuel upstarts will fail. The ones that survive will have figured out a better way to crack the cellulosic nut.

One of those might (just might) turn out to be KL Energy. Based in Rapid City, S.D., KL has devised what it says is a better process to make ethanol out of wood chips. The process, says Chief Executive Steven Corcoran, lends itself to small plants that could be built for $40 million in areas with plentiful low-cost waste wood (like Colorado forests ravaged by the mountain pine beetle
and produce 5 million gallons of ethanol a year. Contrast that with corn-based megaplants that gin up 50 million to 100 million gallons a year.

Corcoran in 2007 raised $9 million in capital to build KL's first commercial-scale plant in Upton, Wyo., which can make 1.5 million gallons of ethanol a year. Too soon to tell if KL's process will survive in the long run, but it is interesting, and at all-in costs of roughly $3.50 a gallon, almost (gasp!) economic.

First, some basics. In making ethanol out of wood, a key differentiator is in how to break the wood into its three constituent parts. The good stuff, cellulose (which contains easily fermented glucose) is melded with hemicellulose (made of less useful sugars) and lignin (kind of like the rubber cement that holds it all together).

To break up the lignin and separate the hemicellulose from the cellulose, ethanol processors pretreat the wood with chopping, grinding and baths in high-pressure steam or sulfuric acid. The resulting mush gets fed in slurry form to enzymes, which break it down into sugars. Those are then fed to yeast bacteria--thus producing the fermentation that yields ethanol. The more cellulose broken out of the wood, the more ethanol comes out the other end.

KL, which perfected its process on lignin-rich Ponderosa pines from South Dakota's Black Hills, doesn't use any chemicals or acids. Its wood chips are first fed into a 400-degree steam cooker, then subjected to a patent-pending mechanical process that KL's chief scientist David Litzen calls axial shear. An analogy: think of a pencil, where the lead in the middle is the cellulose fiber, surrounded by unwanted lignin and hemicellulose. "We want to get the lead inside, so instead of chopping the pencil up perpendicularly and exposing just the ends, we strip the wood casing off the outside and expose the length of the lead," says Litzen. That gives the enzymes (which KL purchases from Novozymes) more surface area to react with.

Litzen, who used to work for Royal Dutch Shell, has put his experience with petrochemical plants to work, making sure that steam used in the pretreatment process is recycled in other stages.

Sounds good so far, and there's more. The powdery lignin, once separated from the cellulose, is a very useful substance in its own right. Pound for pound lignin contains nearly as much energy as coal. Which makes sense, considering that it's the stuff that coal is made of (lignite coal is soft brown coal formed from geologic pressures on forests that died millions of years ago).

Because KL's process does not chemically alter the lignin with acids, it can be formed into pellets and burned in wood pellet stoves. Acid-treated lignin emits sulfur dioxide when burned. The lignin pellets, says KL, have 20% higher energy content (for the same weight) than wood pellets. And powdered lignin can be added to pulverized coal for burning in power plants.

KL has been in discussions with wood pellet makers like Confluence Energy (see story, Turning Dead Trees Into Green Heat.) to

build a plant in Colorado, where beetles have killed millions of acres of lodge pole pines. KL's Corcoran also says he's in talks with interested parties in Europe and Colombia. "Our vision is that one of these plants would be the core element of a community energy center" that could provide a local, sustainable source of both transportation and heating fuel.

It's a nice dream, but what about the cost? Corcoran says a $40 million plant fed with 100,000 tons of trees a year will generate roughly 5 million gallons of ethanol for an all in cost of roughly $3.50 per gallon. Strip out the capital costs, and operating costs are about $1.50 a gallon (enzymes are about 40 cents of that). This assumes no government subsidies at all.

Those are not terrible economics. But KL will need some helping hands to survive. The company, which has shares that trade over-the-counter, posted a net loss of $5 million on $3.5 million in revenue in the nine months through September. KL's fate could be improved if it manages to get some funding from either the U.S. Department of Agriculture or the Department of Energy, which has some $500 million to distribute for biofuels. It will take more subsidies than that to get the U.S. to 36 billion gallons a year by 2021.